7705 Service Aggregation Router

Release 26.10.R1

Interface Configuration Guide

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1 Preface

This guide describes system concepts and provides configuration examples to provision CSM cards, adapter cards, modules and ports for the 7705 SAR.

This guide is organized into functional chapters and provides concepts and descriptions of the implementation flow, as well as Command Line Interface (CLI) syntax and command usage.

Note: This manual generically covers Release 26.x content and may contain some content that will be released in later maintenance loads. See the 7705 SAR 26.x.Rx Software Release Notes, part number 3HE24971000xTQZZA, for information about features supported in each load of the Release 26.x software.

Note: As of Release 23.4, software support for the following hardware has been deprecated:

- 8-port Ethernet Adapter card, version 2 (a8-ethv2) (3HE02776)
- 12-port Serial Data Interface card, version 1 (a12-sdi) (3HE03391)
- 7705 SAR-W (3HE07349)

These components are no longer recognized in the release.

If information about any of the above components is required, please see the applicable installation guides in Release 22.10.

1.1 Audience

This guide is intended for network administrators who are responsible for configuring the 7705 SAR routers. It is assumed that the network administrators have an understanding of networking principles and configurations. Concepts described in this guide include the following:

- CLI concepts
- adapter card and port configuration
- QoS policies
- services

1.2 Technical support

If you purchased a service agreement for your 7705 SAR router and related products from a distributor or authorized reseller, contact the technical support staff for that distributor or reseller for assistance. If you purchased a Nokia service agreement, follow this link to contact a Nokia support representative and to access product manuals and documentation updates:

Product Support Portal

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2 7705 SAR interface configuration process

The following table lists the tasks that are required to provision CSM cards, adapter cards, ports, and SCADA bridges.

This guide is presented in an overall logical configuration flow. Each section describes a software area and provides CLI syntax and command usage to configure parameters for a functional area.

Table 1: Configuration process

Area	Task/description	Chapter
Provisioning	Configure chassis slots and cards	Configuring the IOM and card slot
	Configure adapter cards	Configuring adapter cards and modules
	Configure ports and bridges	Configuring ports Configuring SCADA bridges
Reference	List of security and telecom standards, supported protocols, and proprietary MIBs	Supported standards and protocols

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3 7705 SAR interfaces

This chapter provides information about configuring chassis slots, cards, and ports.

Topics in this chapter include:

- Configuration overview
- Port features
- 802.1x network access control
- MAC authentication
- MACsec
- Link Layer Discovery Protocol
- Supervisory control and data acquisition support
- Configuration notes
- Configuring physical components with CLI
- Configuration command reference
- Show, monitor, clear, and debug command reference

3.1 Configuration overview

This guide uses the term "preprovisioning" in the context of preparing or preconfiguring entities such as chassis slots, the IOM, adapter cards, ports, and interfaces, before hardware is actually installed in the chassis. These entities can be installed but not enabled. When the entity is in a **no shutdown** state (administratively enabled), the entity is considered to be provisioned.

Nokia 7705 SAR routers provide the capability to configure chassis slots to accept specific adapter card types and set the relevant configurations before the equipment is actually installed. The preprovisioning ability allows you to plan your configurations as well as monitor and manage your router hardware inventory. Ports and interfaces can also be preprovisioned. When the functionality is needed, the cards can be inserted into the appropriate chassis slots as required.

The following sections are discussed:

- Configuring the IOM and card slot
- Configuring adapter cards and modules
- Configuring ports
- Configuring SCADA bridges

3.1.1 Configuring the IOM and card slot

The 7705 SAR card slot ID is always 1 and the card type for the IOM is always iom-sar.

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On the 7705 SAR-8 Shelf V2 and 7705 SAR-18, the CSM, which can only be installed in slot A or B of the chassis, does not need to be provisioned. However, the IOM, which is virtualized in the 7705 SAR software, must be activated before the adapter cards, ports, and SCADA bridges can be preprovisioned and configured. The IOM is activated by designating it a card slot ID and card type. This enables the chassis slots to accept the adapter cards.

Note: On the 7705 SAR-8 Shelf V2, the CSM is called the CSMv2; both terms are used interchangeably in these guides. The CSMv2 supports bandwidth of 10 Gb/s, 2.5 Gb/s and 1 Gb/s in the first two adapter card slots and 2.5 Gb/s and 1 Gb/s in the remaining four adapter card slots.

The 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-Wx, and 7705 SAR-X have a fixed physical configuration and each router uses only one control and switching functional block, which is referred to on the CLI as CSM A. The CSM and IOM do not need to be provisioned in order to provision the interface at the adapter card level.

The slot ID (1) is used as part of the adapter card and port identifier on the CLI.

3.1.2 Configuring adapter cards and modules

This section contains information about the following topics:

- Provisioning chassis slots for adapter cards
- Maximum number of adapter cards in a chassis
- Evolution of Ethernet adapter cards, modules, and platforms
- Channelized adapter card support

3.1.2.1 Provisioning chassis slots for adapter cards

A chassis slot and card type must be specified and provisioned before an adapter card can be provisioned. A chassis slot is a physical slot designated with an MDA ID. On the 7705 SAR-8 Shelf V2, the MDA ID is from 1 to 6. On the 7705 SAR-18, the MDA ID is from 1 to 12 for the MDA slots and from X1 to X4 for the XMDA slots. An adapter card is provisioned when a card designated from the allowed adapter card types is inserted. A preprovisioned adapter card slot can remain empty without conflicting with populated slots.

The adapter cards can be installed in the chassis in any combination that does not exceed the maximum number. However, network applications require at least one network-capable adapter card to be installed.

When installed and enabled, the system verifies that the installed adapter card type matches the configured parameters. If the parameters do not match, the adapter card remains offline.

3.1.2.2 Maximum number of adapter cards in a chassis

Note: Unless otherwise specified, references to adapter cards with multiple versions include all versions of the cards.

A maximum of six adapter cards can be installed in the 7705 SAR-8 Shelf V2 chassis. The following adapter cards are supported:

- 2-port 10GigE (Ethernet) Adapter card (maximum of 4)

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- 2-port OC3/STM1 Channelized Adapter card (maximum of 6, depending on channelization – see note below)
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card (maximum of 6)
- 4-port OC3/STM1 Clear Channel Adapter card (maximum of 6)
- 4-port DS3/E3 Adapter card (maximum of 6, depending on channelization – see note below)
- 6-port E&M Adapter card (maximum of 6)
- 6-port FXS Adapter card (maximum of 6)
- 6-port Ethernet 10Gbps Adapter card (maximum of 6)
- 8-port FXO Adapter card (maximum of 6)
- 8-port Gigabit Ethernet Adapter card (maximum of 6)
- 8-port Voice & Teleprotection card (maximum of 6)
- 8-port C37.94 Teleprotection card (maximum of 5)
- 12-port Serial Data Interface card (maximum of 6)
- 16-port T1/E1 ASAP Adapter card (maximum of 6)
- 32-port T1/E1 ASAP Adapter card (maximum of 6)
- Auxiliary Alarm card (maximum of 6)
- CWDM OADM Adapter card (maximum of 6)
- GNSS Receiver card (maximum of 2)
- Integrated Services card (maximum of 6)
- Packet Microwave Adapter card (maximum of 6)
- Power Injector card (maximum of 4)

A maximum of 12 MDA adapter cards and 4 XMDA adapter cards can be installed in the 7705 SAR-18 chassis. The following adapter cards are supported:

- 2-port 10GigE (Ethernet) Adapter card (maximum of 6)
- 2-port OC3/STM1 Channelized Adapter card (maximum of 12, depending on channelization – see note below)
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card (maximum of 12)
- 4-port OC3/STM1 Clear Channel Adapter card (maximum of 12)
- 4-port DS3/E3 Adapter card (maximum of 12, depending on channelization – see note below)
- 6-port E&M Adapter card (maximum of 12)
- 6-port FXS Adapter card (maximum of 12)
- 6-port Ethernet 10Gbps Adapter card (maximum of 12)
- 8-port FXO Adapter card (maximum of 12)
- 8-port Gigabit Ethernet Adapter card (maximum of 12)
- 8-port Voice & Teleprotection card (maximum of 12)
- 8-port C37.94 Teleprotection card (maximum of 11)
- 10-port 1GigE/1-port 10GigE X-Adapter card (maximum of 4)

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- 12-port Serial Data Interface card (maximum of 12)
- 16-port T1/E1 ASAP Adapter card (maximum of 12)
- 32-port T1/E1 ASAP Adapter card (maximum of 12)
- Auxiliary Alarm card (maximum of 12)
- CWDM OADM Adapter card (maximum of 12)
- GNSS Receiver card (maximum of 2)
- Integrated Services card (maximum of 12)
- Packet Microwave Adapter card (maximum of 12)
- Power Injector card (maximum of 8)

Note:

- On a 7705 SAR-8 Shelf V2 chassis:
  - a maximum of six 2-port OC3/STM1 Channelized Adapter cards can be installed in MDA slots 1 to 6 if DS3 channelization is being used. If DS1/E1 or DS0 (64 kb/s) channelization is being used, a maximum of four 2-port OC3/STM1 Channelized Adapter cards can be installed in MDA slots 1 to 6.
  - a maximum of six 4-port DS3/E3 Adapter cards can be installed in MDA slots 1 to 6 if DS3/E3 or DS1/E1 channelization is being used. If DS0 (64 kb/s) channelization is being used, a maximum of four 4-port DS3/E3 Adapter cards can be installed in MDA slots 1 to 6.
  - a maximum of six 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards can be installed in MDA slots 1 to 6 if DS1/E1 channelization is being used. DS0 and DS3/E3 channelization is not supported on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.
  - a maximum of six 6-port Ethernet 10Gbps Adapter cards can be installed in MDA slots 1 to 6. When installed in MDA slot 1 or 2, the 6-port Ethernet 10Gbps Adapter card supports a 10-Gb/s fabric rate. When installed in MDA slots 3 through 6, the aggregate fabric rate is 2.5 Gb/s.
- On a 7705 SAR-18 chassis:
  - a maximum of twelve 2-port OC3/STM1 Channelized Adapter cards can be installed in MDA slots 1 to 12 if DS3 channelization is being used. If DS1/E1 or DS0 (64 kb/s) channelization is being used, a maximum of four 2-port OC3/STM1 Channelized Adapter cards can be installed in MDA slots 1 to 12.
  - a maximum of twelve 4-port DS3/E3 Adapter cards can be installed in MDA slots 1 to 12 if DS3/E3 or DS1/E1 channelization is being used. If DS0 (64 kb/s) channelization is being used, a maximum of four 4-port DS3/E3 Adapter cards can be installed in MDA slots 1 to 12.
  - a maximum of twelve 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards can be installed in MDA slots 1 to 12 if DS1/E1 channelization is being used. DS0 and DS3/E3 channelization is not supported on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.
- The total number of channel groups that can be configured per card and per node is bound by release-specific system limits. For more information, please contact your Nokia technical support representative.

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3.1.2.3 Evolution of Ethernet adapter cards, modules, and platforms

The 7705 SAR hardware components have improved as technology has developed. The following table lists the Ethernet adapter cards, modules, and platforms according to their generation. Second-generation (Gen-2) components have additional features such as increased card memory or improved QoS mechanisms over previously supported first-generation components. Similarly, third-generation (Gen-3) components improve upon second-generation components.

Table 2: Ethernet adapter card, module, and platform generations

Generation	Card, module, and platform
Second generation	2-port 10GigE (Ethernet) Adapter card (v-port)
	2-port 10GigE (Ethernet) module (v-port) (for 7705 SAR-M)
	8-port Gigabit Ethernet Adapter card
	10-port 1GigE/1-port 10GigE X-Adapter card
	Packet Microwave Adapter card
	7705 SAR-A
	7705 SAR-Ax
	7705 SAR-H
	7705 SAR-Hc
	7705 SAR-M
	7705 SAR-Wx
	4-port SAR-H Fast Ethernet module
	6-port SAR-M Ethernet module
Third generation	6-port Ethernet 10Gbps Adapter card
	7705 SAR-X

3.1.2.4 Channelized adapter card support

The following cards and modules support channelization down to the DS0 level:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 12-port Serial Data Interface card
- 6-port E&M Adapter card
- 2-port OC3/STM1 Channelized Adapter card

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- 4-port DS3/E3 Adapter card
- 8-port Voice & Teleprotection card
- 8-port C37.94 Teleprotection card
- 8-port FXO Adapter card
- 6-port FXS Adapter card
- 4-port T1/E1 and RS-232 Combination module

On the 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, 2-port OC3/STM1 Channelized Adapter card, and 4-port DS3/E3 Adapter card (DS3 ports only), and on the T1/E1 ports of the 4-port T1/E1 and RS-232 Combination module, up to 24 channel groups are supported on a DS1 circuit and up to 32 channel groups on an E1 circuit.

The 12-port Serial Data Interface card supports a single channel group on a channelized V.35 circuit, RS-530, RS-232 (also known as EIA/TIA-232) circuit, or X.21 circuit. The RS-232 ports on the 4-port T1/E1 and RS-232 Combination module also support a single channel group on a channelized RS-232 circuit.

The 6-port E&M Adapter card supports a single channel group on a channelized E&M voice interface.

The 8-port Voice & Teleprotection card supports a single channel group on a channelized G.703 (codirectional) circuit, an IEEE C37.94 teleprotection interface (TPIF) circuit, FXS circuit, or FXO circuit.

The 8-port C37.94 Teleprotection card supports a single channel group on an IEEE C37.94 teleprotection interface (TPIF) circuit.

The 8-port FXO Adapter card supports a single channel group on an FXO circuit.

The 6-port FXS Adapter card supports a single channel group on an FXS circuit.

The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card supports channelization at the DS1/E1 level only.

3.1.2.4.1 PPP over fractional T1/E1

The 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, and the T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module each support fractional T1/E1 on a PPP channel group in network mode. Fractional T1/E1 allows one or more DS0 channels to be bundled together (up to the maximum bandwidth of the network link), allowing the customer to use only that portion of the link that is needed. This means that the PPP service can use a selected number of timeslots (octets) in the network T1 or E1 link, therefore reducing the amount of T1 or E1 bandwidth that must be leased or purchased from the attached carrier. This leads to multiplexing efficiencies in the transport network.

Only one channel group can be configured per port. When the channel group is configured for ppp-auto encapsulation and network mode, all timeslots (channels) are automatically allocated to the channel group. The user can then configure the number of timeslots needed. Timeslots not selected cannot be used.

3.1.3 Configuring ports

A port can be configured after the IOM is activated (the card slot and card type are designated) and the adapter card slot is preprovisioned with an allowed adapter card type.

The 7705 SAR supports the following port types:

- Ethernet
- TDM

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- GNSS receiver
- Multilink bundles
- IMA
- SONET/SDH
- Voice
- Microwave link

In addition, this section contains information about the following topics:

- CLI identifiers for adapter cards, modules and platforms
- Access, network, and hybrid ports

3.1.3.1 Ethernet

Ethernet ports are supported on the following cards, modules, and platforms:

- 6-port Ethernet 10Gbps Adapter card
- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card
- 2-port 10GigE (Ethernet) Adapter card/module
- Packet Microwave Adapter card
- 4-port SAR-H Fast Ethernet module
- 6-port SAR-M Ethernet module
- 7705 SAR-A
- 7705 SAR-Ax
- 7705 SAR-H
- 7705 SAR-Hc
- 7705 SAR-M
- 7705 SAR-Wx
- 7705 SAR-X

3.1.3.1.1 6-port Ethernet 10Gbps Adapter card

The 6-port Ethernet 10Gbps Adapter card has four SFP ports for 1-Gb/s fiber or copper SFP transceivers and two SFP+ ports for 10-Gb/s fiber or copper SFP+ transceivers. The card also supports synchronous Ethernet timing. The 6-port Ethernet 10Gbps Adapter card is designed to complement or replace the 8-port Gigabit Ethernet Adapter card in situations where greater processing power and higher throughput capacity are required.

There are three versions of this card: 6-port Ethernet 10Gbps Adapter card version 1, 6-port Ethernet 10Gbps Adapter card version 2, and 6-port Ethernet 10Gbps Adapter card-E. All versions provide the same features as the 8-port Gigabit Ethernet Adapter card except that the 6-port Ethernet 10Gbps Adapter card-E does not have encryption functionality and the 6-port Ethernet 10Gbps Adapter card, version 2, also supports MACsec.

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3.1.3.1.2 8-port Gigabit Ethernet Adapter card

The 8-port Gigabit Ethernet Adapter card has eight SFP ports for fiber or copper SFPs. The card supports dual rate (100 Mb/s and 1000 Mb/s) and Gigabit (1000 Mb/s) fiber connections and 10/100/1000Base-T copper connections. The card also supports synchronous Ethernet timing.

There are three versions of the 8-port Gigabit Ethernet Adapter card. Version 1 and version 2 are identical except that version 2 provides larger table space for FIBs, ACLs, and so on. Version 2 also supports the full IPv6 subnet range for IPv6 static routes and interface IP addresses. The static route range is from /1 to /128, and the default route is ::/0. Supported interface IP address prefixes are from /4 to /127, and /128 on system or loopback interfaces. Version 3 is identical to version 2 except that it is equipped with a hardware-based encryption engine to support features such as IPSec.

Higher limits and full subnet ranges are supported only when all the adapter cards in a particular node are equipped with hardware for larger table support.

Gigabit Ethernet optical ports offer significant advantages over fast Ethernet ports, even where lower-speed services are currently offered. With Gigabit Ethernet, service providers have the opportunity to standardize access infrastructure, ensure that capacity is available to accommodate growing bandwidth requirements, and minimize the operational costs associated with future service upgrades to hardware and software.

3.1.3.1.3 10-port 1GigE/1-port 10GigE X-Adapter card

There are two versions of the 10-port 1GigE/1-port 10GigE X-Adapter card. Both versions are identical except that version 2 is equipped with a hardware-based encryption engine to support features such as IPSec. The card is supported only on the 7705 SAR-18.

The 10-port 1GigE/1-port 10GigE X-Adapter card has 10 small form-factor pluggable (SFP) ports on its faceplate.

When the 10-port 1GigE/1-port 10GigE X-Adapter card is configured in 10-port GigE mode, the 10 SFP ports are available for fiber SFP transceivers. In this mode, the card supports dual-rate (100 Mb/s and 1000 Mb/s) and Gigabit (1000 Mb/s) fiber connections. The card also supports synchronous Ethernet timing.

When the 10-port 1GigE/1-port 10GigE X-Adapter card is configured in 1-port GigE mode, only one SFP + (port 1) of the 10 ports is active and available for use with fiber SFP+ transceivers. The card supports 10-Gb/s fiber connections. The card also supports synchronous Ethernet timing. The 1-port GigE mode is designed for use in situations where greater processing power and higher throughput capacity are required.

The 10-port 1GigE/1-port 10GigE X-Adapter card provides larger table space for FIBs, ACLs, and so on. The card also supports the full IPv6 subnet range for IPv6 static routes and interface IP addresses. The static route range is from /1 to /128, and the default route is ::/0. Supported interface IP address prefixes are from /4 to /127, and /128 on system or loopback interfaces.

Higher limits and full subnet ranges are supported only when all the adapter cards in a particular node are equipped with hardware for larger table support.

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3.1.3.1.4 2-port 10GigE (Ethernet) Adapter card/module

The 2-port 10GigE (Ethernet) Adapter card/module is used to connect to and from access rings carrying a high concentration of traffic. The following table lists the maximum number of cards or modules that are supported on each platform. A single card can be installed in the 7705 SAR-8 Shelf V2 or the 7705 SAR-18; however, it is strongly recommended that a minimum of two cards be installed for redundancy.

Table 3: Maximum number of cards/modules supported in each chassis

Chassis	Maximum number of cards or modules
7705 SAR-8 Shelf V2	Up to four cards
7705 SAR-18	Up to six cards
7705 SAR-M	One module

The 2-port 10GigE (Ethernet) Adapter card/module has two small form-factor pluggable (XFP) ports on its faceplate. The two XFP ports are for 10-Gigabit Ethernet XFPs. The card provides high processing power and throughput capacity and operates at 10 Gb/s for Ethernet ports and 2.5 Gb/s for the virtual port (v-port).

The 2-port 10GigE (Ethernet) Adapter card provides larger table space for FIBs, ACLs, and so on. The card also supports the full IPv6 subnet range for IPv6 static routes and interface IP addresses on the v-port. The supported range for statically provisioned or dynamically learned routes is from /1 to /128. Supported interface IP address prefixes are from /4 to /127, and /128 on system or loopback interfaces.

The 2-port 10GigE (Ethernet) module supports IPv6 on the v-port. The supported range for statically provisioned or dynamically learned routes is from /1 to /64 or is /128 (indicating a host route). Supported interface IP address prefixes are from /4 to /64, and /128 on system or loopback interfaces.

The 2-port 10GigE (Ethernet) Adapter card/module supports LLDP on the Ethernet ports but not on the v-port.

3.1.3.1.5 Packet Microwave Adapter card

The Packet Microwave Adapter card has two RJ45 ports (ports 1 and 2) and six SFP ports (ports 3 through 8). All ports provide 10/100/1000 Mb/s connections (when connected to an MPR-e radio, they are always in Gigabit Ethernet (1-Gb/s) mode). Ports 1 through 4 support microwave awareness (MWA) and Ethernet/IP/MPLS networking; ports 5 through 8 support Ethernet/IP/MPLS networking only.

All Gigabit Ethernet ports provide the same networking feature capability as the 8-port Gigabit Ethernet Adapter card. For frequency synchronization, synchronous Ethernet and SSM are the mechanisms that are applied when using optical 1000Base-SX to connect to an MPR-e radio. When using electrical 1000Base-T to connect the Packet Microwave Adapter card and an MPR-e radio, proprietary clock recovery (PCR) is used (a copper SFP is mandatory on ports 3 and 4).

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3.1.3.1.6 4-port SAR-H Fast Ethernet module

The 4-port SAR-H Fast Ethernet module has four RJ45 Fast Ethernet ports (10/100 Mb/s) on its faceplate. Any functionality supported on the 7705 SAR-H Ethernet ports is also supported on the 4-port SAR-H Fast Ethernet module, with the exception of hierarchical QoS (H-QoS) functionality and hybrid mode.

3.1.3.1.7 6-port SAR-M Ethernet module

The 6-port SAR-M Ethernet module has six Ethernet ports:

- two SFP Fast Ethernet ports (10/100 Mb/s) (ports 1 and 2)
- two XOR (combination) SFP/RJ point five Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 3a/3b and 4a/4b)
- two PoE-capable RJ point five copper Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 5 and 6)

Ports 5 and 6 can each support Power over Ethernet (PoE). Port 5 can also support PoE+, but if it is configured for PoE+, then port 6 cannot support PoE power.

Any functionality supported on the 7705 SAR-M Ethernet ports is also supported on the 6-port SAR-M Ethernet module, with the exception of half-duplex mode (all ports) and hybrid mode (Fast Ethernet ports only).

3.1.3.1.8 7705 SAR-A

The 7705 SAR-A has two variants with fixed physical configurations. Both variants have 12 Ethernet ports:

- four XOR (combination) Gigabit Ethernet ports, either 10/100/1000Base-T RJ45 (ports 1A to 4A) or 100/1000 Mb/s SFP (ports 1B to 4B)
- four SFP Gigabit Ethernet ports (100/1000 Mb/s) (ports 5 to 8)
- four RJ45 Fast Ethernet ports (10/100 Mb/s) (ports 9 to 12)

3.1.3.1.9 7705 SAR-Ax

The 7705 SAR-Ax has a fixed physical configuration that has 12 Ethernet ports:

- four XOR (combination) Gigabit Ethernet ports, either 10/100/1000Base-T RJ45 (ports 1A to 4A) or 100/1000 Mb/s SFP (ports 1B to 4B)
- eight SFP Gigabit Ethernet ports (100/1000 Mb/s) (ports 5 to 12)

3.1.3.1.10 7705 SAR-H

The 7705 SAR-H has a fixed physical configuration that has eight Ethernet ports:

- two SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 1 and 2)
- two XOR (combination) RJ45/SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 3 and 4)
- four PoE-capable RJ45 Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 5 to 8)

The 7705 SAR-H also has two module slots.

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If a PoE Power Supply is connected, it increases the number of Ethernet ports that can supply PoE to a connected device.

3.1.3.1.11 7705 SAR-Hc

The 7705 SAR-Hc has a fixed physical configuration that has six Ethernet ports:

- two SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 1 and 2)
- two Gigabit Ethernet RJ45 ports (10/100/1000 Mb/s) (ports 3 and 4)
- two PoE-capable RJ45 Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 5 and 6)

3.1.3.1.12 7705 SAR-M

The 7705 SAR-M has four variants with fixed physical configurations. All variants have seven Ethernet ports:

- four SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 1 to 4)
- three Gigabit Ethernet RJ45 ports (10/100/1000 Mb/s) (ports 5 to 7)

Two variants of the 7705 SAR-M also have a module slot.

3.1.3.1.13 7705 SAR-Wx

The 7705 SAR-Wx has four variants with fixed physical configurations that provide the following Ethernet interfaces.

Two variants have the following five Gigabit Ethernet ports:

- three SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 1 to 3)
- two Gigabit Ethernet RJ45 ports (10/100/1000 Mb/s) (ports 4 and 5)

Two variants have the following five Gigabit Ethernet ports:

- three SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 1 to 3)
- one Gigabit Ethernet RJ45 port (10/100/1000 Mb/s) (port 4)
- one PoE+ Gigabit Ethernet RJ45 port (10/100/1000 Mb/s) (port 5)

Note: The DSL variants of the 7705 SAR-Wx are no longer supported.

3.1.3.1.14 7705 SAR-X

The 7705 SAR-X has a fixed physical configuration that has 14 Ethernet ports:

- four XOR (combination) RJ45/SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 2/1A, 2/2A, 3/1A, 3/2A for RJ45 and 2/1B, 2/2B, 3/1B, 3/2B for SFP)
- eight SFP Gigabit Ethernet ports (10/100/1000 Mb/s) (ports 2/3 to 2/6 and 3/3 to 3/6)
- two SFP+ 10-Gigabit Ethernet ports (ports 2/7 and 3/7)

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3.1.3.2 TDM

TDM ports are supported on the following cards, modules, and platforms:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 4-port DS3/E3 Adapter card
- 8-port Voice & Teleprotection card
- 8-port C37.94 Teleprotection card
- 12-port Serial Data Interface card
- 4-port T1/E1 and RS-232 Combination module
- 7705 SAR-A
- 7705 SAR-Hc
- 7705 SAR-M
- 7705 SAR-X

3.1.3.2.1 16-port T1/E1 ASAP Adapter card

On the16-port T1/E1 ASAP Adapter card, channelization is supported down to the DS0 level. To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 operation. All ports on the card must be either T1 or E1; there cannot be a mix of the two types. When the first port is configured on a card, all other ports on the card must be set to the same type.

The 16-port T1/E1 ASAP Adapter card supports fractional T1/E1 on network ports configured for PPP. Fractional T1/E1 allows a portion of the link to be used for traffic (up to the full link bandwidth).

DS1 ports on the adapter card can be configured for either bipolar with eight-zero substitution (B8ZS) zero code suppression or alternate mark inversion (AMI). B8ZS and AMI are line coding techniques.

3.1.3.2.2 32-port T1/E1 ASAP Adapter card

On the 32-port T1/E1 ASAP Adapter card, channelization is supported down to the DS0 level. To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 operation. All ports on the card must be either T1 or E1; there cannot be a mix of the two types. When the first port is configured on a card, all other ports on the card must be set to the same type.

The 32-port T1/E1 ASAP Adapter card supports fractional T1/E1 on network ports configured for PPP. Fractional T1/E1 allows a portion of the link to be used for traffic (up to the full link bandwidth).

DS1 ports on the card can be configured for either bipolar with eight-zero substitution (B8ZS) zero code suppression or alternate mark inversion (AMI). B8ZS and AMI are line coding techniques.

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3.1.3.2.3 2-port OC3/STM1 Channelized Adapter card

On the 2-port OC3/STM1 Channelized Adapter card, channelization is supported down to the DS0 level. To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 channelization. All ports on the card must be either SONET or SDH; there cannot be a mix of the two types. When the first port is configured on a card, all other ports on the card must be set to the same type.

The 2-port OC3/STM1 Channelized Adapter card also supports DS3 channelization on access for TDM services as well as network mode with PPP.

3.1.3.2.4 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card can be configured to be in 4-port OC3/STM1 mode or 1-port OC12/STM4 mode (using the **mda-mode** command).

When the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card is configured in 4-port OC3/STM1 mode, four SFP ports are available for optical and electrical SFP transceivers. In this mode, the card supports OC3 SONET or STM1 SDH transmission.

When the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card is configured in 4-port OC3/STM1 mode, channelization is supported down to the DS1 level. To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 channelization in access mode, or PPP/MLPPP or POS in network mode. All ports on the card must be either SONET or SDH; there cannot be a mix of the two types. When the first port is configured on a card, all other ports on the card must be set to the same type. Switching between port types causes the adapter card to reset.

When the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card is configured in 1-port OC12/STM4 mode, SFP port 1 is available for optical SFP transceivers. Ports 2 through 4 are not available. In this mode, the card supports OC12 SONET and STM4 SDH transmission. The 1-port OC12/STM4 mode is designed for use in situations where greater bandwidth is required on a single port.

3.1.3.2.5 4-port DS3/E3 Adapter card

The 4-port DS3/E3 Adapter card has two versions. Both versions have the same functionality; version 2 of the adapter card is a replacement for version 1.

The 4-port DS3/E3 Adapter card has four TDM DS3/E3 ports. The port type must be configured to be either DS3 or E3. Each DS3 port can be clear channel or channelized down to DS0 (64 kb/s). E3 ports can be clear channel only. Once the first port type has been configured, all other ports on the same 4-port DS3/E3 Adapter card must be set to the same type.

To change between types, the ports must first be deleted. DS3 ports provide bipolar with three-zero substitution (B3ZS) zero code suppression and E3 ports provide high density bipolar of order 3 (HDB3) zero code suppression. B3ZS and HDB3 zero code suppression are line coding techniques.

Channelization is supported down to the DS0 level (for DS3 ports only). To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 operation. All ports on the card must be either T1 or E1; there cannot be a mix of the two types. When the first port is configured on a card, all other ports on the card must be set to the same type.

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3.1.3.2.6 8-port Voice & Teleprotection card

On the 8-port Voice & Teleprotection card, channelization is supported down to the DS0 level. To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 operation. All ports on the card must be either T1 or E1; there cannot be a mix of the two types. When the first port is configured on a card, all other ports on the card must be set to the same type.

Channelization is supported on the two codirectional G.703 ports and two IEEE C37.94 teleprotection interface ports.

3.1.3.2.7 8-port C37.94 Teleprotection card

On the 8-port C37.94 Teleprotection card, channelization is supported down to the DS0 level on the eight IEEE C37.94 teleprotection interface (TPIF) ports.

3.1.3.2.8 12-port Serial Data Interface card

There are two versions of the 12-port Serial Data Interface card.

Version 2 has four connectors that support three serial data ports each. Each port grouping can be configured for V.35, RS-232, or X.21 operation. When a port has been configured for a specific interface type, the other two ports in that same grouping must be configured for the same type. The card also supports an RS-530 interface with the use of an adapter cable that connects to a DB15 connector on the front of the X.21 distribution panel. There is no configuration specifically for the RS-530 interface; configuration is done in X.21 mode and applies to the RS-530 interface when it is physically enabled through hardware. All X.21 functionality is available on the RS-530 interface, except that only DCE operation is supported for RS-530. However, because X.21 does not support all the control leads available for RS-530, only a subset of the RS-530 control leads are supported.

The 12-port Serial Data Interface card, version 3, has six connectors that support two data ports each. Each port grouping can be configured for V.35, RS-232, X.21, or RS-530 operation. When a port has been configured for a specific interface type, the other port in the group must be configured for the same type.

Channelization on the 12-port Serial Data Interface card is supported down to the DS0 level.

3.1.3.2.9 4-port T1/E1 and RS-232 Combination module

T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (supported on the 7705 SAR-H) support channelization down to the DS0 level. To change port types, all ports must first be shut down. The ports can be configured for DS1 (T1) or E1 operation. All ports on the module must be either T1 or E1; there cannot be a mix of the two types. When the first port is configured on a module, all other ports on the card must be set to the same type.

3.1.3.2.10 7705 SAR-A

The 7705 SAR-A has two variants with fixed physical configurations. One variant supports both Ethernet and T1/E1 ports. The variant that supports T1/E1 ports includes eight RJ45 T1/E1 ports. All ports must be configured as either T1 or E1 ports; a mix of T1 and E1 ports is not allowed.

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DS1 (T1) ports on the chassis can be configured for either bipolar with eight-zero substitution (B8ZS) zero code suppression or alternate mark inversion (AMI). B8ZS and AMI are line coding techniques.

3.1.3.2.11 7705 SAR-Hc

The 7705 SAR-Hc has a fixed physical configuration that includes two RS-232 RJ45 ports. The chassis also includes Gigabit Ethernet/Ethernet support via SFP and RJ45 ports.

3.1.3.2.12 7705 SAR-M

The 7705 SAR-M has four variants with fixed physical configurations. Two variants support both Ethernet and T1/E1 ports. These variants include 16 RJ45 T1/E1 ports. All ports must be configured as either T1 or E1 ports; a mix of T1 and E1 ports is not allowed.

DS1 (T1) ports on the chassis can be configured for either bipolar with eight-zero substitution (B8ZS) zero code suppression or alternate mark inversion (AMI). B8ZS and AMI are line coding techniques.

3.1.3.2.13 7705 SAR-X

The 7705 SAR-X has a fixed physical configuration that provides TDM pseudowire services via eight T1/E1 RJ45 ports.

3.1.3.3 GNSS receiver

The 7705 SAR-H GPS Receiver module is equipped with a GPS RF port for retrieval and recovery of GPS and GLONASS signals.

The 7705 SAR-Ax and two variants of the 7705 SAR-Wx are equipped with an integrated GNSS receiver and a GNSS RF port for retrieval and recovery of GPS and GLONASS signals.

The GNSS Receiver card installed in the 7705 SAR-8 Shelf V2 or 7705 SAR-18 is equipped with a GNSS RF port for retrieval and recovery of both GPS and GLONASS signals.

Note: GLONASS-only signal recovery is not supported in this release.

3.1.3.4 Multilink bundles

A multilink bundle is a collection of channels on channelized ports that physically reside on the same adapter card. Multilink bundles are used by providers who offer either bandwidth-on-demand services or fractional bandwidth (DS3) services. Multilink bundles are supported over PPP channels (MLPPP). All member links of an MLPPP group must be of the same type (either E1 or DS1).

The following cards, modules, and platforms support multilink bundles:

- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

  The following must have all member links of an MLPPP bundle configured on the same card or module:

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– 16-port T1/E1 ASAP Adapter card
– 32-port T1/E1 ASAP Adapter card
– T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)

The following must have all member links of an MLPPP bundle configured on the same card or module, and on the same port:

– 2-port OC3/STM1 Channelized Adapter card
– 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

3.1.3.5 IMA

The 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, and 2-port OC3/STM1 Channelized Adapter card support Inverse Multiplexing over ATM (IMA). IMA is a standard developed to address the increasing need for bandwidth greater than the DS1 or E1 link speeds (1.544 or 2.048 Mb/s, respectively) but less than higher link speeds such as DS3 (44.736 Mb/s). IMA combines the transport bandwidth of multiple DS1 or E1 channels in a logical link (called an IMA group) to provide scalable bandwidth.

3.1.3.6 SONET/SDH

The 4-port OC3/STM1 Clear Channel Adapter card has four hot-pluggable, SFP-based ports that can be independently configured to be SONET (OC3) or SDH (STM1).

The 2-port OC3/STM1 Channelized Adapter card has two hot-pluggable, SFP-based ports that can be configured to be SONET (OC3) or SDH (STM1). All ports on the 2-port OC3/STM1 Channelized Adapter card must be of the same type (either SONET or SDH).

The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card has four hot-pluggable, SFP-based ports that can be configured to be SONET (OC3 or OC12) or SDH (STM1 or STM4). The card can be configured to be in either 4-port mode or 1-port mode (using the **mda-mode** command). In 4-port mode, all four ports can be configured as OC3 or STM1. In 1-port mode, only port 1 can be configured as OC12 or STM4. All ports on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card must be of the same type (either SONET or SDH).

3.1.3.7 Voice

Voice ports are supported on the following cards:

- 6-port E&M Adapter card
- 8-port Voice & Teleprotection card
- 8-port FXO Adapter card
- 6-port FXS Adapter card

3.1.3.7.1 6-port E&M Adapter card

The 6-port E&M Adapter card has six RJ45 ports that support the transport of an analog voiceband signal between two analog devices over a digital network. The analog signals are converted into a 64 kb/s digital pulse code modulation (PCM) format using either Mu-Law (North America) or A-Law (rest of world)

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companding. The type of companding is selectable on a per-card basis. Companding conversion (that is, Mu-Law to A-Law or vice versa) is not supported.

The signaling type is selectable on a per-card basis. When either A-Law or Mu-Law companding is configured, Type I, Type II, or Type V signaling can be selected. However, the only supported configurations are both ends of the connection operating in the same mode (for example, Type I to Type I) or one end operating in Type I mode and the other in Type V mode. The default signaling type for Mu-Law is Type I and the default signaling type for A-Law is Type V.

Each voice port can be configured to operate in either a two-wire or four-wire (default) mode. The ports (in groups of three: ports 1 to 3 and ports 4 to 6) can also be configured to operate in transmission-only mode, which provides a four-wire audio path with no signaling. A transmit and receive transmission level point (the analog-to-digital decibel level) can be configured for each port. The following table shows the signaling type, companding law, and audio wires configuration options on the 6-port E&M Adapter card.

Table 4: Configuration options for the 6-port E&M Adapter card

Signaling type	Companding type	Number of wires
Type I, Type II, Type V	Mu-Law or A-Law	Two-wire or four-wire
Transmission-only (no signaling)	Mu-Law or A-Law	Four-wire

3.1.3.7.2 8-port Voice & Teleprotection card

The 8-port Voice & Teleprotection card supports the transport of an analog voiceband signal between two analog devices over a digital network.

The card has two FXS RJ45 ports and two FXO RJ45 ports that support analog voiceband signals. The analog signals are converted into a 64 kb/s digital pulse code modulation (PCM) format using either Mu-Law (North America) or A-Law (rest of world) companding. The type of companding is selectable on a per-card basis. Companding conversion (that is, Mu-Law to A-Law or vice versa) is not supported.

The signaling type is selectable at the port level on a per-port basis depending on companding type.

FXO supports:

- 1511profile1 (1511 loop start) – A-Law companding
- 3600ls (loop start) – Mu-Law companding
- 3600re (remote extension) – A-Law companding
- 1511sn137 (1511 profile 137) – A-Law companding

FXS supports:

- 3600plar (private line automatic ringdown) – A-Law and Mu-Law companding
- 1511plar – A-Law companding
- 1511profile1 (loop start) – A-Law companding
- 3600ls (loop start) – Mu-Law companding
- 3600re (remote extension) – A-Law companding
- 1511sn137 (1511 profile 137) – A-Law companding

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The default signaling type for FXO and FXS is 3600ls for Mu-Law companding and 3600re for A-Law companding.

3.1.3.7.3 8-port FXO Adapter card

The 8-port FXO Adapter card supports the transport of an analog voiceband signal between two analog devices over a digital network.

The card supports analog voiceband signals through four RJ45 connectors that provide eight foreign exchange office (FXO) ports, with two ports supported per connector. The analog signals are converted into a 64 kb/s digital pulse code modulation (PCM) format using either Mu-Law (North America) or A-Law (rest of world) companding. The type of companding is selectable on a per-card basis. Companding conversion (that is, Mu-Law to A-Law or vice versa) is not supported.

The signaling type is selectable at the port level on a per-port basis depending on companding type.

FXO supports:

- 1511profile1 (1511 loop start) – A-Law companding
- 3600ls (loop start) – Mu-Law companding
- 3600re (remote extension) – A-Law companding
- 1511sn137 (1511 profile 137) – A-Law companding

The default signaling type is 3600ls for Mu-Law companding and 3600re for A-Law companding.

3.1.3.7.4 6-port FXS Adapter card

The 6-port FXS Adapter card provides the capability of transporting a large number of voice circuits from one 7705 SAR location and terminating them at another 7705 SAR location that is connected to a PBX.

The card can also be configured for a private line automatic ringdown (PLAR) application, which is typically used outside of a PBX network, in order to provide a site-to-site or remote site-to-control center hotline functionality.

The card has six foreign exchange subscriber (FXS) ports. Each port provides a short-reach, on-premises analog interface to an analog telephone set. After an incoming analog signal from a set is terminated on one of the FXS interfaces, it is converted into a digital 64 kb/s pulse code modulation (PCM) format using either Mu-Law companding (North America) or A-Law companding (rest of world).

The signal is then mapped into the E1 channel associated signaling (CAS) transport scheme for A-Law or the T1 robbed bit signaling (RBS) transport scheme for Mu-Law and transmitted using a Cpipe over any 7705 SAR network interface that supports the Cpipe service. For standard TDM, the network interface can be a T1/E1 or OC3/STM1 channelized interface. For MPLS, an Ethernet, T1/E1, OC3/STM1 channelized MLPPP, or OC3/STM1 clear channel interface can be used.

For a PBX application, the signal is terminated at the 7705 SAR hub location that is connected to a PBX by either an FXO interface or a T1/E1 interface (assuming the signaling formats are compatible). The FXO interface can be provided by either an 8-port FXO Adapter card or 8-port Voice & Teleprotection card that is installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis at the 7705 SAR hub location.

For a PLAR application, the signal is terminated on an FXS interface on either another 6-port FXS Adapter card or an 8-port Voice & Teleprotection card that is installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis that is located at a remote location or terminated on TDM-capable equipment such as a 3600 MainStreet or 1511 MAX. The connection is made over an E1 interface or a T1 interface. A hotline call can

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originate from the TDM-capable node and terminate on an FXS interface on a 6-port FXS Adapter card (or on an FXS interface on an 8-port Voice & Teleprotection card).

The following table shows the configuration options available on a 6-port FXS Adapter card. The companding law type is configured at the card level; the other options are configured at the voice port level.

Table 5: Configuration options for the 6-port FXS Adapter card

Configuration	Supported options
Companding type	Mu-Law (the default) A-Law
Fault signaling	Idle (the default) Seized
Line balance	Nominal (the default) 800
Ring generation	16 Hz (the default) 20 Hz 25 Hz
Signaling type	3600 private line automatic ringdown (PLAR) (if Mu-Law or A-Law is used) 1511 PLAR (if A-Law is used) 1511 profile1 (if A-Law is used) 3600 loop start (LS) (if Mu-Law is used; this is the default) 3600 remote extension (RE) (if A-Law is used; this is the default) 1511sn137 (1511 profile 137) (if A-Law is used)
Transmission level point (TLP)	Rx: –7 dB to 0 dB (1-dB increments; the default is –3 dB) Tx: –4 dB to +3 dB (1-dB increments; the default is 0 dB)

3.1.3.8 Microwave link

A microwave link can be configured as a virtual port object on a 7705 SAR-8 Shelf V2 or 7705 SAR-18 in order to provide a basic microwave connection or the microwave awareness (MWA) capability to an MPR-e node.

For more information, see Microwave link.

3.1.3.9 CLI identifiers for adapter cards, modules and platforms

On the CLI, the adapter cards are referred to as MDAs. A port is identified using the format *slot/mda/port,* where *slot* identifies the IOM card slot ID (always 1), *mda* identifies the physical slot in the chassis for the

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adapter card, and *port* identifies the physical port on the adapter card; for example, 1/5/1. Adapter cards are configured at the card and port level.

On the fixed platforms, no configuration is required at the adapter card level to provision the ports.

On the CLI for the 7705 SAR-A, the *slot/mda* identifier for the T1/E1 ports is 1/2 and for the Ethernet ports is 1/1. T1/E1 ports are identified as 1/2/1 through 1/2/8 for the variant of the chassis with T1/E1 ports. Ethernet ports for both variants of the 7705 SAR-A are identified as 1/1/1 through 1/1/12.

On the CLI for the 7705 SAR-Ax, the *slot/mda* identifier for the Ethernet ports is 1/1 and for the GNSS RF port is 1/2.

On the CLI for the 7705 SAR-H, the *slot/mda* identifier for the Ethernet ports is 1/1. The chassis has two slots for modules (the 4-port T1/E1 and RS-232 Combination module, the GPS Receiver module, and the 4-port SAR-H Fast Ethernet module). On the CLI, the *slot/mda* identifier for a module installed in the first slot position is 1/2 and for a module installed in the second slot position is 1/3. Ethernet ports are identified as 1/1/1 through 1/1/8. Module ports are identified as 1/2/*port-num* for modules installed in the first slot position and 1/3/*port-num* for modules installed in the second slot position.

On the CLI for the 7705 SAR-Hc, the *slot/mda* identifier for the Ethernet ports is 1/1 and for the RS-232 ports is 1/2. Ethernet ports are identified as 1/1/1 through 1/1/6 and RS-232 ports are identified as 1/2/1 and 1/2/2.

On the CLI for the 7705 SAR-M, the *slot/mda* identifier for the Ethernet ports is 1/1 and for the T1/E1 ports is 1/2. For those variants of the chassis that have a module slot, the *slot/mda* identifier for the module is 1/3. The 7705 SAR-M supports the following modules: CWDM OADM module, 2-port 10GigE (Ethernet) module, and 6-port SAR-M Ethernet module. Ethernet ports for all variants of the 7705 SAR-M are identified as 1/1/1 through 1/1/7. T1/E1 ports are identified as 1/2/1 through 1/2/16 for the variants with T1/E1 ports. Module ports are identified as 1/3/*port-num* for the variants with module slots.

On the CLI for the 7705 SAR-Wx, the *slot/mda* identifier for the Ethernet ports is 1/1 and for the GPS connector is 1/3. Ethernet ports for the Ethernet-only variant and the Ethernet and PoE+ variant are identified as 1/1/1 through 1/1/5. For the variant supporting Ethernet ports and a GPS connector, the GPS connector is identified as 1/3/1.

On the CLI for the 7705 SAR-X, the *slot/mda* identifier for the T1/E1 ports is specified as 1/1 and for the Ethernet ports is 1/2 or 1/3. T1/E1 ports are identified as 1/1/1 to 1/1/8. Ethernet ports are identified as 1/2/*port-num* or 1/3/*port-num*, where the port number has a value from 1 to 7, depending on how the port is configured.

For the 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, and 4-port DS3/E3 Adapter card, the *channel-group-id* identifies the DS1 or E1 channel group; for example, 1/5/1.20. For the 2-port OC3/STM1 Channelized Adapter card, the *channel-group-id* identifies the DS1, E1, or DS3 channel group. For the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, the *channel-group-id* identifies the DS1 or E1 channel group. For the 12-port Serial Data Interface card, the *channel-group-id* identifies the V.35, RS-530, RS-232, or X.21 channel group; only one channel group per port is supported on the card, so the format would be 1/1/1.1.

For the 6-port E&M Adapter card, the *channel-group-id* identifies the E&M voice channel group; only one channel group per port is supported on the card, so the format would be 1/1/1.1. For the 8-port Voice & Teleprotection card, the 8-port C37.94 Teleprotection card, the 8-port FXO Adapter card, and the 6-port FXS Adapter card, the *channel-group-id* identifies the DS0 channel group; only one channel group per port is supported on the card, so the format would be 1/1/1.1.

For the 4-port T1/E1 and RS-232 Combination module, the *channel-group-id* identifies the DS1 or E1 channel group for the T1/E1 ports (for example, 1/2/3.5) or the channel group for the RS-232 ports (for example, 1/2/2.1).

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On the CLI for the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module, for virtual-port configuration, an Ethernet port is identified as v-port.

The following output examples display the administrative and operational states of adapter cards for all platforms.

For the 7705 SAR-8 Shelf V2:

```
NOK-1>show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  6
1/1    a12-sdiv2                        up    provisioned   12
1/2    a4-oc3                           up    provisioned   4
1/3    a16-chds1v2                      up    provisioned   16
1/4    a4-chds3v2                       up    provisioned   4
1/5    a8-1gb-sfp                       up    provisioned   8
1/6    a2-choc3                         up    provisioned   2
A      csmv2-10g                        up    up                      Active
B      csmv2-10g                        up    down                    Standby
===============================================================================
NOK-1>#
```

For the 7705 SAR-18:

```
*A:NOK-1# show card state

===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  12
1/1    aux-alarm                        up    up
1/2    a8-1gb-sfp                       up    up            8
1/3    a8-1gb-sfp                       up    up            8
1/4    a8-1gb-sfp                       up    provisioned   8
1/5    a8-1gb-sfp                       up    provisioned   8
1/6    a32-chds1v2                      up    up            32
1/7    a32-chds1v2                      up    up            32
1/8    a8-pmc                           up    up            8
1/9    mw-pic-2                         up    up            2
1/10   a4-oc3                           up    provisioned   4
1/11   a4-chds3v2                       up    provisioned   4
1/12   a2-choc3                         up    provisioned   2
1/X1   x-10GigE-v2                      up    provisioned   1
1/X2   x-10GigE-v2                      up    provisioned   1
1/X3   x-10GigE-v2                      up    provisioned   1
1/X4   x-10GigE-v2                      up    provisioned   1
A      csm-10g                          up    up                      Active
B      csm-10g                          up    down                    Standby
===============================================================================
*A:NOK-1#
```

For the 7705 SAR-A:

```
*A:NOK-1# show card state
```


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```
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  2
1/1    i12-eth-xor                      up    up            12
1/2    i8-chds1                         up    up            8
A      csm-2.5g                         up    up                        Active
===============================================================================
*A:NOK-1#
```

For the 7705 SAR-Ax:

```
*A:sar-Ax# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                  Admin Operational   Num   Num Comments
Id         Equipped Type (if different)  State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                           up    up                  2
1/1    i12-1gb-xor                       up    up            12
1/2    i1-gnss                           up    up            1
A      csm-2.5g                          up    up                      Active
===============================================================================
```

For the 7705 SAR-H:

```
*A:NOK-1# show card state

===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  3
1/1    i8-1gb                           up    up            8
1/2    p4-combo                         up    up            4
1/3    p4-combo                         up    up            4
A      csm-2.5g                         up    up                        Active
===============================================================================
*A:NOK-1#
```

For the 7705 SAR-Hc:

```
*A:NOK-1# show card state

===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  2
1/1    i6-1gb                           up    up            6
1/2    i2-sdi                           up    up            2
A      csm-2.5g                         up    up                        Active
===============================================================================
```


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```
*A:NOK-1#
```

For the 7705 SAR-M:

```
*A:NOK-1# show card state

===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  3
1/1    i7-1gb                           up    up            7
1/2    i16-chds1                        up    up            16
1/3    p6-eth                           up    up            6
A      csm-2.5g                         up    up                        Active
===============================================================================
*A:ALU-1#
```

For the 7705 SAR-Wx Ethernet variant:

```
*A:NOK-1# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  1
1/1    i5-1gb-b                         up    up            5
A      csm-2.5g                         up    up                        Active
===============================================================================
*A:NOK-1#
```

For the 7705 SAR-X:

```
*A:NOK-1# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                           up    up                  3
1/1    i8-chds1-x                        up    up             8
1/2    i7-mix-eth                        up    up             7
1/3    i7-mix-eth                        up    up             7
A      csm-2.5g                          up    up                        Active
===============================================================================
*A:NOK-1#
```

3.1.3.10 Access, network, and hybrid ports

All ports must be set to access (customer-facing), network, or hybrid mode. When the mode is configured on a port, the appropriate encapsulation type must be configured to distinguish the services on the port or channel (for access mode), or to define the transport mode (for network mode).

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For the 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, and 4-port DS3/E3 Adapter card, the card must be enabled to support a set of software services before the encapsulation type is configured. This support is enabled using the **mda-mode** command (see the mda-mode command in the Configuration command reference section):

Access ports

Access ports are configured for customer-facing traffic on which services are configured. If a service access point (SAP) is to be configured on the port or channel, the port or channel must be configured as an access port or channel.

The encapsulation type on the 16-port T1/E1 ASAP Adapter card and the 32-port T1/E1 ASAP Adapter card can be ipcp, cem, atm, frame-relay, hdlc, or cisco-hdlc.

On the 12-port Serial Data Interface card, the encapsulation type can be cem, ipcp, frame-relay, hdlc, or cisco-hdlc, depending on the interface type. V.35 ports and X.21 ports at super-rate speeds (64 kb/s and above) support all of the above encapsulation types. RS-232 ports and X.21 ports operating at subrate speeds support only cem encapsulation. RS-530 ports support only cem encapsulation.

On the 4-port T1/E1 and RS-232 Combination module, the encapsulation type for T1/E1 ports can be ipcp or cem. RS-232 ports operating at subrate speeds support only cem encapsulation.

On the 6-port E&M Adapter card, 8-port Voice & Teleprotection card, 8-port C37.94 Teleprotection card, 8-port FXO Adapter card, and 6-port FXS Adapter card, the encapsulation type must be cem.

On the 8-port Gigabit Ethernet Adapter card, 6-port Ethernet 10Gbps Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card, Packet Microwave Adapter card, 4-port SAR-H Fast Ethernet module, 6-port SAR-M Ethernet module, and the Ethernet ports on all fixed platforms with Ethernet ports, the encapsulation type can be set as null, dot1q, or qinq.

Note:

- The 10-port 1GigE/1-port 10GigE X-Adapter card supports qinq only when it is in 10-port 1GigE mode.
- The Packet Microwave Adapter card supports qinq only when the port is not in mw-link mode.

On the 4-port OC3/STM1 Clear Channel Adapter card, the encapsulation type must be atm.

On the 4-port DS3/E3 Adapter card, the encapsulation type for DS3/E3 clear channel ports can be atm, cem, or frame-relay. The encapsulation type for DS3 channelized ports can be cem or frame-relay.

On the 2-port OC3/STM1 Channelized Adapter card, the encapsulation type can be ipcp, cem, or atm.

On the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, the encapsulation type must be cem.

Network ports

Network ports are configured for network-facing traffic. Network ports are used as uplinks for Ethernet, ATM, PPP, and TDM pseudowires.

On the Ethernet cards, the Packet Microwave Adapter card, the 2-port 10GigE (Ethernet) Adapter card, and 2-port 10GigE (Ethernet) module, the encapsulation type can be set as null or dot1q.

Note: QinQ encapsulation is not supported on a port in network mode.

The encapsulation type must be ppp-auto for PPP/MLPPP bundles on the following:

- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M

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- T1/E1 ports on the 7705 SAR-X
- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)

Network PPP (encapsulation type ppp-auto) can be configured to use some with fractional ppp or all the timeslots on T1/E1 ports on the following:

- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X
- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)

On the 4-port OC3/STM1 Clear Channel Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, 4-port DS3/E3 Adapter card, and 2-port OC3/STM1 Channelized Adapter card, the encapsulation type must be ppp-auto. Fractional PPP is not supported on these cards; all timeslots of the DS1 channel will be used.

Hybrid ports

Hybrid ports are configured for access (customer-facing) and network-facing traffic. Hybrid ports can support access and network modes simultaneously over different VLANs. Within the span of a port, some of the VLANs can be in access mode and associated with SAPs for various services, while other VLANs can be in network mode and support any of the network-side operations, including label switching, IP forwarding (GRT IP routing), GRE SDPs, and so on.

The default modes are listed in the following table. All channel groups on a port must either be all access or all network channel groups; there cannot be a mix. When the first channel group is configured, all other channel groups on that port must be set to the same mode. To change modes, all channel groups must first be shut down.

Table 6: Default port mode per adapter card, module, or platform

Default mode	Adapter card, module, or platform
Network	2-port 10GigE (Ethernet) Adapter card 2-port 10GigE (Ethernet) module 10-port 1GigE/1-port 10GigE X-Adapter card (in 1-port 10GigE mode, the port operates in network mode only)
Access	2-port OC3/STM1 Channelized Adapter card 4-port DS3/E3 Adapter card 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card 4-port OC3/STM1 Clear Channel Adapter card 4-port SAR-H Fast Ethernet module

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Default mode	Adapter card, module, or platform
	4-port T1/E1 and RS-232 Combination module is access for the T1/E1 ports; the RS-232 ports operate in access mode only
	6-port E&M Adapter card
	6-port Ethernet 10Gbps Adapter card
	6-port FXS Adapter card
	6-port SAR-M Ethernet module
	8-port FXO Adapter card
	8-port Gigabit Ethernet Adapter card
	8-port Voice & Teleprotection card
	8-port C37.94 Teleprotection card
	12-port Serial Data Interface card
	16-port T1/E1 ASAP Adapter card
	32-port T1/E1 ASAP Adapter card
	Auxiliary Alarm card
	CWDM OADM Adapter card
	GNSS Receiver card
	GPS Receiver module
	Integrated Services card
	Packet Microwave Adapter card
	Power Injector card
	7705 SAR-A
	7705 SAR-Ax
	7705 SAR-H
	7705 SAR-Hc
	7705 SAR-M
	7705 SAR-Wx
	7705 SAR-X

3.1.3.10.1 Rate limiting

The 7705 SAR supports egress rate limiting and ingress rate limiting on Ethernet ports.

The egress rate is set at the port level in the **config>port>ethernet** context.

Egress rate limiting sets a limit on the amount of traffic that can leave the port to control the total bandwidth on the interface. If the egress rate limit is reached, the port applies backpressure on the queues, which stops the flow of traffic until the queue buffers are emptied. This feature is useful in scenarios where

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there is a fixed amount of bandwidth; for example, a mobile operator who has leased a fixed amount of bandwidth from the service provider.

The **ingress-rate** command configures a policing action to rate-limit the ingress traffic. Ingress rate enforcement uses dedicated hardware for rate limiting; however, software configuration is required at the port level (ingress rate limiter) to ensure that the network processor or the adapter card or port never receives more traffic than they are optimized for.

The configured ingress rate ensures that the network processor does not receive traffic greater than this configured value on a per-port basis. When the ingress rate value is reached, all subsequent frames are dropped. The ingress rate limiter drops excess traffic without determining whether the traffic has a higher or lower priority.

3.1.3.10.2 Access ports

Access ports on the following can be configured for PPP/MLPPP channel groups:

- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 12-port Serial Data Interface card
- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)
- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

Customer IP traffic can be transported directly over PPP or MLPPP links. Access ports on the following can also be configured for TDM to transport 2G traffic from BTSs or ATM/IMA to transport 3G UMTS traffic from Node Bs:

- 2-port OC3/STM1 Channelized Adapter card
- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 7705 SAR-M

In access mode, PPP channels can be associated with n × DS0 channel groups. Although multiple PPP channel groups are supported per T1/E1 port, all the channel groups must be the same encapsulation type. For example, if one channel group on a given port is set for ipcp encapsulation, another channel group on the same port cannot be set to cem. If MLPPP channels are used, an MLPPP channel group fills up an entire DS1 or E1 link.

The 2-port OC3/STM1 Channelized Adapter card supports ipcp encapsulation of PPP/MLPPP packets for transport over an Ipipe.

The data ports on the 12-port Serial Data Interface card and the RS-232 ports on the 4-port T1/E1 and RS-232 Combination module provide transport between two data devices. Each data stream that is transported across the network can be mapped into a TDM pseudowire (Cpipe) for transport across an MPLS network. The other end can terminate either on another 7705 SAR or a multiplexer capable of terminating the pseudowire.

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The 12-port Serial Data Interface card supports frame relay encapsulation of data on V.35 and X.21 channel groups for transport over a frame relay pseudowire (Fpipe) or IP interworking pseudowire (Ipipe). The 12-port Serial Data Interface card also supports ipcp and cisco-hdlc encapsulation of PPP and Cisco HDLC packets, respectively, for transport over an Ipipe.

The 12-port Serial Data Interface card and the 4-port T1/E1 and RS-232 Combination module can also be part of a system architecture where a circuit originates on an SDI port on the 7705 SAR, transits over an MPLS network, and terminates on a TDM-capable node (such as the 3600 MainStreet) connected to a 7705 SAR over a T1/E1 connection. In addition to the MPLS network functionality, the 12-port Serial Data Interface card and the 4-port T1/E1 and RS-232 Combination module can also operate in a TDM SAP-to-SAP mode where the other SAP can be another port on the 12-port Serial Data Interface card or on a T1/E1 ASAP card.

Access ports on the 8-port Gigabit Ethernet Adapter card, 6-port Ethernet 10Gbps Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card (10-port 1GigE mode only), and the Packet Microwave Adapter card can transport traffic from sources such as e911 locators, site surveillance equipment, VoIP phones, and video cameras. The Ethernet traffic is transported over the PSN using Ethernet VLLs.

Note: For information about VLLs, see the 7705 SAR Services Guide, "VLL Services".

A microwave link from a Packet Microwave Adapter card port in access mode can peer with user equipment such as a node B or MPR-e radio. The 7705 SAR-8 Shelf V2 or the 7705 SAR-18 treat the microwave access link as a normal SAP into a service such as Epipe, Ipipe, or VPLS/VPRN.

Voice ports on the 6-port E&M Adapter card, 8-port Voice & Teleprotection card, and 8-port FXO Adapter card provide voiceband transmission between two analog devices over a digital network. A 7705 SAR-8 Shelf V2 or 7705 SAR-18 terminates the voice circuit and then transmits the data over a TDM-based network interface (SAP-to-SAP) or an MPLS packet-based network interface (SAP-to-SDP). For standard TDM, a T1 or E1 interface is used to transmit the data across the network.

For MPLS, any network interface (that is, Ethernet, T1/E1 MLPPP, or OC3/STM1) can be used. The traffic originating from the 6-port E&M Adapter card, 8-port Voice & Teleprotection card, or 8-port FXO Adapter card can be mapped into a TDM pseudowire (Cpipe) for transport across the MPLS network. The 6-port E&M Adapter card, and 8-port FXO Adapter card support one TDM pseudowire per port.

The voice circuit can terminate on another 7705 SAR-8 Shelf V2 or 7705 SAR-18 over the MPLS or T1/E1 TDM connection, on other TDM-capable equipment (such as a 3600 MainStreet node) over a T1/E1 TDM connection, or on other MPLS-capable equipment over an MPLS pseudowire emulation (PWE) connection. A TDM-capable node (such as a 3600 MainStreet or 1511 MAX) can also connect to an FXO port on the 8-port Voice & Teleprotection card.

Voice ports on a 6-port FXS Adapter card can be configured for a PBX application or a PLAR (hotline) application. For a PBX application, the voice circuits are terminated on an FXO interface at a 7705 SAR hub location that is connected to a PBX. The FXO interface can be provided by either an 8-port FXO Adapter card or 8-port Voice & Teleprotection card that is installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis at the 7705 SAR hub location.

For a PLAR application, voice circuits are terminated on an FXS interface on either another 6-port FXS Adapter card or an 8-port Voice & Teleprotection card that is installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis located at a remote location or terminated on TDM-capable equipment such as a 3600 MainStreet or 1511 MAX. A hotline call can also originate from the TDM-capable node and terminate on an FXS interface on a 6-port FXS Adapter card (or on an FXS interface on an 8-port Voice & Teleprotection card.

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On an 8-port C37.94 Teleprotection card, access traffic over the TPIF interfaces can be mapped into a TDM pseudowire (Cpipe) for transport across an MPLS network. The TPIF interfaces connect teleprotection relays used by utilities. They can also be used with a relay to connect to a TPIF interface on an 8-port Voice & Teleprotection card or to a TPIF interface on equipment such as a 1511 MAX.

SONET/SDH ports in access mode on a 4-port OC3/STM1 Clear Channel Adapter card can be configured for ATM (such as for 3G UMTS Node Bs).

The DS3/E3 clear channel access ports on the 4-port DS3/E3 Adapter card, can be configured for ATM PW services (categories CBR, VBR-rt, VBR-nrt, UBR, and UBR+MCR), for TDM PW services to transport 2G traffic from BTSs, and for frame relay PW service.

Access ports on the 2-port OC3/STM1 Channelized Adapter card can be configured for TDM to transport 2G traffic from BTSs or ATM/IMA to transport 3G UMTS traffic from Node Bs. Access ports on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card can only be configured for TDM.

All member links of the IMA group must reside on the same card. The 2G traffic is transported across the PSN encapsulated in a TDM VLL. The 3G traffic is transported using ATM VLLs.

For PPP/MLPPP channel groups, the encapsulation type must be ipcp. For Ethernet VLLs, the encapsulation type can be null, dot1q, or qinq. For TDM VLLs, the encapsulation type must be cem. For ATM VLLs, the encapsulation type must be atm.

3.1.3.10.2.1 H-QoS for access egress Ethernet ports

To support hierarchical QoS (H-QoS) on second-generation Ethernet adapter cards, the 7705 SAR supports the configuration of one aggregate CIR rate for all the unshaped 4-priority access egress Ethernet SAPs on a port, thereby ensuring that all the unshaped SAPs can compete with the shaped SAPs on the port for fabric bandwidth. Use the **config>port>ethernet>access>egress>unshaped-sap-cir** command to set the aggregate CIR rate.

Third-generation (Gen-3) Ethernet adapter cards and platforms have 4-priority schedulers, and all SAPs are shaped SAPs. See Table 2: Ethernet adapter card, module, and platform generations for a list of Gen-2 and Gen-3 adapter cards, modules, and platforms. See the "QoS for Gen-3 adapter cards and platforms" section in the 7705 SAR Quality of Service Guide for more information about 4-priority schedulers for Gen-3 hardware.

Ports on the 4-port SAR-H Fast Ethernet module do not support H-QoS.

For more information about H-QoS on shaped and unshaped Ethernet SAPs, see the "Per-SAP aggregate shapers (H-QoS)" section in the 7705 SAR Quality of Service Guide.

3.1.3.10.3 Network ports

Network uplinks can be configured as standalone PPP ports, or MLPPP can be configured on T1/E1 ports or channels. All member links of an MLPPP group must be of the same type (either E1 or Ds1).

The following cards, modules, and platforms support multilink bundles:

- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

  The following must have all member links of an MLPPP bundle configured on the same card or module:

  – 16-port T1/E1 ASAP Adapter card

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– 32-port T1/E1 ASAP Adapter card
– T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)

The following must have all member links of an MLPPP bundle configured on the same card or module, and on the same port:

– 2-port OC3/STM1 Channelized Adapter card
– 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

Ethernet ports on the 8-port Gigabit Ethernet Adapter card, 6-port Ethernet 10Gbps Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card, and Packet Microwave Adapter card can be configured for network mode. Ethernet uplinks can be used as a cost-effective alternative to T1/E1 links.

On the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module, the Ethernet ports and the v-port can be configured for network mode only.

A microwave link from a Packet Microwave Adapter card port in network mode provides a network uplink to an MPR-e radio. The 7705 SAR-8 Shelf V2 or 7705 SAR-18 treats the microwave link as a Gigabit Ethernet network link with MPLS always running over it. All standard MPLS/IP functions available on a network port or SDP are also available on the microwave link.

For network uplinks on the 4-port OC3/STM1 Clear Channel Adapter card and 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, a clear channel port can be configured for POS to connect to the packet network. PPP can be enabled on a port by setting the encapsulation type to ppp-auto.

On the 2-port OC3/STM1 Channelized Adapter card, DS3 clear channels within OC3 or STM1 can be configured for PPP as the network uplink. The encapsulation type must be set to ppp-auto.

On the 4-port DS3/E3 Adapter card, a DS3/E3 clear channel port can be configured for PPP as the network uplink. The encapsulation type must be set to ppp-auto.

The 7705 SAR supports both copper and fiber uplinks.

3.1.3.10.3.1 Aggregate CIR for unshaped VLANs on network egress Ethernet ports

The 7705 SAR supports the configuration of one aggregate CIR rate for all the unshaped network egress Ethernet VLANs on a port, thereby ensuring that all the unshaped VLANs can compete with the shaped VLANs (that is, network interfaces) at the port level for egress bandwidth. Use the **config>port>ethernet>network>egress>unshaped-if-cir** command to set the aggregate CIR rate.

Note: The **unshaped-if-cir** command does not apply to Gen-3 Ethernet adapter cards and platforms, except for network egress in hybrid mode. In this case, the **shaper-if-cir** command applies.

For more information about shaped and unshaped Ethernet VLANs, see the "Per-VLAN network egress shapers" and "QoS for Gen-3 adapter cards and platforms" sections in the 7705 SAR Quality of Service Guide.

3.1.3.10.4 Hybrid ports

Hybrid ports are supported on Ethernet ports, where they provide the capabilities and features of access and network mode ports on a per-VLAN basis. The following services support hybrid port functionality: Epipe PW, Ipipe PW, IP-VPN, VPLS, and IES.

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For ingress traffic, QoS and traffic management on a hybrid port functions in the same way for access and network port modes. See the 7705 SAR Quality of Service Guide, "QoS for hybrid ports on Gen-2 hardware" and "QoS for Gen-3 adapter cards and platforms" for details.

Network VLANs on a hybrid port provide OAM down MEP support, as well as port loopback support (in line mode with latched timers only).

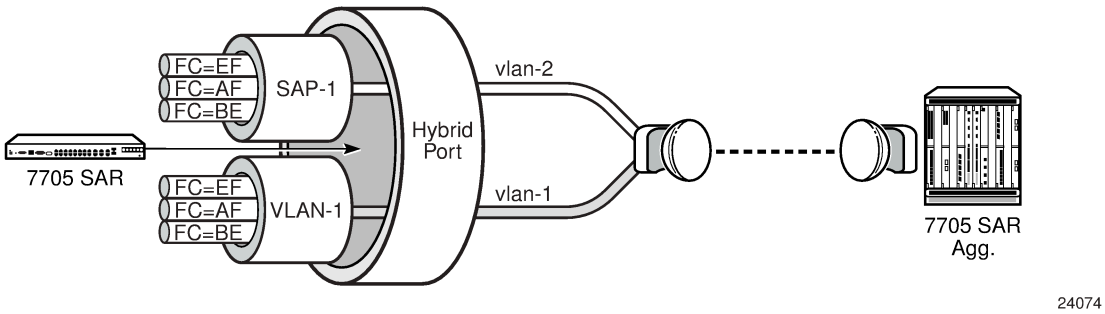
The following hardware supports hybrid ports:

- 6-port SAR-M Ethernet module (except for the Fast Ethernet ports (ports 1 and 2))
- 6-port Ethernet 10Gbps Adapter card
- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card (only in 10-port 1GigE mode)
- Packet Microwave Adapter card (only in Ethernet port mode (not mw-link mode))
- 7705 SAR-A Ethernet ports (except for the Fast Ethernet ports (ports 9 to 12))
- 7705 SAR-Ax Ethernet ports
- 7705 SAR-M Ethernet ports
- 7705 SAR-H Ethernet ports
- 7705 SAR-Hc Ethernet ports
- 7705 SAR-Wx Ethernet ports
- 7705 SAR-X Ethernet ports

In some scenarios, combining the access and network capabilities under the same port is beneficial. A typical scenario is shown in the following figure, where a single port hosts both access-side services and a traffic management model together with network-side IP/MPLS routing and switching capabilities simultaneously.

In this scenario, a network interface is configured to ensure connectivity between the cell site 7705 SAR and the aggregation site 7705 SAR. The network interface is used for all IP/MPLS traffic and is bound to VLAN-1. Another VLAN (VLAN-2) is configured to bind the management traffic of a microwave radio (an MPR-e) to an access-side service such as an Ethernet PW or VPLS. For security reasons, many mobile operators prefer to transport management traffic of network elements under a service construct as opposed to basic GRT-based routing. To accommodate this preference, an access-side service and a network interface can be configured to coexist on the same port when the port is configured for hybrid mode.

Figure 1: Hybrid port application



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3.1.4 Configuring SCADA bridges

Supervisory control and data acquisition (SCADA) bridges are configured on an Integrated Services card as part of the multidrop data bridge (MDDB), pulse code modulation (PCM) multidrop bridge, and voice conference bridge (VCB) functionality. MDDB, PCM, and VCB are used to support SCADA systems on a 7705 SAR-8 Shelf V2 or 7705 SAR-18.

For information about MDDB, see Multidrop data bridge. For information about PCM multidrop bridge, see PCM multidrop bridge. For information about VCB, see Voice conference bridge.

A SCADA bridge can be configured after the IOM is activated (the card slot and card type are designated) and the adapter card slot is preprovisioned with the Integrated Services card **mda-type**.

3.2 Port features

This section contains information about the following topics:

- Multilink point-to-point protocol
- Multiclass MLPPP
- cHDLC
- IMA
- Network synchronization on ports and circuits
- Node synchronization from GNSS receiver ports
- Flow control on Ethernet ports
- Ethernet OAM
- Ethernet loopbacks
- Ethernet port down-when-looped
- Ethernet ring (adapter card and module)
- MTU configuration guidelines
- LAG
- LAG and ECMP hashing
- SONET/SDH
- Automatic protection switching
- T1/E1 line card redundancy
- Deploying preprovisioned components
- Microwave link
- Custom alarms on Ethernet ports

3.2.1 Multilink point-to-point protocol

This section contains information about the following topics:

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- MLPPP overview
- Protocol field
- B&E bits
- Sequence number
- Information field
- Padding
- FCS
- LCP
- T1/E1 link hold timers

3.2.1.1 MLPPP overview

Multilink point-to-point protocol (MLPPP) is a method of splitting, recombining, and sequencing packets across multiple logical data links. MLPPP is defined in RFC 1990, *The PPP Multilink Protocol (MP)*.

MLPPP allows multiple PPP links to be bundled together, providing a single logical connection between two routers. Data can be distributed across the multiple links within a bundle to achieve high bandwidth. As well, MLPPP allows for a single frame to be fragmented and transmitted across multiple links. This capability allows for lower latency and also for a higher maximum receive unit (MRU).

Multilink protocol is negotiated during the initial LCP option negotiations of a standard PPP session. A system indicates to its peer that it is willing to perform MLPPP by sending the MP option as part of the initial LCP option negotiation.

The system has the following capabilities:

- The system offering the option is capable of combining multiple physical links into one logical link.
- The system is capable of receiving upper layer protocol data units (PDUs) that are fragmented using the MP header and then reassembling the fragments back into the original PDU for processing.
- The system is capable of receiving PDUs of size N octets, where N is specified as part of the option, even if N is larger than the maximum receive unit (MRU) for a single physical link.

When MLPPP has been successfully negotiated, the sending system is free to send PDUs encapsulated and/or fragmented with the MP header.

MP introduces a new protocol type with a protocol ID (PID) of 0x003d. Figure 2: MLPPP 24-bit fragment format and Figure 3: MLPPP 12-bit fragment format show the MLPPP fragment frame structure. Framing to indicate the beginning and end of the encapsulation is the same as that used by PPP and described in RFC 1662, *PPP in HDLC-like Framing*.

MP frames use the same HDLC address and control pair value as PPP: Address – 0xFF and Control – 0x03. The 2-octet protocol field is also structured the same way as in PPP encapsulation.

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Figure 2: MLPPP 24-bit fragment format

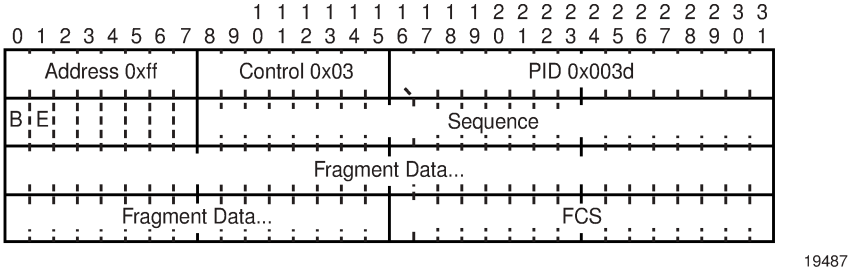
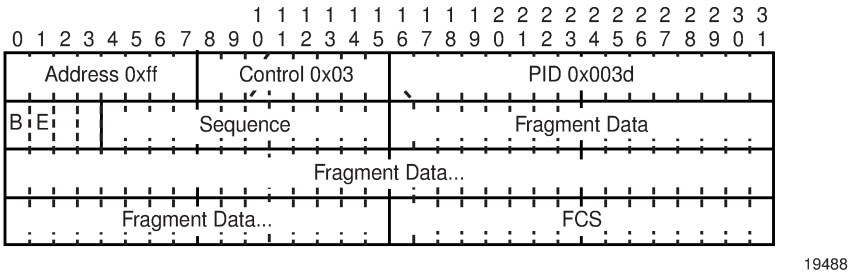


Figure 3: MLPPP 12-bit fragment format



The required and default format for MP is the 24-bit format. During the LCP state, the 12-bit format can be negotiated. The 7705 SAR is capable of supporting and negotiating the alternate 12-bit frame format.

The maximum differential delay supported for MLPPP is 25 ms.

3.2.1.2 Protocol field

The protocol field (PID) is 2 octets. Its value identifies the datagram encapsulated in the Information field of the packet. For MP, the PID also identifies the presence of a 4-octet MP header (or 2-octet, if negotiated).

A PID of 0x003d identifies the packet as MP data with an MP header.

The LCP packets and protocol states of the MLPPP session follow those defined by PPP in RFC 1661. The options used during the LCP state for creating an MLPPP NCP session are described in the sections that follow.

3.2.1.3 B&E bits

The B&E bits are used to indicate the start and end of a packet. Ingress packets to the MLPPP process have an MTU, which may or may not be larger than the maximum received reconstructed unit (MRRU) of the MLPPP network. The B&E bits manage the fragmentation of ingress packets when the packet exceeds the MRRU.

The B-bit indicates the first (or beginning) packet of a given fragment. The E-bit indicates the last (or ending) packet of a fragment. If there is no fragmentation of the ingress packet, both B&E bits are set to true (=1).

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3.2.1.4 Sequence number

Sequence numbers can be either 12 or 24 bits long. The sequence number is 0 for the first fragment on a newly constructed bundle and increments by one for each fragment sent on that bundle. The receiver keeps track of the incoming sequence numbers on each link in a bundle and reconstructs the required unbundled flow through processing of the received sequence numbers and B&E bits. For a detailed description of the algorithm, see RFC 1990.

3.2.1.5 Information field

The Information field is 0 or more octets. The Information field contains the datagram for the protocol specified in the protocol field.

The MRRU has the same default value as the MTU for PPP. The MRRU is always negotiated during LCP.

3.2.1.6 Padding

On transmission, the Information field of the ending fragment may be padded with an arbitrary number of octets up to the MRRU. It is the responsibility of each protocol to distinguish padding octets from real information. Padding must only be added to the last fragment (E-bit set to true).

3.2.1.7 FCS

The FCS field of each MP packet is inherited from the normal framing mechanism from the member link on which the packet is transmitted. There is no separate FCS applied to the reconstituted packet as a whole if it is transmitted in more than one fragment.

3.2.1.8 LCP

The link control protocol (LCP) is used to establish the connection through an exchange of configure packets. This exchange is complete, and the LCP opened state entered, once a Configure-Ack packet has been both sent and received.

LCP allows for the negotiation of multiple options in a PPP session. MP is somewhat different from PPP, and therefore the following options are set for MP and are not negotiated:

- no async control character map
- no magic number
- no link quality monitoring
- address and control field compression
- protocol field compression
- no compound frames
- no self-describing padding

Any non-LCP packets received during this phase must be silently discarded.

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3.2.1.9 T1/E1 link hold timers

T1/E1 link hold timers (or MLPPP link flap dampening) guard against the node reporting excessive interface transitions. Timers can be set to determine when link up and link down events are advertised; that is, up-to-down and down-to-up transitions of the interface are not advertised to upper layer protocols (are dampened) until the configured timer has expired.

3.2.2 Multiclass MLPPP

The 7705 SAR supports multiclass MLPPP (MC-MLPPP) to address end-to-end delay caused by low-speed links transporting a mix of small and large packets. With MC-MLPPP, large, low-priority packets are fragmented to allow opportunities to send high-priority packets. QoS for MC-MLPPP is described in QoS in MC-MLPPP.

MC-MLPPP allows for the prioritization of multiple types of traffic flowing over MLPPP links, such as traffic between the cell site routers and the mobile operator's aggregation routers. MC-MLPPP, as defined in RFC 2686, *The Multi-Class Extension to Multi-Link PPP*, is an extension of the MLPPP standard. MC-MLPPP is supported on access ports wherever PPP/MLPPP is supported, except on the 2-port OC3/STM1 Channelized Adapter card. It allows multiple classes of fragments to be transmitted over an MLPPP bundle, with each class representing a different priority level mapped to a forwarding class. The highest-priority traffic is transmitted over the MLPPP bundle with minimal delay regardless of the order in which packets are received.

Figure 4: Original MLPPP header format shows the original MLPPP header format that allowed only two implied classes. The two classes were created by transmitting two interleaving flows of packets; one with MLPPP headers and one without. This resulted in two levels of priority sent over the physical link, even without the implementation of multiclass support.

Figure 5: MC-MLPPP header format shows the short and long sequence number fragment format MC-MLPPP headers. The short sequence number fragment format header includes two class bits to allow for up to four classes of service. Four class bits are available in the long sequence number fragment format header, but a maximum of four classes are still supported. This extension to the MLPPP header format is detailed in RFC 2686.

Figure 4: Original MLPPP header format

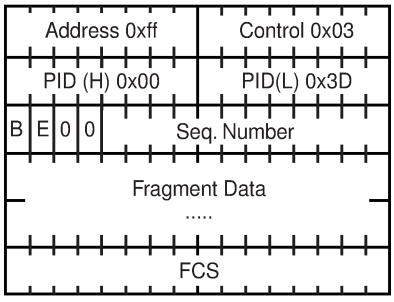

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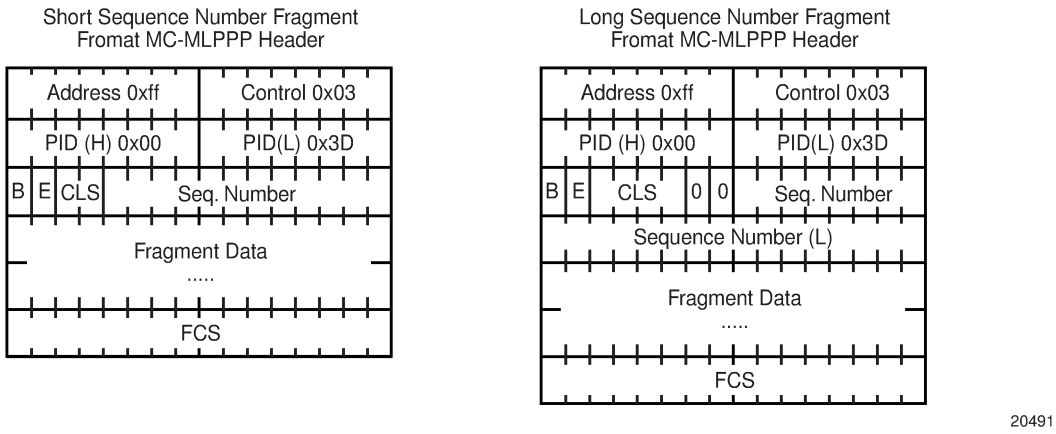
Figure 5: MC-MLPPP header format



The new MC-MLPPP header format uses the previously unused bits before the sequence number as the class identifier to allow four distinct classes of service to be identified.

3.2.2.1 QoS in MC-MLPPP

MC-MLPPP on the 7705 SAR supports scheduling based on multiclass implementation. Instead of the standard profiled queue-type scheduling, an MC-MLPPP encapsulated access port performs class-based traffic servicing. The four MC-MLPPP classes are scheduled in a strict priority fashion, as shown in the following table.

Table 7: MC-MLPPP class priorities

MC-MLPPP class	Priority
0	Priority over all other classes
1	Priority over classes 2 and 3
2	Priority over class 3
3	No priority

For example, if a packet is sent to an MC-MLPPP class 3 queue and all other queues are empty, the 7705 SAR fragments the packet according to the configured fragment size and begins sending the fragments. If a new packet arrives at an MC-MLPPP class 2 queue while the class 3 fragment is still being serviced, the 7705 SAR finishes sending any fragments of the class 3 packet that are on the wire, then holds back the remaining fragments in order to service the higher-priority packet.

The fragments of the first packet remain at the top of the class 3 queue. For packets of the same class, MC-MLPPP class queues operate on a first-in, first-out basis.

The user configures the required number of MLPPP classes to use on a bundle. The forwarding class of the packet, as determined by the ingress QoS classification, is used to determine the MLPPP class for the packet. The mapping of forwarding class to MLPPP class is a function of the user-configurable number of

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MLPPP classes. The mapping for 4-class, 3-class, and 2-class MLPPP bundles is shown in the following table.

Table 8: Packet forwarding class to MC-MLPPP class mapping

FC ID	FC name	MLPPP class 4-class bundle	MLPPP class 3-class bundle	MLPPP class 2-class bundle
7	NC	0	0	0
6	H1	0	0	0
5	EF	1	1	1
4	H2	1	1	1
3	L1	2	2	1
2	AF	2	2	1
1	L2	3	2	1
0	BE	3	2	1

If one or more forwarding classes are mapped to a queue, the scheduling priority of the queue is based on the lowest forwarding class mapped to it. For example, if forwarding classes 0 and 7 are mapped to a queue, the queue is serviced by MC-MLPPP class 3 in a 4-class bundle model.

3.2.3 cHDLC

The 7705 SAR supports Cisco HDLC, which is an encapsulation protocol for information transfer. Cisco HDLC is a bit-oriented synchronous data-link layer protocol that specifies a data encapsulation method on synchronous serial links using frame characters and checksums.

Cisco HDLC monitors line status on a serial interface by exchanging keepalive request messages with peer network devices. The protocol also allows routers to discover IP addresses of neighbors by exchanging SLARP address-request and address-response messages with peer network devices.

The basic frame structure of a cHDLC frame is shown in the following table.

Table 9: cHDLC information frame

Flag	Address	Control	Protocol	Information	FCS
0x7E	0x0F, 0x8F	0x00	0x0800, 0x8035	—	16 or 32 bit

The fields in the cHDLC frame have the following characteristics:

- Address field – supports unicast (0x0F) and broadcast (0x8F) addresses
- Control field – always set to 0x00

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- Protocol field – supports IP (0x0800) and SLARP (0x8035; see SLARP for information about limitations)
- Information field – the length can be 0 to 9 kB
- FCS field – can be 16 or 32 bits. The default is 16 bits for ports with a speed equal to or lower than OC3, and 32 bits for all other ports. The FCS for cHDLC is calculated with the same method and same polynomial as PPP.

3.2.3.1 SLARP

The 7705 SAR supports only the SLARP keepalive protocol.

For the SLARP keepalive protocol, each system sends the other a keepalive packet at a user configurable interval. The default interval is 10 seconds. Both systems must use the same interval to ensure reliable operation. Each system assigns sequence numbers to the keepalive packets it sends, starting with zero, independent of the other system. These sequence numbers are included in the keepalive packets sent to the other system. Also included in each keepalive packet is the sequence number of the last keepalive packet received from the other system, as assigned by the other system. This number is called the returned sequence number. Each system keeps track of the last returned sequence number it has received. Immediately before sending a keepalive packet, the system compares the sequence number of the packet it is about to send with the returned sequence number in the last keepalive packet it has received. If the two differ by 3 or more, it considers the line to have failed, and will not route higher-level data across it until an acceptable keepalive response is received.

3.2.4 IMA

Inverse Multiplexing over ATM (IMA) is a cell-based protocol where an ATM cell stream is inverse-multiplexed and demultiplexed in a cyclical fashion among ATM-supporting channels to form a higher bandwidth logical link. This logical link is called an IMA group. By grouping channels into an IMA group, customers gain bandwidth management capability at in-between rates (for example, between DS1 and DS3 or between E1 and E3) through the addition or removal of channels to or from the IMA group. The 7705 SAR supports the IMA protocol as specified by the *Inverse Multiplexing for ATM (IMA) Specification* version 1.1.

In the ingress direction, traffic coming over multiple ATM channels configured as part of a single IMA group is converted into a single ATM stream and passed for further processing to the ATM layer, where service-related functions (for example, Layer 2 traffic management or feeding into a pseudowire) are applied. In the egress direction, a single ATM stream (after service functions are applied) is distributed over all paths that are part of an IMA group after ATM layer processing takes place.

An IMA group interface compensates for differential delay and allows for only a minimal cell delay variation. The maximum differential delay supported for IMA is 75 ms on the 16-port T1/E1 ASAP Adapter card and 32-port T1/E1 ASAP Adapter card and 50 ms on the 2-port OC3/STM1 Channelized Adapter card.

The interface deals with links that are added or deleted, or that fail. The higher layers see only an IMA group and not individual links; therefore, service configuration and management is done using IMA groups, and not individual links that are part of it.

The IMA protocol uses an IMA frame as the unit of control. An IMA frame consists of a series of 128 consecutive cells. In addition to ATM cells received from the ATM layer, the IMA frame contains IMA OAM cells. Two types of cells are defined: IMA Control Protocol (ICP) cells and IMA filler cells. ICP cells carry information used by the IMA protocol at both ends of an IMA group (for example, IMA frame sequence

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number, link stuff indication, status and control indication, IMA ID, Tx and Rx test patterns, version of the IMA protocol). A single ICP cell is inserted at the ICP cell offset position (the offset may be different on each link of the group) of each frame. Filler cells are used by the transmitting side to fill up each IMA frame in case there are not enough ATM stream cells from the ATM layer, so a continuous stream of cells is presented to the physical layer. Those cells are then discarded by the receiving end. IMA frames are transmitted simultaneously on all paths of an IMA group, and when they are received out of sync at the other end of the IMA group link, the receiver compensates for differential link delays among all paths.

3.2.5 Network synchronization on ports and circuits

The 7705 SAR provides network synchronization on the following ports and CES circuits:

- Network synchronization on T1/E1 and Ethernet ports
- Network synchronization on SONET/SDH ports
- Network synchronization on DS3/E3 ports
- Network synchronization on DS3 CES circuits
- Network synchronization on T1/E1 ports and circuits

3.2.5.1 Network synchronization on T1/E1 and Ethernet ports

Line timing mode provides physical layer timing (Layer 1) that can be used as an accurate reference for nodes in the network. This mode is immune to any packet delay variation (PDV) occurring on a Layer 2 or Layer 3 link. Physical layer timing provides the best synchronization performance through a synchronization distribution network.

On the 7705 SAR-A variant with T1/E1 ports, line timing is supported on T1/E1 ports. Line timing is also supported on all synchronous Ethernet ports on both 7705 SAR-A variants. Synchronous Ethernet is supported on the XOR ports (1 to 4), configured as either RJ45 ports or SFP ports. Synchronous Ethernet is also supported on SFP ports 5 to 8. Ports 9 to 12 do not support synchronous Ethernet and therefore do not support line timing.

On the 7705 SAR-Ax, line timing is supported on all Ethernet ports.

On the 7705 SAR-H, line timing is supported on:

- all Ethernet ports
- T1/E1 ports on a chassis equipped with a 4-port T1/E1 and RS-232 Combination module

On the 7705 SAR-Hc, line timing is supported on all Ethernet ports.

On the 7705 SAR-M variants with T1/E1 ports, line timing is supported on T1/E1 ports. Line timing is also supported on all RJ45 Ethernet ports and SFP ports on all 7705 SAR-M variants.

In addition, line timing is supported on the following 7705 SAR-M modules:

- 2-port 10GigE (Ethernet) module
- 6-port SAR-M Ethernet module

On the 7705 SAR-Wx, line timing is supported on:

- RJ45 Ethernet ports and optical SFP ports (these ports support synchronous Ethernet and IEEE 1588v2 PTP)

On the 7705 SAR-X, line timing is supported on T1/E1 ports and Ethernet ports.

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On the 7705 SAR-8 Shelf V2 and 7705 SAR-18, line timing is supported on:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 6-port Ethernet 10Gbps Adapter card
- 8-port Gigabit Ethernet Adapter card (dual-rate and copper SFPs do not support synchronous Ethernet)
- 2-port 10GigE (Ethernet) Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card (supported on the 7705 SAR-18 only)
- 4-port DS3/E3 Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 4-port OC3/STM1 Clear Channel Adapter card
- Packet Microwave Adapter card on ports that support synchronous Ethernet and on ports that support PCR

Synchronous Ethernet is a variant of line timing and is automatically enabled on ports and SFPs that support it. The operator can select a synchronous Ethernet port as a candidate for the timing reference. The recovered timing from this port is then used to time the system. This ensures that any of the system outputs are locked to a stable, traceable frequency source.

3.2.5.2 Network synchronization on SONET/SDH ports

Each SONET/SDH port can be independently configured to be loop-timed (recovered from an Rx line) or node-timed (recovered from the SSU in the active CSM).

A SONET/SDH port’s receive clock rate can be used as a synchronization source for the node.

3.2.5.3 Network synchronization on DS3/E3 ports

Each clear channel DS3/E3 port on a 4-port DS3/E3 Adapter card can be independently configured to be loop-timed (recovered from an Rx line), node-timed (recovered from the SSU in the active CSM), or differential-timed (derived from the comparison of a common clock to the received RTP timestamp in TDM pseudowire packets). When a DS3 port is channelized, each DS1 or E1 channel can be independently configured to be loop-timed, node-timed, or differential-timed (differential timing on DS1/E1 channels is supported only on the first three ports of the card). When not configured for differential timing, a DS3/E3 port can be configured to be a timing source for the node.

3.2.5.4 Network synchronization on DS3 CES circuits

Each DS3 CES circuit on a 2-port OC3/STM1 Channelized Adapter card card can be loop-timed (recovered from an Rx line) or free-run (timing source is from its own clock). A DS3 circuit can be configured to be a timing source for the node.

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3.2.5.5 Network synchronization on T1/E1 ports and circuits

Each T1/E1 port can be independently configured for loop-timing (recovered from an Rx line) or node-timing (recovered from the SSU in the active CSM).

In addition, T1/E1 CES circuits on the following can be independently configured for adaptive timing (clocking is derived from incoming TDM pseudowire packets):

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 7705 SAR-M (variants with T1/E1 ports)
- 7705 SAR-X
- 7705 SAR-A (variant with T1/E1 ports)
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

T1/E1 CES circuits on the following can be independently configured for differential timing (recovered from RTP in TDM pseudowire packets):

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card (DS1/E1 channels)
- 4-port DS3/E3 Adapter card (DS1/E1 channels on DS3 ports; E3 ports cannot be channelized); differential timing on DS1/E1 channels is supported only on the first three ports of the card
- 7705 SAR-M (variants with T1/E1 ports)
- 7705 SAR-X
- 7705 SAR-A (variant with T1/E1 ports)
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

A T1/E1 port can be configured to be a timing source for the node.

Note: Adaptive timing and differential timing are not supported on DS1 or E1 channels that have CAS signaling enabled.

3.2.6 Node synchronization from GNSS receiver ports

The GNSS receiver port on the 7705 SAR-Ax, 7705 SAR-Wx, or 7705 SAR-H GPS Receiver module, and the GNSS Receiver card installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18, can provide a synchronization clock to the SSU in the router with the corresponding QL for SSM. This frequency can then be distributed to the rest of the router from the SSU as configured with the **ref-order** and **ql-selection** commands; see the 7705 SAR Basic System Configuration Guide for information. The GNSS reference is qualified only if the GNSS receiver port is operational, has sufficient satellites locked, and has a frequency successfully recovered. A PTP master/boundary clock can also use this frequency reference with PTP peers.

In the event of GNSS signal loss or jamming resulting in the unavailability of timing information, the GNSS receiver automatically prevents output of clock or synchronization data to the system, and the system can revert to alternate timing sources.

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A 7705 SAR using GNSS or IEEE 1588v2 PTP for time of day/phase recovery can perform high-accuracy OAM timestamping and measurements. See the 7705 SAR Basic System Configuration Guide for information about node timing sources.

3.2.7 Flow control on Ethernet ports

IEEE 802.3x flow control, which is the process of pausing the transmission based on received pause frames, is supported on Fast Ethernet, Gigabit Ethernet, and 10-Gigabit Ethernet (SFP+) ports. In the transmit direction, the Ethernet ports generate pause frames if the buffer occupancy reaches critical values or if port FIFO buffers are overloaded. Pause frame generation is automatically handled by the Ethernet Adapter card when the system-wide constant thresholds are exceeded. The generation of pause frames ensures that newly arriving frames still can be processed and queued, mainly to maintain the SLA agreements.

If autonegotiation is on for an Ethernet port, enabling and disabling of IEEE 802.3x flow control is autonegotiated for receive and transmit directions separately. If autonegotiation is turned off, the reception and transmission of IEEE 802.3x flow control is enabled by default and cannot be disabled.

Ingress flow control for the 6-port SAR-M Ethernet module is Ethernet link-based and not port-based. When IEEE 802.3x flow control is enabled on the 6-port SAR-M Ethernet module, pause frames are multicast to all ports on the Ethernet link. There are two Ethernet links on the 6-port SAR-M Ethernet module: one for ports 1, 3, and 5, and one for ports 2, 4, and 6. Pause frames are sent to either ports 1, 3, and 5, or to ports 2, 4, and 6, depending on which link the pause frame originates.

3.2.8 Ethernet OAM

This section contains information about the following topics:

- Ethernet OAM overview
- CRC monitoring
- Remote loopback
- 802.3ah OAMPDU tunneling and termination for Epipe service
- Dying gasp

For more information about Ethernet OAM, see the 7705 SAR OAM and Diagnostics Guide, "Ethernet OAM capabilities”.

3.2.8.1 Ethernet OAM overview

802.3ah Clause 57 (EFM OAM) defines the operations, administration, and maintenance (OAM) sublayer, which is a link level Ethernet OAM. It provides mechanisms for monitoring link operations such as remote fault indication and remote loopback control.

Ethernet OAM gives network operators the ability to monitor the status of Ethernet links and quickly determine the location of failing links or fault conditions.

Because some of the sites where the 7705 SAR will be deployed will only have Ethernet uplinks, this OAM functionality is mandatory. For example, mobile operators must be able to request remote loopbacks from the peer router at the Ethernet layer in order to debug any connectivity issues. EFM OAM provides this capability.

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EFM OAM is supported on network and access Ethernet ports and is configured at the port level. The access ports can be configured to tunnel the OAM traffic originated by the far-end devices.

EFM OAM has the following characteristics:

- All EFM OAM, including loopbacks, operate on point-to-point links only.
- EFM loopbacks are always line loopbacks (line Rx to line Tx).
- When a port is in loopback, all frames (except EFM frames) are discarded. If dynamic signaling and routing is used (dynamic LSPs, OSPF, IS-IS, or BGP routing), all services also go down. If all signaling and routing protocols are static (static routes, LSPs, and service labels), the frames are discarded but services stay up.

The following EFM OAM functions are supported:

- OAM capability discovery
- configurable transmit interval with an Information OAMPDU
- active or passive mode
- OAM loopback
- OAMPDU tunneling and termination (for Epipe service)
- dying gasp at network and access ports
- non-zero vendor-specific information field – the 32-bit field is encoded using the format 00:PP:CC:CC and references TIMETRA-CHASSIS-MIB
  - 00 – must be zeros
  - PP – the platform type from tmnxHwEquippedPlatform
  - CC:CC – the chassis type index value from tmnxChassisType that is indexed in tmnxChassisTypeTable. The table identifies the specific chassis backplane.

    The value 00:00:00:00 is sent for all releases that do not support the non-zero value or are unable to identify the required elements. There is no decoding of the peer or local vendor information fields on the network element. The hexadecimal value is included in the **show port** *port-id* **ethernet efm-oam** output.

With **ignore-efm-state** configured, if the EFM OAM protocol cannot negotiate a peer session or an established session fails, the port will enter the link up state. The link up state is used by many protocols to indicate that the port is administratively up and there is physical connectivity but a protocol (such as EFM OAM) has caused the port operational state to be down. The **show port** *slot/mda/port* command output includes a Reason Down field to indicate if the protocol is the underlying reason for the link up state. For EFM OAM, the Reason Down code is efmOamDown. This is shown in the following command output example, where port 1/1/3 is in a link up state.

```
*A:ALU-1># show port
===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   C/QS/S/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
1/1/1       Down  No   Down    1578 1578    - netw null xcme
1/1/2       Down  No   Down    1578 1578    - netw null xcme
1/1/3       Up    Yes  Link Up 1522 1522    - accs qinq xcme
1/1/4       Down  No   Down    1578 1578    - netw null xcme
1/1/5       Down  No   Down    1578 1578    - netw null xcme
1/1/6       Down  No   Down    1578 1578    - netw null xcme
```


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```
*A:ALU-1># show port 1/1/3
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/3                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Reason Down        : efmOamDown
Physical Link      : Yes                         MTU              : 1522
Single Fiber Mode  : No                          Min Frame Length : 64 Bytes
IfIndex            : 35749888                    Hold time up     : 0 seconds
Last State Change  : 12/18/2012 15:58:29         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled
Phys State Chng Cnt: 1

......
```

The EFM OAM protocol can be decoupled from the port state and operational state. In cases where an operator wants to remove the protocol, monitor only the protocol, migrate, or make changes, the **ignore-efm-state** command can be configured under the **config**>**port**>**ethernet**>**efm-oam** context.

When the **ignore-efm-state** command is configured on a port, the protocol behavior is normal. However, any failure in the EFM protocol state (discovery, configuration, time-out, loops, and so on) will not affect the port. Only a protocol warning message will be raised to indicate issues with the protocol. When the **ignore-efm-state** command is not configured on a port, the default behavior is that the port state will be affected by any EFM OAM protocol fault or clear conditions.

Enabling and disabling this command immediately affects the port state and operating state based on the active configuration, and this is displayed in the **show port** command output. For example, if the **ignore-efm-state** command is configured on a port that is exhibiting a protocol error, that protocol error does not affect the port state or operational state and there is no Reason Down code in the output. If the **ignore-efm-state** command is disabled on a port with an existing EFM OAM protocol error, the port will transition to port state link up, operational state down with reason code efmOamDown.

If the port is a member of a microwave link, the **ignore-efm-state** command must be enabled before the EFM OAM protocol can be activated. This restriction is required because EFM OAM is not compatible with microwave links.

3.2.8.2 CRC monitoring

Cyclic redundancy check (CRC) errors typically occur when Ethernet links are compromised due to optical fiber degradation, weak optical signals, bad optical connections, or problems on a third-party networking element. As well, higher-layer OAM options such as EFM and BFD may not detect errors and trigger appropriate alarms and switchovers if the errors are intermittent, since this does not affect the continuous operation of other OAM functions.

CRC error monitoring on Ethernet ports allows degraded links to be alarmed or failed in order to detect network infrastructure issues, trigger necessary maintenance, or switch to redundant paths. This is achieved through monitoring ingress error counts and comparing them to the configured error thresholds. The rate at which CRC errors are detected on a port can trigger two alarm states. Crossing the configured signal degrade (SD) threshold (**sd-threshold**) causes an event to be logged and an alarm to be raised, which alerts the operator to a potential issue on a link. Crossing the configured signal failure (SF) threshold (**sf-threshold**) causes the affected port to enter the operationally down state, and causes an event to be logged and an alarm to be raised.

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The CRC error rates are calculated as M×10E-N, which is the ratio of errored frames allowed for total frames received. The operator can configure both the threshold (N) and a multiplier (M). If the multiplier is not configured, the default multiplier (1) is used.

For example, setting the SD threshold to 3 results in a signal degrade error rate threshold of 1×10E-3 (1 errored frame per 1000 frames). Changing the configuration to an SD threshold of 3 and a multiplier of 5 results in a signal degrade error rate threshold of 5×10E-3 (5 errored frames per 1000 frames). The signal degrade error rate threshold must be lower than the signal failure error rate threshold because it is used to notify the operator that the port is operating in a degraded but not failed condition.

A sliding window (**window-size**) is used to calculate a statistical average of CRC error statistics collected every second. Each second, the oldest statistics are dropped from the calculation. For example, if the default 10-s sliding window is configured, at the 11th second the oldest second of statistical data is dropped and the 11th second is included. This sliding average is compared against the configured SD and SF thresholds to determine if the error rate over the window exceeds one or both of the thresholds, which will generate an alarm and log event.

When a port enters the failed condition as a result of crossing an SF threshold, the port is not automatically returned to service. Because the port is operationally down without a physical link, error monitoring stops. The operator can enable the port by using the **shutdown** and **no shutdown** port commands or by using other port transition functions such as clearing the MDA (**clear mda** command) or removing the cable. A port that is down due to crossing an SF threshold can also be re-enabled by changing or disabling the SD threshold. The SD state is self-clearing, and it clears if the error rate drops below 1/10th of the configured SD rate.

3.2.8.3 Remote loopback

EFM OAM provides a link-layer frame loopback mode, which can be controlled remotely.

To initiate a remote loopback, the local EFM OAM client sends a loopback control OAMPDU by enabling the OAM remote loopback command. After receiving the loopback control OAMPDU, the remote OAM client puts the remote port into local loopback mode.

OAMPDUs are slow protocol frames that contain appropriate control and status information used to monitor, test, and troubleshoot OAM-enabled links.

To exit a remote loopback, the local EFM OAM client sends a loopback control OAMPDU by disabling the OAM remote loopback command. After receiving the loopback control OAMPDU, the remote OAM client puts the port back into normal forwarding mode.

When a port is in local loopback mode (the far end requested an Ethernet OAM loopback), any packets received on the port will be looped back, except for EFM OAMPDUs. No data will be transmitted from the node; only data that is received on the node will be sent back out.

When the node is in remote loopback mode, local data from the CSM is transmitted, but any data received on the node is dropped, except for EFM OAMPDUs.

Remote loopbacks should be used with caution; if dynamic signaling and routing protocols are used, all services go down when a remote loopback is initiated. If only static signaling and routing is used, the services stay up. On the 7705 SAR, the Ethernet port can be configured to accept or reject the **remote-loopback** command.

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3.2.8.4 802.3ah OAMPDU tunneling and termination for Epipe service

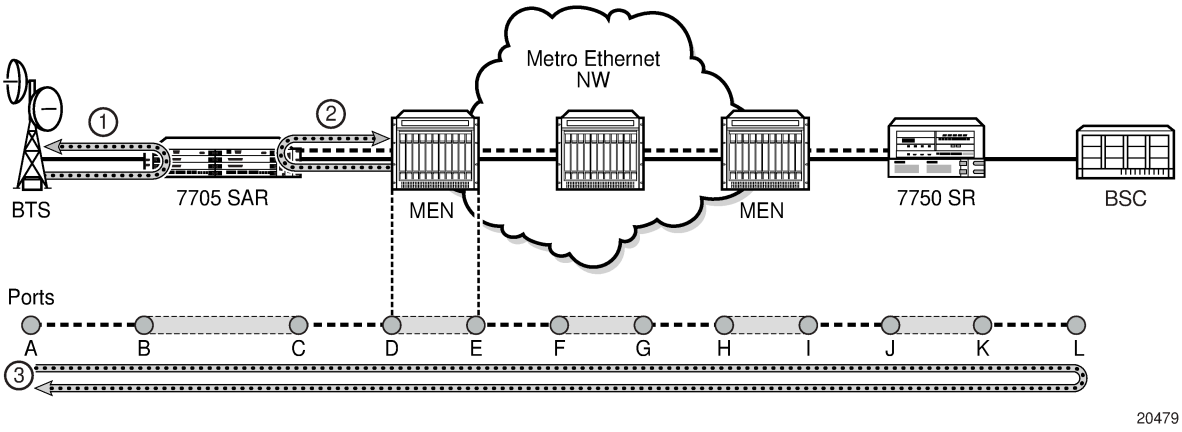
Customers who subscribe to Epipe service may have customer equipment running 802.3ah at both ends. The 7705 SAR can be configured to tunnel EFM OAMPDUs received from a customer device to the other end through the existing network using MPLS or GRE, or to terminate received OAMPDUs at a network or an access Ethernet port.

Note: This feature applies only to port-based Epipe SAPs because 802.3ah runs at port level, not at VLAN level.

While tunneling offers the ability to terminate and process the OAM messages at the head-end, termination on the first access port at the cell site can be used to detect immediate failures or can be used to detect port failures in a timelier manner. The user can choose either tunneling or termination, but not both at the same time.

In the following figure, scenario 1 shows the termination of received EFM OAMPDUs from a customer device on an access port, while scenario 2 shows the same thing except for a network port. Scenario 3 shows tunneling of EFM OAMPDUs through the associated Ethernet PW. To configure termination (scenario 1), use the **config>port>ethernet>efm-oam>no shutdown** command.

Figure 6: EFM capability on the 7705 SAR



3.2.8.5 Dying gasp

Dying gasp is used to notify the far end that EFM-OAM is disabled or shut down on the local port. The dying gasp flag is set on the OAMPDUs that are sent to the peer. The far end can then take immediate action and inform upper layers that EFM-OAM is down on the port.

When a dying gasp is received from a peer, the node logs the event and generates an SNMP trap to notify the operator.

3.2.9 Ethernet loopbacks

The following loopbacks are supported on Ethernet ports:

- timed network line loopback

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- timed and untimed access line loopbacks
- timed and untimed access internal loopbacks
- persistent access line loopback
- persistent access internal loopback
- MAC address swapping
- CFM loopback on network and access ports
- CFM loopback on ring ports and v-port

3.2.9.1 Line and internal Ethernet loopbacks

A line loopback loops frames received on the corresponding port back toward the transmit direction. Line loopbacks are supported on ports configured for access or network mode.

Similarly, a line loopback with MAC addressing loops frames received on the corresponding port back toward the transmit direction, and swaps the source and destination MAC addresses before transmission. See MAC swapping for more information.

An internal loopback loops frames from the local router back to the framer. This is usually referred to as an equipment loopback. The transmit signal is looped back and received by the interface. Internal loopbacks are supported on ports configured in access mode.

If a loopback is enabled on a port, the port mode cannot be changed until the loopback has been disabled.

A port can support only one loopback at a time. If a loopback exists on a port, it must be disabled or the timer must expire before another loopback can be configured on the same port. EFM-OAM cannot be enabled on a port that has an Ethernet loopback enabled on it. Similarly, an Ethernet loopback cannot be enabled on a port that has EFM-OAM enabled on it.

When an internal loopback is enabled on a port, autonegotiation is turned off silently. This is to allow an internal loopback when the operational status of a port is down. Any user modification to autonegotiation on a port configured with an internal Ethernet loopback will not take effect until the loopback is disabled.

The loopback timer can be configured from 30 s to 86400 s. All non-zero timed loopbacks are turned off automatically under the following conditions: an adapter card reset, an activity switch, or timer expiry. Line or internal loopback timers can also be configured as a latched loopback by setting the timer to 0 s, or as a persistent loopback with the **persistent** keyword. Latched and persistent loopbacks are enabled indefinitely until turned off by the user. Latched loopbacks survive adapter card resets and activity switches, but are lost if there is a system restart. Persistent loopbacks survive adapter card resets and activity switches and can survive a system restart if the **admin save** or **admin save detail** command was executed before the restart. Latched loopbacks (untimed) and persistent loopbacks can be enabled only on Ethernet access ports.

Persistent loopbacks are the only Ethernet loopbacks saved to the database by the **admin-save** and **admin-save-detail** commands.

An Ethernet port loopback may interact with other features. See Interaction of Ethernet port loopback with other features for more information.

3.2.9.1.1 MAC swapping

Typically, an Ethernet port loopback only echoes back received frames. That is, the received source and destination MAC addresses are not swapped. However, not all Ethernet equipment supports echo mode,

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where the original sender of the frame must support receiving its own port MAC address as the destination MAC address.

The MAC swapping feature on the 7705 SAR is an optional feature that will swap the received destination MAC address with the source MAC address when an Ethernet port is in loopback mode. After the swap, the FCS is recalculated to ensure the validity of the Ethernet frame and to ensure that the frame is not dropped by the original sender due to a CRC error.

3.2.9.1.2 Interaction of Ethernet port loopback with other features

EFM OAM and line loopback are mutually exclusive. If one of these functions is enabled, it must be disabled before the other can be used.

However, a line loopback precedes the dot1x behavior. That is, if the port is already dot1x-authenticated it will remain so. If it is not, EAP authentication will fail.

Ethernet port-layer line loopback and Ethernet port-layer internal loopback can be enabled on the same port with the down-when-looped feature. EFM OAM cannot be enabled on the same port with the down-when-looped feature. For more information, see Ethernet port down-when-looped.

3.2.9.2 CFM loopbacks for OAM on Ethernet ports

This section contains information about the following topics:

- CFM loopback overview
- CFM loopback mechanics

3.2.9.2.1 CFM loopback overview

Connectivity fault management (CFM) loopback support for loopback messages (LBMs) on Ethernet ports allows operators to run standards-based Layer 1 and Layer 2 OAM tests on ports receiving unlabeled packets.

The 7705 SAR supports CFM MEPs associated with different endpoints (that is, Up and Down SAP MEPs, Up and Down spoke SDP MEPs, Up and Down mesh SDP MEPs, and network interface facility Down MEPs). In addition, for traffic received from an uplink (network ingress), the 7705 SAR supports CFM LBM for both labeled and unlabeled packets. CFM loopbacks are applied to the Ethernet port.

See the 7705 SAR OAM and Diagnostics Guide, "Ethernet OAM Capabilities", for information about CFM MEPs.

The following figure shows an application where an operator leases facilities from a transport network provider in order to transport traffic from a cell site to their MTSO. The operator leases a certain amount of bandwidth between the two endpoints (the cell site and the MTSO) from the transport provider, who offers Ethernet Virtual Private Line (EVPL) or Ethernet Private Line (EPL) PTP service. Before the operator offers services on the leased bandwidth, the operator runs OAM tests to verify the SLA. Typically, the transport provider (MEN provider) requires that the OAM tests be run in the direction of (toward) the first Ethernet port that is connected to the transport network. This is done to eliminate the potential effect of queuing, delay, and jitter that may be introduced by an SDP or SAP.

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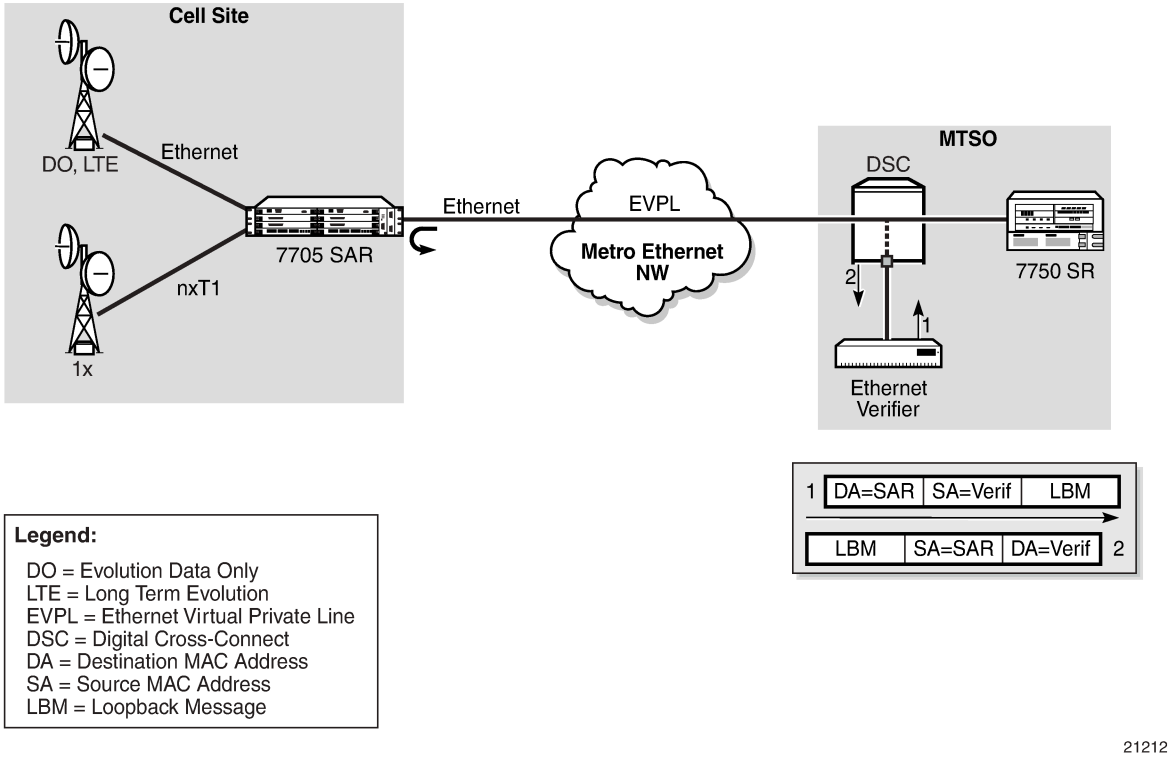
Figure 7: CFM loopback on Ethernet ports



The figure shows an Ethernet verifier at the MTSO that is directly connected to the transport network (in front of the 7750 SR). Therefore, the Ethernet OAM frames are not label-encapsulated. Because Ethernet verifiers do not support label operations and the transport provider mandates that OAM tests be run between the two hand-off Ethernet ports, the verifier cannot be relocated behind the 7750 SR node at the MTSO. Therefore, CFM loopback frames received are not MPLS-encapsulated, but are simple Ethernet frames where the **type** is set to CFM (dot1ag or Y.1731).

3.2.9.2.2 CFM loopback mechanics

The following are important facts to consider when working with CFM loopbacks:

- CFM loopbacks can be enabled on a per-port basis, and:
  - the port can be in access or network mode
  - when enabled on a port, all received LBM frames are processed, regardless of the VLAN and the service that the VLAN or SAP is bound to
  - there is no associated MEP creation involved with this feature; therefore, no domain, association, or similar checks are performed on the received frame
  - upon finding a destination address MAC match, the LBM frame is sent to the CFM process
- CFM loopback support on a physical ring port on the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module differs from other Ethernet ports. For these ports, **cfm-loopback** is configured, optionally, using **dot1p** and **match-vlan** to create a list of up to 16 VLANs. The null VLAN is

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always applied. The CFM loopback message will be processed if it does not contain a VLAN header or if it contains a VLAN header with a VLAN ID that matches one in the configured **match-vlan** list.

- received LBM frames undergo no queuing or scheduling in the ingress direction
- at egress, loopback reply (LBR) frames are stored in their own queue; that is, a separate new queue is added exclusively for LBR frames
- users can configure the way a response frame is treated among other user traffic stored in network queues; the configuration options are high-priority, low-priority, or dot1p, where dot1p applies only to physical ring ports
- for network egress or access egress, where 4-priority scheduling is enabled:
  - **high-priority** – either cir = port_speed, which applies to all frames that are scheduled via an expedited in-profile scheduler, or RR for all other (network egress queue) frames that reside in expedited queues and are in an in-profile state
  - **low-priority** – either cir = 0, pir = port_speed, which applies to all frames that are scheduled via a best effort out-of-profile scheduler, or RR for all other frames that reside in best-effort queues and are in an out-of-profile state
- for the 8-port Gigabit Ethernet Adapter card, the 10-port 1GigE/1-port 10GigE X-Adapter card, and the v-port on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module, for network egress, where 16-priority scheduling is enabled:
  - **high-priority** – has higher priority than any user frames
  - **low-priority** – has lower priority than any user frames
- for the physical ring ports on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module, which can only operate as network egress, the priority of the LBR frame is derived from the dot1p setting of the received LBM frame. Based on the assigned ring-type network queue policy, dot1p-to-queue mapping is handled using the same mapping rule that applies to all other user frames.
- the above queue parameters and scheduler mappings are all preconfigured and cannot be altered. The desired QoS treatment is selected by enabling the CFM loopback and specifying **high-priority**, **low-priority, or dot1p**.

3.2.10 Ethernet port down-when-looped

Newly provisioned circuits are often put into loopback with a physical loopback cable for testing and to ensure the ports meet the SLA. If loopbacks are not cleared, or physically removed, by the operator when the testing is completed, they can adversely affect the performance of all other SDPs and customer interfaces (SAPs). This is especially problematic for point-to-multipoint services such as VPLS, since Ethernet does not support TTL, which is essential in terminating loops.

The down-when-looped feature is used on the 7705 SAR to detect loops within the network and to ensure continued operation of other ports. When the down-when-looped feature is activated, a keepalive loop PDU is transmitted periodically toward the network. The Ethernet port then listens for returning keepalive loop PDUs. In unicast mode, a loop is detected if any of the received PDUs have an Ethertype value of 9000, which indicates a loopback (Configuration Test Protocol), and the source (SRC) and destination (DST) MAC addresses are identical to the MAC address of the Ethernet port. In broadcast mode, a loop is detected if any of the received PDUs have an Ethertype value of 9000 and the SRC MAC address matches the MAC address of the Ethernet port and the DST MAC address matches the broadcast MAC address. When a loop is detected, the Ethernet port is immediately brought down.

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Ethernet port-layer line loopbacks and the down-when-looped feature can be enabled on the same port. The keepalive loop PDU is still transmitted; however, if the port receives its own keepalive loop PDU, the keepalive PDU is extracted and processed to avoid infinite looping.

Ethernet port-layer internal loopbacks and the down-when-looped feature can also be enabled on the same port. When the keepalive PDU is internally looped back, it is extracted and processed as usual. If the SRC MAC address matches the port MAC address, the port is disabled due to detection of a loop. If the SRC MAC address is a broadcast MAC address because the **swap-src-dst-mac** option in the **loopback** command is enabled, then there is no change to port status and it remains operationally up.

EFM OAM and down-when-looped cannot be enabled on the same port.

3.2.11 Ethernet ring (adapter card and module)

The 2-port 10GigE (Ethernet) Adapter card can be installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis and the 2-port 10GigE (Ethernet) module can be installed in a 7705 SAR-M to connect to and from access rings carrying a high concentration of traffic. For the maximum number of cards or modules supported per chassis, see Table 3: Maximum number of cards/modules supported in each chassis.

A number of 7705 SAR nodes in a ring typically aggregate traffic from customer sites, map the traffic to a service, and connect to an SR node. The SR node acts as a gateway point out of the ring. A 10GigE ring allows for higher bandwidth services and aggregation on a per-7705 SAR basis. The 2-port 10GigE (Ethernet) Adapter card/module increases the capacity of backhaul networks by providing 10GigE support on the aggregation nodes, thus increasing the port capacity.

In a deployment of a 2-port 10GigE (Ethernet) Adapter card/module, each 7705 SAR node in the ring is connected to the east and west side of the ring over two different 10GigE ports. If 10GigE is the main uplink, the following are required for redundancy:

- two cards per 7705 SAR-8 Shelf V2
- two cards per 7705 SAR-18
- two 7705 SAR-M nodes, each equipped with 2-port 10GigE (Ethernet) module

With two cards per 7705 SAR-8 Shelf V2 or 7705 SAR-18 node, for example, east and west links of the ring can be terminated on two different adapter cards, reducing the impact of potential hardware failure.

The physical ports on the 2-port 10GigE (Ethernet) Adapter card/module boot up in network mode and this network setting cannot be disabled or altered. At boot-up, the MAC address of the virtual port (v-port) is programmed automatically for efficiency and security reasons.

There is native built-in Ethernet bridging among the ring ports and the v-port. Bridging destinations for traffic received from one of the ring ports include the 10GigE ring port and the network interfaces on the v-port. Bridging destinations for traffic received from the v-port include one or both of the 10GigE ring ports.

With bridging, broadcast and multicast frames are forwarded over all ports except the received one. Unknown frames are forwarded to both 10GigE ports if received from the v-port or forwarded to the other 10GigE port only if received from one of the 10GigE ports (the local v-port MAC address is always programmed).

The bridge traffic of the physical 10GigE ports is based on learned and programmed MAC addresses.

3.2.12 MTU configuration guidelines

This section contains information about the following topics:

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- MTU configuration overview
- IP fragmentation
- Jumbo frames
- Default port MTU values

3.2.12.1 MTU configuration overview

Because of the services overhead (that is, pseudowire/VLL, MPLS tunnel, dot1q/qinq and dot1p overhead), it is crucial that configurable variable frame size be supported for end-to-end service delivery.

Observe the following general rules when planning your service and physical maximum transmission unit (MTU) configurations:

- The 7705 SAR must contend with MTU limitations at many service points. The physical (access and network) port, service, and SDP MTU values must be individually defined. Figure 8: MTU points on the 7705 SAR identifies the various MTU points on the 7705 SAR.
- The ports that will be designated as network ports intended to carry service traffic must be identified.
- MTU values should not be modified frequently.
- MTU values must conform to both of the following conditions:
  - the service MTU must be less than or equal to the SDP path MTU
  - the service MTU must be less than or equal to the access port (SAP) MTU
- When the **allow-fragmentation** command is enabled on an SDP, the current MTU algorithm is overwritten with the configured path MTU. The administrative MTU and operational MTU both show the specified MTU value. If the path MTU is not configured or available, the operational MTU is set to 2000 bytes, and the administrative MTU displays a value of 0. When **allow-fragmentation** is disabled, the operational MTU reverts to the previous value.

For more information, see the "MTU Settings" section in the 7705 SAR Services Guide. To configure various MTU points, use the following commands:

- port MTUs are set with the **mtu** command, under the **config**>**port** context, where the port type can be Ethernet, TDM, serial, or SONET/SDH
- service MTUs are set in the appropriate **config>service** context
- path MTUs are set with the **path-mtu** command under the **config>service>sdp** context

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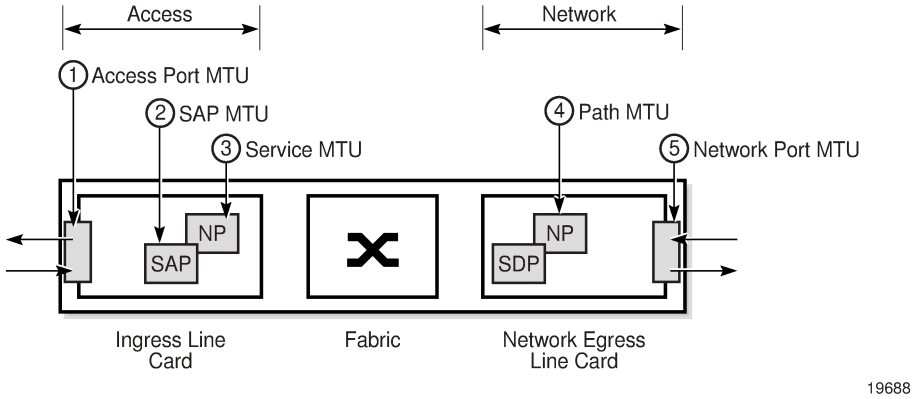
Figure 8: MTU points on the 7705 SAR



Frame size configuration is supported for an Ethernet port configured as an access or a network port.

For an Ethernet adapter card that does not support jumbo frames, all frames received at an ingress network or access port are policed against 1576 bytes (1572 + 4 bytes of FCS), regardless of the port MTU. Any frames longer than 1576 bytes are discarded and the "Too Long Frame" and "Error Stats" counters in the port statistics display are incremented. See Jumbo frames for more information.

At network egress, Ethernet frames are policed against the configured port MTU. If the frame exceeds the configured port MTU, the "Interface Out Discards" counter in the port statistics is incremented.

When the network group encryption (NGE) feature is used, additional bytes due to NGE packet overhead must be considered. See the "NGE Packet Overhead and MTU Considerations" section in the 7705 SAR Services Guide for more information.

3.2.12.2 IP fragmentation

IP fragmentation is used to fragment a packet that is larger than the MTU of the egress interface, so that the packet can be transported over that interface.

For IPv4, the router fragments or discards the IP packets based on whether the DF (Do not fragment) bit is set in the IP header. If the packet that exceeds the MTU cannot be fragmented, the packet is discarded and an ICMP message "Fragmentation Needed and Don't Fragment was Set" is sent back to the source IP address.

For IPv6, the router cannot fragment the packet so must discard it. An ICMP message "Packet too big" is sent back to the source node.

As a source of self-generated traffic, the 7705 SAR can perform packet fragmentation.

Fragmentation can be enabled for GRE tunnels. See the "GRE Fragmentation" section in the 7705 SAR Services Guide for more information.

3.2.12.3 Jumbo frames

Jumbo frames are supported on all Ethernet ports.

The maximum MTU size for a jumbo frame on the 7705 SAR is 9732 bytes. The maximum MTU for a jumbo frame may vary depending on the Ethernet encapsulation type, as shown in the following table. The

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calculations of the other MTU values (service MTU, path MTU, and so on) are based on the port MTU. The values in the table are also maximum receive unit (MRU) values. MTU values are user-configured values. MRU values are the maximum MTU value that a user can configure on an adapter card that supports jumbo frames.

Table 10: Maximum MTU (or MRU) per Ethernet encapsulation type

Encapsulation	Maximum MTU (bytes)
Null	9724
Dot1q	9728
QinQ	9732

For an Ethernet adapter card, all frames received at an ingress network or access port are policed against the MRU for the ingress adapter card, regardless of the configured MTU. Any frames larger than the MRU are discarded and the "Too Long Frame" and "Error Stats" counters in the port statistics display are incremented.

At network egress, frames are checked against the configured port MTU. If the frame exceeds the configured port MTU and the DF bit is set, then the "MTU Exceeded" discard counter will be incremented on the ingress IP interface statistics display, or on the MPLS interface statistics display if the packet is an MPLS packet.

For example, on adapter cards that do not support an MTU greater than 2106 bytes, fragmentation is not supported for frames greater than the maximum supported MTU for that card (that is, 2106 bytes). If the maximum supported MTU is exceeded, the following occurs:

- An appropriate ICMP reply message (Destination Unreachable) is generated by the 7705 SAR. The router ensures that the ICMP generated message cannot be used as a DOS attack (that is, the router paces the ICMP message).
- The appropriate statistics are incremented.

Jumbo frames offer better utilization of an Ethernet link because as more payload is packed into an Ethernet frame of constant size, the ratio of overhead to payload is minimized.

From the traffic management perspective, large payloads may cause long delays, so a balance between link utilization and delay must be found. For example, for ATM VLLs, concatenating a large number of ATM cells when the MTU is set to a very high value could generate a 9-kB ATM VLL frame. Transmitting a frame that large would take more than 23 ms on a 3-Mb/s policed Ethernet uplink.

3.2.12.3.1 Behavior of adapter cards not supporting jumbo frames

The 7705 SAR-8 Shelf V2 and the 7705 SAR-18 do not support ingress fragmentation, and this is true for jumbo frames. Therefore, any jumbo frame packet that gets routed to an adapter card that does not have Ethernet ports and therefore does not support jumbo frame MTU (for example, a 16-port T1/E1 ASAP Adapter card or a 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card) is discarded if the packet size is greater than the TDM port's maximum supported MTU. If the maximum supported MTU is exceeded, the following occurs:

- An ICMP reply message (Destination Unreachable) is generated by the 7705 SAR. The router ensures that the ICMP-generated message cannot be used as a DOS attack (that is, the router paces the ICMP message).

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- The port statistics show IP or MPLS Interface MTU discards, for IP or MPLS traffic, respectively. MTU Exceeded Packets and Bytes counters exist separately for IPv4/6 and MPLS under the IP interface hierarchy for all discarded packets where ICMP Error messages are not generated.

For example, if a packet arrives on an 8-port Gigabit Ethernet Adapter card and is to be forwarded to a 16-port T1/E1 ASAP Adapter card with a maximum port MTU of 2090 bytes and a channel group configured for PPP with the port MTU of 1000 bytes, the following may occur:

- If the arriving packet is 800 bytes, forward the packet.
- If the arriving packet is 1400 bytes, forward the packet, which will be fragmented by the egress adapter card.
- If the arriving packet is fragmented and the fragments are 800 bytes, forward the packet.
- If the arriving packet is 2500 bytes, send an ICMP error message (because the egress adapter card has a maximum port MTU of 2090 bytes).
- If the arriving packet is fragmented and the fragment size is 2500 bytes, there is an ICMP error.

3.2.12.3.2 Jumbo frame behavior on the fixed platforms

The 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-M, 7705 SAR-Wx, and 7705 SAR-X are able to fragment packets between Ethernet ports (which support jumbo frames) and TDM ports (which do not support jumbo frames). In this case, when a packet arrives from a port that supports jumbo frames and is routed to a port that does not support jumbo frames (that is, a TDM port) the packet will get fragmented to the port MTU of the TDM port.

For example, if a packet arrives on a 7705 SAR-A and is to be forwarded to a TDM port that has a maximum port MTU of 2090 bytes and a channel group configured for PPP with the port MTU of 1000 bytes (PPP port MTU), the following may occur:

- If the arriving packet is 800 bytes, forward the packet.
- If the arriving packet is 1400 bytes and the DF bit is 0, forward the packet, which will be fragmented to the PPP port MTU size.
- If the arriving packet is 2500 bytes and the DF bit is 0, forward the packet, which will be fragmented to the PPP port MTU size.

3.2.12.3.3 Multicast support for jumbo frames

Jumbo frames are supported in a multicast configuration as long as all adapter cards in the multicast group support jumbo frames. If an adapter card that does not support jumbo frames is present in the multicast group, the replicated multicast jumbo frame packet will be discarded by the fabric because of an MRU error of the fabric port (Rx).

The multicast group replicates the jumbo frame for all adapter cards, regardless of whether they support jumbo frames, only when forwarding the packet through the fabric. The replicated jumbo frame packet is discarded on adapter cards that do not support jumbo frames.

3.2.12.3.4 PMC jumbo frame support

For the Packet Microwave Adapter card (PMC), ensure that the microwave hardware installed with the card supports the corresponding jumbo frame MTU. If the microwave hardware does not support the jumbo

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frame MTU, it is recommended that the MTU of the PMC port be set to the maximum frame size that is supported by the microwave hardware.

3.2.12.4 Default port MTU values

The following table displays the default and maximum port MTU values that are dependent upon the port type, mode, and encapsulation type.

Note: The 7705 SAR now supports a lower IP MTU value of 128 bytes (from the original 512-byte minimum). The IP MTU is derived from the port MTU configuration for network ports. This lower IP MTU is supported only on Ethernet encapsulated ports. See the 7705 SAR Services Guide, "Bandwidth Optimization for Low-speed Links" for information.

Table 11: Port MTU default and maximum values

Port type	Mode	Encap type	Default (bytes)	Max MTU (bytes)
10/100 Ethernet[1]	Access/ Network	null	1514	9724 [2]
		dot1q	1518	9728 [2]
		qinq[3]	1522 (access only)	9732 (access only) [2]
GigE SFP [1]and 10-GigE SFP+	Access/ Network	null	1514 (access) 1572 (network)	9724 (access and network)
		dot1q	1518 (access) 1572 (network)	9728 (access and network)
		qinq[3]	1522 (access only)	9732 (access only)
Ring port	Network	null	9728 (fixed)	9728 (fixed)
v-port (on Ring adapter card)	Network	null	1572	9724
		dot1q	1572	9728
TDM (PW)	Access	cem	1514	1514
TDM (ATM PW)	Access	atm	1524	1524
TDM (FR PW)	Access	frame-relay	1514	2090
TDM (HDLC PW)	Access	hdlc	1514	2090
TDM (IW PW)	Access	cisco-hdlc	1514	2090
TDM (PPP/MLPPP)	Access	ipcp	1502	2090
	Network	ppp-auto	1572	2090

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Port type	Mode	Encap type	Default (bytes)	Max MTU (bytes)
Serial V.35 or X.21 (FR PW) [4]	Access	frame-relay	1514	2090
Serial V.35 or X.21 (HDLC PW) [4]	Access	hdlc	1514	2090
Serial V.35 or X.21 (IW PW) [4]	Access	frame-relay	1514	2090
		ipcp	1502	2090
		cisco-hdlc	1514	2090
SONET/SDH	Access	atm	1524	1524
SONET/SDH	Network	ppp-auto	1572	2090

Notes:

1. The maximum MTU value is supported only on cards that have buffer chaining enabled.
2. On the Packet Microwave Adapter card, the MWA ports support 4 bytes less than the Ethernet ports. MWA ports support a maximum MTU of 9720 bytes (null) or 9724 bytes (dot1q). MWA ports do not support QinQ.
3. QinQ is supported only on access ports.
4. For X.21 serial ports at super-rate speeds.

For more information, see the "MTU Settings" section in the 7705 SAR Services Guide.

3.2.13 LAG

This section contains information about the following topics:

- LAG overview
- LACP and active/standby operation
- QoS adaptation for LAG on access
- QoS for LAG on network
- Access ingress fabric shaping
- Hold-down timers
- Multi-chassis LAG
- Static LAG (active/standby LAG operation without LACP)
- LAG support on mixed-generation hardware
- BFD over LAG links (micro-BFD)

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3.2.13.1 LAG overview

The 7705 SAR supports link aggregation groups (LAGs) based on the IEEE 802.1ax standard (formerly 802.3ad). Link aggregation provides:

- increased bandwidth by combining multiple links into one logical link (in active/active mode)
- load sharing by distributing traffic across multiple links (in active/active mode)
- redundancy and increased resiliency between devices by having a standby link to act as backup if the active link fails (in active/standby mode)

In the 7705 SAR implementation, all links must operate at the same speed.

Packet sequencing must be maintained for any given session. The hashing algorithm deployed by Nokia routers is based on the type of traffic transported to ensure that all traffic in a flow remains in sequence while providing effective load sharing across the links in the LAG. See LAG and ECMP hashing for more information.

LAGs must be statically configured or formed dynamically with Link Aggregation Control Protocol (LACP). See LACP and active/standby operation for information about LACP.

All Ethernet-based supported services can benefit from LAG, including:

- network interfaces and SDPs
- spoke SDPs, mesh SDPs, and EVPN endpoints
- IES and VPRN interfaces and SAPs
- Ethernet and IP pseudowire SAPs
- routed VPLS (r-VPLS) SAPs

LAGs are supported on access, network, and hybrid ports. A LAG can be in active/active mode or in active/standby mode for access, network, or hybrid ports. Active/standby mode is a subset of active/active mode if subgroups are enabled.

LAGs are supported on access ports on the following:

- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card (10-port GigE mode)
- 6-port Ethernet 10Gbps Adapter card
- 4-port SAR-H Fast Ethernet module
- 6-port SAR-M Ethernet module
- Packet Microwave Adapter card (for ports not in a microwave link)
- all fixed platforms

LAGs are supported on network ports on the following:

- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card
- 6-port Ethernet 10Gbps Adapter card
- 4-port SAR-H Fast Ethernet module
- 6-port SAR-M Ethernet module

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- Packet Microwave Adapter card (for ports not in a microwave link and ports in a 1+0 network microwave link; LAGs are not supported on ports in a 1+1 HSB microwave link)
- all fixed platforms

LAGs are supported on hybrid ports on the following:

- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card (10-port GigE mode)
- 6-port Ethernet 10Gbps Adapter card
- 6-port SAR-M Ethernet module
- Packet Microwave Adapter card (for ports not in a microwave link)
- all fixed platforms

Note: For more information about Packet Microwave Adapter card ports, including microwave link support, see Microwave link overview.

On access ports, a LAG supports active/active and active/standby operation. For active/standby operation the links must be in different subgroups. Links can be on the same platform or adapter card/module or distributed over multiple components. Load sharing is supported among the active links in a LAG group.

On network ports, a LAG supports active/active and active/standby operation. For active/standby operation the links must be in different subgroups. Links can be on the same platform or adapter card/module or distributed over multiple components. Load sharing is supported among the active links in a LAG group. Any tunnel type (for example, IP, GRE, or MPLS) transporting any service type, any IP traffic, or any labeled traffic (LER, LSR) can use the LAG load-sharing, active/active, and active/standby functionality.

LAGs are supported on network 1+0 microwave links. Ports that are in a microwave link can be added to the same LAG as ports that are not in a microwave link. Ports belonging to a microwave link must have limited autonegotiation enabled before the link can be added to a LAG.

A LAG that contains ports in a microwave link must have LACP enabled for active/standby operation. Static LAG configuration (without LACP) is not supported for active/standby LAGs with microwave-enabled ports.

On hybrid ports, a LAG supports active/active and active/standby operation. For active/standby operation the links must be in different subgroups. Links can be on the same platform or adapter card/module or distributed over multiple components. Load sharing is supported among the active links in a LAG group.

A LAG group with assigned members can be converted from one mode to another as long as the number of member ports are supported in the new mode and the ports all support the new mode, none of the members belong to a microwave link, and the LAG group is not associated with a network interface or a SAP.

Note: For details on LAG scale per platform or adapter card, contact your Nokia technical support representative.

A subgroup is a group of links within a LAG. On access, network, or hybrid ports, a LAG can have a maximum of four subgroups and a subgroup can have links up to the maximum number supported on the LAG. The LAG is active/active if there is only one sub-group and is active/standby if there is more than one subgroup.

When configuring a LAG, most port features (port commands) can only be configured on the primary member port. The configuration, or any change to the configuration, is automatically propagated to any remaining ports within the same LAG. Operators cannot modify the configurations on non-primary ports. For more information, see Configuring LAG parameters.

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If the LAG has one member link on a second-generation (Gen-2) Ethernet adapter card and the other link on a third-generation (Gen-3) Ethernet adapter card or platform, a mix-and-match scenario exists for traffic management on the LAG SAP. In this case, all QoS parameters for the LAG SAP are configured but only those parameters applicable to the active member link are used. See LAG support on mixed-generation hardware for more information.

Configuring a multiservice site (MSS) aggregate rate can restrict the use of LAG SAPs. For more information, see the "MSS and LAG interaction on the 7705 SAR-8 Shelf V2 and 7705 SAR-18" section in the 7705 SAR Quality of Service Guide.

3.2.13.2 LACP and active/standby operation

On access, network, and hybrid ports, where multiple links in a LAG can be active at the same time, normal operation is that all non-failing links are active and traffic is load-balanced across all the active links. In some cases, however, it is desirable to have only some of the links active and the other links kept in standby mode. The Link Aggregation Control Protocol (LACP) is used to make the selection of the active links in a LAG predictable and compatible with any vendor equipment. The mechanism is based on the IEEE 802.1ax standard so that interoperability is ensured.

Note: LACP cannot be configured for static LAG. For more information about static LAG, see Static LAG (active/standby LAG operation without LACP).

LACP is disabled by default and therefore must be enabled on the LAG if required. LACP can be used in either active mode or passive mode. The mode must match with connected CE devices for proper operation. For example, if the LAG on the 7705 SAR end is configured to be active, the CE end must be passive.

The following figure shows the interconnection between a DSLAM and a LAG aggregation node. In this configuration, LAG is used to protect against hardware failure. If the active link goes down, the link on standby takes over (see Figure 10: LAG on access failure switchover). The links are distributed across two different adapter cards to eliminate a single point of failure.

Figure 9: LAG on access interconnection

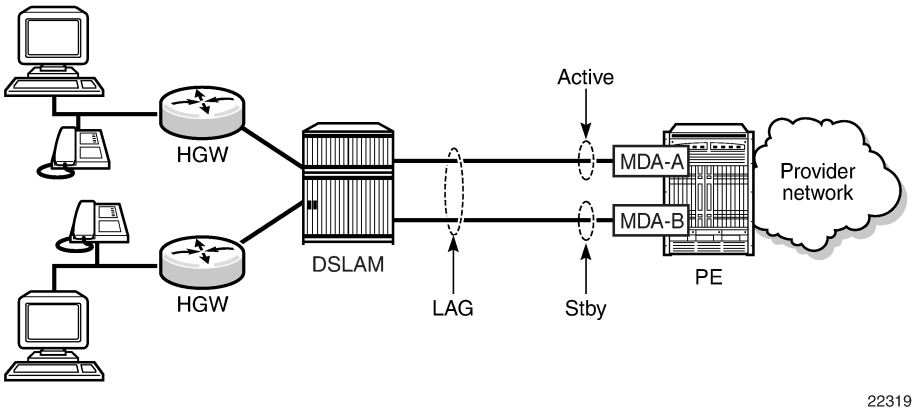

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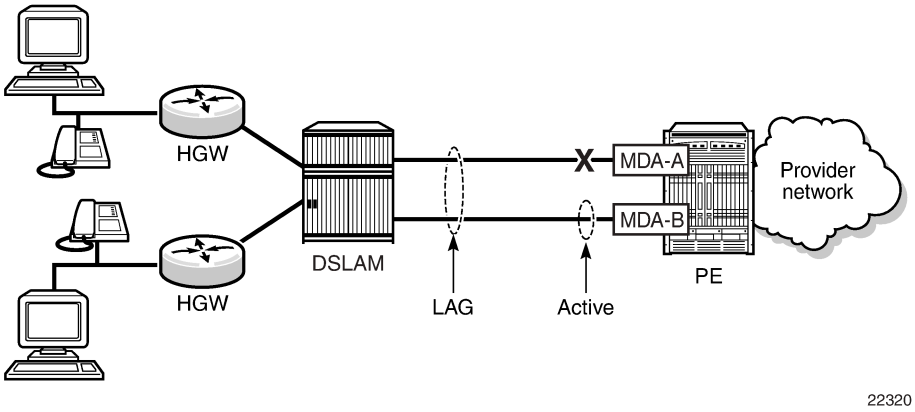
Figure 10: LAG on access failure switchover



LACP handles active/standby operation of LAG subgroups as follows:

- Each link in a LAG is assigned to a subgroup. On access, network, and hybrid ports, a LAG can have a maximum of four subgroups and a subgroup can have up to the maximum number of links supported for the LAG. The selection algorithm implemented by LACP ensures that only one subgroup in a LAG is selected as active.
- The algorithm selects the active link as follows:
  - If multiple subgroups satisfy the selection criteria, the subgroup currently active remains active. Initially, the subgroup containing the highest-priority (lowest value) eligible link is selected as active.
  - An eligible member is a link that can potentially become active. This means it is operationally up, and if the **slave-to-partner** flag is set, the remote system did not disable its use (by signaling standby).
- The selection algorithm works in a revertive mode (for details, see the IEEE 802.1ax standard). This means that every time the configuration or status of a subgroup changes, the selection algorithm reruns. If multiple subgroups satisfy the selection criteria, the subgroup currently active remains active. This behavior does not apply if the **selection-criteria** *hold-time* parameter is set to infinite.

Log events and traps are generated at both the LAG and link level to indicate any LACP changes. See the TIMETRA-LAG-MIB for details.

3.2.13.3 QoS adaptation for LAG on access

QoS on access port LAGs (access ports and hybrid ports in access mode) is handled differently from QoS on network port LAGs (see QoS for LAG on network). Based on the configured hashing, traffic on a SAP can be sent over multiple LAG ports or can use a single port of a LAG. There are two user-selectable adaptive QoS modes (distribute and link) that allow the user to determine how the configured QoS rate is distributed to each of the active LAG port SAP queue schedulers, SAP schedulers (H-QoS), and MSS schedulers. These modes are:

- **adapt-qos distribute**

  For SAP queue schedulers, SAP schedulers (H-QoS), and SAP egress MSS schedulers, distribute mode divides the QoS rates (as specified by the SLA) equally among the active LAG links (ports). For example, if a SAP queue PIR and CIR are configured on an active/active LAG SAP to be 200 Mb/s and

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100 Mb/s respectively, and there are four active LAG ports, the SAP queue on each LAG port will be configured with a PIR of 50 Mb/s (200/4) and a CIR of 25 Mb/s (100/4).

For the SAP ingress MSS scheduler, the scheduler rate is configured on an MDA basis. Distributive adaptive QoS divides the QoS rates (as specified by the SLA) among the active link MDAs proportionally to the number of active links on each MDA.

For example, if an MSS shaper group with an aggregate rate of 200 Mb/s and a CIR of 100 Mb/s is assigned to an active/active LAG SAP where the LAG has two ports on MDA 1 and three ports on MDA 2, the MSS shaper group on MDA 1 will have an aggregate rate of 80 Mb/s (200 × 2/5 of the SLA) and a CIR of 40 Mb/s (100 × 2/5 of the SLA). MDA 2 will have an aggregate rate of 120 Mb/s (200 × 3/5) and a CIR of 60 Mb/s (100 × 3/5).

- **adapt-qos link** (default)

  For SAP queue schedulers, SAP schedulers (H-QoS), and SAP egress MSS schedulers, link mode forces the full QoS rates (as specified by the SLA) to be configured on each of the active LAG links. For example, if a SAP queue PIR and CIR are configured on an active/active LAG SAP to be 200 Mb/s and 100 Mb/s respectively, and there are two active LAG ports, the SAP queue on each LAG port will be configured to the full SLA, which is a PIR of 200 Mb/s and a CIR of 100 Mb/s.

  For the SAP ingress MSS scheduler, the scheduler rate is configured on an MDA basis. In LAG link mode, each active LAG link MDA MSS shaper scheduler is configured with the full SLA. For example, if an MSS shaper group is configured with an aggregate rate of 200 Mb/s and CIR of 100 Mb/s and is assigned to an active/active LAG SAP with three ports on MDA 1 and two ports on MDA 2, the MSS shaper group on MDA 1 and MDA 2 are each configured with the full SLA of 200 Mb/s for the aggregate rate and 100 Mb/s for the CIR.

The following table shows examples of rate and bandwidth distributions based on the **adapt-qos** mode configuration.

Table 12: Adaptive QoS rate and bandwidth distribution

Scheduler	Distribute	Link
SAP queue scheduler	Rate distributed = rate / number of active links	100% rate configured on each LAG SAP queue
SAP scheduler (H-QoS)	Rate distributed = rate / number of active links	100% rate configured on each SAP scheduler
SAP egress MSS scheduler	Rate distributed = rate / number of active links	100% rate configured on each port's MSS scheduler
SAP ingress MSS scheduler	Rate distributed per active LAG MDA = rate × (number of active links on MDA / total number of active links)	100% rate configured on each active LAG MDA MSS scheduler

The following restrictions apply to ingress MSS LAG adaptive QoS (distribute mode):

- A unique MSS shaper group must be used per LAG when a non-default ingress MSS shaper group is assigned to a LAG SAP using adaptive QoS.
- When a shaper group is assigned to a LAG SAP using adaptive QoS, all ports in the LAG group must have their MDAs assigned to the same shaper policy.

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The following restrictions apply to egress MSS LAG:

- The shaper policy for all LAG ports in a LAG must be the same and can only be configured on the primary LAG port member.

The following limitations apply to adaptive QoS (distribute mode):

- The QoS rates for an ingress LAG using adaptive QoS are only distributed among the active links when a non-default shaper group is used. If a default shaper group is used, the full QoS rates are configured for each port in the LAG as if link mode is being used.
- The QoS rates for an ingress or egress LAG using adaptive QoS will not be distributed among the active links when a user sets the PIR/CIR on a SAP queue, or aggregate rate/CIR on a SAP scheduler or MSS scheduler, to the default values (max and 0).

3.2.13.3.1 Adaptive QoS examples (distribute mode)

The following examples can be used as guidelines for configuring **adapt-qos distribute**.

SLA distribution for SAP queue-level PIR/CIR configuration

- Configure a **qos sap-ingress** policy with a queue ID of 2, a PIR of 200 Mb/s, and a CIR of 100 Mb/s. Assign it to an active/active LAG SAP with five active ports.
- For each port, the PIR/CIR configuration of SAP queue 2 is calculated so that the PIR = 40 Mb/s and CIR = 20 Mb/s.
- If one link goes down, the PIR/CIR configuration of SAP queue 2 on each active port is recalculated so that the PIR = 50 Mb/s and CIR = 25 Mb/s.

SLA distribution for ingress/egress (H-QoS)

- Create a LAG SAP with two different ports (for example, port 1/1/1 and port 1/1/2) in a LAG subgroup.
- Configure a LAG SAP aggregate rate of 200 Mb/s and a CIR of 100 Mb/s.
- To maintain the SLA, the SAP aggregate rate and CIR must be divided by the number of operational links in the LAG group.
- Because there are two active ports (links) in this LAG, the H-QoS aggregate rate and CIR are divided evenly between the two ports.
- The port 1/1/1 SAP scheduler (H-QoS) aggregate rate is 100 Mb/s and the CIR is 50 Mb/s.
- The port 1/1/2 SAP scheduler (H-QoS) aggregate rate is 100 Mb/s and the CIR is 50 Mb/s.

SLA distribution for Ingress MSS

- Configure a shaper group with an ID of 2 with an aggregate rate of 200 Mb/s and a CIR of 100 Mb/s.
- Create a LAG SAP using shaper group 2 that has two ports from one MDA (for example, ports 1/1/1 and 1/1/2) and three ports from a different MDA (for example, ports 1/2/1, 1/2/2, and 1/2/3) in its LAG group.
- The ingress MSS scheduler rate is configured on an MDA basis. Adaptive QoS divides the QoS rates among the active link MDAs, proportionally to the number of active links on each MDA.
- For MDA 1, the MSS shaper group aggregate rate is 80 Mb/s and the CIR is 40 Mb/s (2/5 of the bandwidth with two active links on MDA 1).
- For MDA 2, the MSS shaper group aggregate rate is 120 Mb/s and the CIR is 60 Mb/s (3/5 of the bandwidth with three active links on MDA 2).

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3.2.13.4 QoS for LAG on network

QoS on network port LAGs is handled differently from QoS on access port LAGs. The **adapt-qos** command is not supported on network port LAGs. However, QoS behavior on network port LAGs is similar to QoS on access port LAGs configured for **adapt-qos link** mode. For network queue and per-VLAN shapers, the full QoS rates are configured on each of the active LAG links. For example, if a per-VLAN shaper **agg-rate-limit** aggregate rate (PIR) and CIR are configured on an active/active LAG interface to be 200 Mb/s and 100 Mb/s respectively, and there are two active LAG ports, the per-VLAN shaper on each LAG port will be configured to an aggregate rate of 200 Mb/s and a CIR of 100 Mb/s.

3.2.13.5 Access ingress fabric shaping

To prevent traffic congestion and ease the effects of possible bursts, a fabric shaper is implemented on each adapter card. Traffic being switched to a LAG SAP on an access interface goes through fabric shapers that are either in aggregate mode or destination mode. When in destination mode, the multipoint shaper is used to set the rate on all adapter cards. For more information about the modes used in fabric shaping, see the 7705 SAR Quality of Service Guide, "Configurable ingress shaping to fabric (access and network)".

Note: Even though the multipoint shaper is used to set the fabric shaping rate for traffic switched to a LAG SAP, it is the per-destination unicast counters that are incremented to show the fabric statistics rather than the multipoint counter. Only the fabric statistics of the active port of the LAG are incremented, not the standby port.

3.2.13.6 Hold-down timers

Hold-down timers control how quickly a LAG responds to operational port state changes. The following timers are supported:

- **port-level hold-time (up/down) timer**

  This timer controls the delay before a port is added to or removed from a LAG when the port comes up or goes down. Each port in the LAG has the same timer value, which is configured on the primary LAG link (port). The timer is set with the **config>port>ethernet>hold-time** command.

- **subgroup-level hold-down timer**

  This timer controls the delay before a switch from the current subgroup to a new candidate subgroup, selected by the LAG subgroup selection algorithm. The timer is set with the **config>lag>selection-criteria** command.

  The timer can be configured to never expire, which prevents a switch from an operationally up subgroup to a new candidate subgroup. This setting can be manually overridden by using the **tools>perform>force>lag-id** command (see the 7705 SAR OAM and Diagnostics Guide, "Tools Command Reference", for information about this command).

  If the port-level timer is set, it must expire before the subgroup selection occurs and this timer is started. The subgroup-level timer is supported only for LAGs running LACP.

- **LAG-level hold-down timer**

  This timer controls the delay before a LAG is declared operationally down when the available links fall below the required port or bandwidth minimum. This timer is recommended for MC-LAG operation. The

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timer prevents a LAG from being brought down when an MC-LAG switchover executes a make-before-break switch. The LAG-level timer is set with the **config>lag>hold-time** down command.

If the port-level timer is set, it must expire before the LAG operational status is processed and this timer is started.

3.2.13.7 Multi-chassis LAG

Multi-chassis LAG (MC-LAG) is a redundancy feature on the 7705 SAR, useful for nodes that are taken out of service for maintenance, upgrades, or relocation. MC-LAG also provides redundancy for incidents of peer nodal failure. See the "Multi-chassis LAG redundancy" section in the 7705 SAR Basic System Configuration Guide.

3.2.13.8 Static LAG (active/standby LAG operation without LACP)

Some Layer 2-capable network equipment devices support LAG protected links in an active/standby mode but without LACP. This is commonly referred to as static LAG. In order to interwork with these products, the 7705 SAR supports configuring LAG without LACP.

LACP provides a standard means of communicating health and status information between LAG peers. If LACP is not used, the peers must be initially configured in a way that ensures that the ports on each end are connected and communicating. Otherwise, LAG will not be active. Which LAG peer is made active is a local decision. If the port **priority** settings are the same for all ports, it is possible that the two ends will select ports on different physical links and LAG will not be active. Decide the primary link by setting the port **priority** for the LAG on each peer to ensure that the active ports on each end coincide with the same physical link.

The key parameters for configuring static LAG are **selection-criteria** (set to **best-port**) and **standby-signaling** (set to **power-off**). The selection criteria is used to determine which selection algorithm decides the primary port (the active port in a no-fault condition). It is always the subgroup with the **best-port** (the highest-priority port - lowest configured value) that is chosen as the active subgroup. The selection criteria must be set to **best-port** before standby signaling can be placed in **power-off** mode. Once the selection criteria is set to **best-port**, setting the **standby-signaling** parameter to **power-off** causes the transmitters on the standby ports to be powered down.

After a switchover caused by a failure on the active link, the transmitters on the standby link are powered on. The switch time for static LAG is typically longer than it is with LACP, due to the time it takes for the transmitters to come up and transmission to be established. When the fault is restored, static LAG causes a revertive switch to take place. The revertive switch is of shorter duration than the initial switchover since the system is able to prepare the other side for the switch and initiate the switchover once it is ready.

Note: Because the transmitters on the standby link are off, it is not possible for the LAG to respond to a physical disconnect (fault) on the standby link. This means that it is possible to have a failure on the active link result in a switch to a failed standby link.

3.2.13.9 LAG support on mixed-generation hardware

This section contains information about the following topics:

- LAG configuration at SAP level
- LAG configuration at port level

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3.2.13.9.1 LAG configuration at SAP level

The 6-port Ethernet 10Gbps Adapter card and the 7705 SAR-X are third-generation (Gen-3) hardware components. All other Ethernet hardware components are second-generation (Gen-2) components. See Table 2: Ethernet adapter card, module, and platform generations for a list of second-generation and third-generation Ethernet adapter cards, ports, and platforms.

The 7705 SAR supports mix-and-match traffic management (TM) across LAG members, where one member is a port on a Gen-3 adapter card or platform and the other member is a port on a Gen-2 adapter card or platform. Mix-and-match LAG does not apply to the 7705 SAR-X because it has only Gen-3 Ethernet ports.

For mix-and-match LAG TM scenarios, the 7705 SAR supports a generic QoS configuration, where the operator can configure all the settings available on each generation adapter card, but it is the card responsible for transporting traffic that determines which settings are applicable. That is, only the settings that apply to the active member port are used.

For example, configuring **scheduling-mode** applies to Gen-2 adapter card SAPs but does not apply to the Gen-3 adapter card SAPs because Gen-3 cards support only one scheduling mode (4-priority), which is its implicit (default) scheduler mode and is not configurable.

Because it cannot be known whether SAP traffic rides over a Gen-2 or a Gen-3 adapter card and whether both adapter cards support H-QoS (tier 2, per-SAP shapers), the operator can choose to configure per-SAP aggregate CIR and PIR shaper rates. When the active link is on a Gen-2- or Gen-3-based port, per-SAP aggregate CIR and PIR rates are both used to enforce shaper rates, except when the active link is on a Gen-3-based port and traffic is in the network egress direction. In this case, only the PIR portion of the per-SAP aggregate rate is used to enforce shaper rates.

In the following descriptions of LAG configuration, **scheduler-mode**, *agg-rate*, and *cir-rate* refer to SAP configuration, as shown below for an Epipe SAP. Similar commands exist for SAPs in other services as well as for egress traffic.

Example:

```
config>service>epipe>sap lag-id>ingress#
   scheduler-mode {4-priority | 16-priority}
   agg-rate-limit agg-rate [cir cir-rate]
```

Note:

- The SAP identifier in the previous command has a *lag-id* (LAG SAP), not a *port-id* (regular SAP). A LAG SAP references two ports (one active and one standby), but only one port at a time carries traffic.
- The *agg-rate* is a PIR rate.

For information about traffic management for Gen-3 adapter cards and platforms, see the "QoS for Gen-3 adapter cards and platforms" section in the 7705 SAR Quality of Service Guide.

For mix-and-match LAG configurations, the following behaviors apply:

- The configured aggregate rate on the LAG SAP is used to dictate the per-SAP aggregate rate on the active LAG port, regardless of which generation of adapter card is used (Gen-3 or Gen-2) or the configured scheduler mode. On a Gen-2 adapter card, the aggregate rate only applies when the port is in 16-priority scheduler mode. This behavior implies the following points:

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  - The scheduler mode can be set to 16-priority or 4-priority. When servicing packets, the Gen-2-based datapath uses the configured scheduler mode (16-priority or 4-priority), while the Gen-3-based datapath always uses 4-priority scheduling.
  - When the traffic is transported over a Gen-3-based port (that is, the active link is on a Gen-3-based adapter card), the aggregate rate (*agg-rate*) is used to enforce a maximum shaper rate, as is the aggregate rate CIR (*cir-rate*).
  - When the active link is on a Gen-2-based adapter card, both aggregate rate CIR and PIR (*cir-rate* and *agg-rate*) are used. The aggregate rate (PIR) enforces the per-SAP bandwidth limit, and the CIR is used to identify in-profile and out-of-profile packets for aggregate scheduling purposes.

In addition, the following items describe mix-and-match LAG configuration behavior (that is, how the LAG SAP settings are applied or ignored depending on the active member port):

- For a LAG SAP, **scheduler-mode**, *agg-rate*, and *cir-rate* are all configurable on a per-SAP basis, regardless of the LAG member port combination (that is, both Gen-2 ports, both Gen-3 ports, or a Gen-2-/Gen-3 port mix).
- The configured **scheduler-mode** can be set to 4-priority or 16-priority, regardless of the LAG member port combination.
- *Agg-rate* and *cir-rate* can be set whether **scheduler-mode** is set to 4-priority or 16-priority.
- The configured **scheduler-mode** applies to Gen-2-based LAG member ports only and is not used for Gen-3-based LAG member ports. Gen-3 cards always use 4-priority scheduler mode. The **unshaped-sap-cir** keyword does not apply to Gen-3 SAPs because Gen-3 SAPs are all shaped SAPs.
- If **scheduler-mode** is 4-priority on the LAG SAP, where the LAG has one Gen-2-based port member and one Gen-3-based port member, the following points apply:
  - The Gen-2-based adapter card is configured with 4-priority scheduling, while *agg-rate* and *cir-rate* are not applied, and H-QoS is not enabled.
  - The Gen-3-based adapter card is configured with *agg-rate* and *cir-rate*, while **scheduler-mode** is ignored.
  - When LAG active/standby switching occurs from an active Gen-3-based port to an active Gen-2-based port, traffic management is changed from a 4-priority scheduler with H-QoS to a 4-priority scheduler without H-QoS that functions like an unshaped SAP.
  - For the reverse case, when LAG active/standby switching occurs from an active Gen-2-based port to an active Gen-3-based port, traffic management is changed from a 4-priority scheduler without H-QoS to a 4-priority scheduler with H-QoS.
- If **scheduler-mode** is 16-priority on the LAG SAP, where the LAG has one Gen-2-based port member and one Gen-3-based port member, the following points apply:
  - The Gen-2-based adapter card is configured with 16-priority scheduling mode, *agg-rate* and *cir-rate*. This means that H-QoS is enabled.
  - The Gen-3-based adapter card is configured with *agg-rate* and *cir-rate*, while **scheduler-mode** is ignored.
  - When LAG active/standby switching occurs from an active Gen-3-based port to an active Gen-2-based port, traffic management is changed from a 4-priority scheduler with H-QoS using the *agg-rate* and *cir-rate*, to a 16-priority scheduler with H-QoS using the *agg-rate* and the *cir-rate* (that is, from 4-priority (Gen-3) mode to 16-priority mode for shaped SAPs).
  - For the reverse case, when LAG active/standby switching occurs from an active Gen-2-based port to an active Gen-3-based port, traffic management is changed from a 16-priority scheduler with H-QoS

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using the *agg-rate* and the *cir-rate*, to a 4-priority (Gen-3) scheduler with H-QoS enabled using the *agg-rate* and the *cir-rate*.

- If **scheduler-mode** is 16-priority mode on the LAG SAP, the combination of a Gen-1-based port with a Gen-2-based or Gen-3-based port is blocked because Gen-1 adapter cards do not support 16-priority mode. The only valid option for this combination of ports is 4-priority scheduling mode.

Lastly, for LAG on access ports, the primary port configuration settings are applied to both the primary and secondary LAG ports. Therefore, in order to support unshaped SAPs when the primary port is a Gen-3-based port and the secondary port is a Gen-2-based port, configuring the **unshaped-sap-cir** on the Gen-3-based port is allowed, even though it does not apply to the Gen-3-based port. This is because **unshaped-sap-cir** is needed by the secondary Gen-2-based port when it becomes the active port. The full command is **config>port>ethernet>access>egress> unshaped-sap-cir** *cir-rate*.

3.2.13.9.2 LAG configuration at port level

The 7705 SAR allows all configurations on Gen-2 and Gen-3 ports, even if some or all of the configurations are not applicable to all the ports. The software uses only the settings that are applicable to the particular port and ignores those that are not applicable. Any change to the primary LAG member configuration propagates to all non-primary ports.

The following table lists the port commands that can be affected by LAG configuration, indicates the command's applicability to Gen-2 and Gen-3 ports, and describes the LAG behavior for mixed LAG configuration.

Note: For LAG on network ports, the **egress-rate**, **unshaped-if-cir,** and **network-queue** policy can only be configured on the primary LAG port and this configuration is propagated to the other LAG members.

Table 13: Port command applicability for LAG configurations on mixed-generation hardware

CLI command	Gen-2 port	Gen-2 port on module[1]	Gen-3 port	Configuration behavior
unshaped-if-cir	Supported [2]	Supported [2]	Supported [3]	Allowed on Gen-2 and Gen-3 hardware, but not on Fast Ethernet ports. All port members of the same LAG must have the same value.
unshaped-sap-cir	Supported	Supported	N/A	Allowed on Gen-2 and Gen-3 hardware. All LAG members are allowed if all member ports have the same **unshaped-sap-cir** value. Change the value only on the primary member. The value is propagated to all other members.
shaper-policy	Supported	Supported	Supported	Allowed on Gen-2 and Gen-3 hardware
cbs	Supported	Supported	Supported	Allowed on Gen-2 and Gen-3 hardware. All LAG members must

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CLI command	Gen-2 port	Gen-2 port on module[1]	Gen-3 port	Configuration behavior
				have the same value. Change the value only on the primary member. The value is propagated to all other members.
src-pause	Enable or disable	Disable	Enable or disable	Allowed to change enable/disable on Gen-2 and Gen-3 hardware, except for a Gen-3 port on a 6-port SAR-M Ethernet Module, where only the **no src-pause** command is supported and cannot be changed. All LAG members must have same value. Change the value only on the primary member. The value is propagated to all other members.
include-fcs	Enable or disable	Always enabled	Enable or disable	Allowed on Gen-2 and Gen-3 hardware
scheduler-mode (for port)	16-priority	16-priority	4-priority	Allowed to configure per-port independently, whether the port is a standalone or an active/standby member. There is no propagation among ports within the same LAG.

Notes:

1. Refers to the 6-port SAR-M Ethernet module
2. Not supported on Fast Ethernet ports.
3. If the port is in network mode, the **unshaped-if-cir** command can be configured but does not take effect. If the port is in hybrid mode, the command takes effect.

As indicated in the table, each generation of adapter card uses its own configured scheduler mode or uses the only command option available for Gen-2 and Gen-3 adapter cards. For example, on a LAG where:

- one member link is on Gen-2 hardware – this port uses 16-priority scheduler mode, which is the default mode and cannot be changed
- one member link is on Gen-3 hardware – this port uses 4-priority (Gen-3) scheduler mode, which is the default mode and cannot be changed

3.2.13.10 BFD over LAG links (micro-BFD)

The 7705 SAR supports the application of BFD to monitor individual LAG link members in order to speed up the detection of link failures. When BFD is associated with an Ethernet LAG, BFD sessions are set up over each link member. These asynchronous independent sessions are referred to as micro-BFD sessions. When micro-BFD is configured, a link is not operational in the associated LAG until the associated micro-BFD session is fully established. The link member is taken out of the operational state in the LAG if the micro-BFD session fails.

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Although ETH-EFM can be used on individual LAG links, EFM timers are limited to 100 ms. With micro-BFD, 10-ms timers are supported, which allows for much faster detection times. The micro-BFD sessions use the well-known destination UDP port 6784 over LAG links. The source MAC address is the local system MAC address for the LAG interface. The micro-BFD packets use the well-known destination MAC address 01:00:5e:90:00:01.

3.2.13.10.1 Configuration rules

The following table shows the rules to configure the micro-BFD IP addresses.

Table 14: Rules to configure micro-BFD IP addresses

LAG and associated interface	Local IP address	Remote IP address
Null encap LAG and interface	BFD IP must match the interface IP	Same subset as interface IP
Dot1q LAG and zero VLAN interface	BFD IP must match the interface IP	Same subset as interface IP
Dot1q LAG and non-zero VLAN interface or no interface	Any IP	Any IP

Note:

- The **remote-ip-address** must match the BFD **local-ip-address** configured on the remote system.
- If the LAG bundle is associated with a different IP interface, the local IP and remote IP addresses must be modified to match the new IP subnet.
- The local and remote LAG nodes must be configured with the same values for the following micro-BFD parameters:
  - **bfd-on-distributing-only**
  - **max-setup-time**
  - **max-admin-down-time**

  If these values do not match between the local and remote ends, micro-BFD and LAG may not come up.

The following table shows the services supported with micro-BFD.

Table 15: Services supported with micro-BFD

LAG and associated interface	Network interface	IES	VPRN	Epipe	Ipipe	VPLS
Null encap LAG interface	✓	✓	✓			
Dot1q LAG and zero VLAN interface	✓	✓				

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LAG and associated interface	Network interface	IES	VPRN	Epipe	Ipipe	VPLS
Dot1q LAG and non-zero VLAN interface or no interface	✓	✓	✓	✓	✓	✓

3.2.13.10.2 Configuration examples

This section provides micro-BFD configuration examples for null and dot1q encapsulation interface types.

Table 16: Configuring micro-BFD for network LAG using null encapsulation

Local LAG node configuration	Remote LAG node configuration
*A:7705:Dut-A# configure lag 10 *A:7705:Dut-A>config>lag# info ---------- description "NETWORK LAG - NULL ENCAP" port 1/2/1 port 1/3/1 lacp active administrative-key 32769 bfd family ipv4 local-ip-address 110.110.110.1 remote- ip-address 110.110.110.2 no shutdown exit exit no shutdown *A:7705:Dut-A# configure router interface "int-lag-10" *A:7705:Dut-A>config>router>if# info ---------- address 110.110.110.1/24 port lag-10 no shutdown	*A:7705:Dut-A# /configure lag 10 *A:7705:Dut-A>config>lag# info ---------- description "NETWORK LAG - NULL ENCAP" port 1/4/1 port 1/6/1 lacp active administrative-key 32769 bfd family ipv4 local-ip-address 110.110.110.2 remote- ip-address 110.110.110.1 no shutdown exit exit no shutdown *A:7705:Dut-A# configure router interface "int-lag-10" *A:7705:Dut-A>config>router>if# info ---------- address 110.110.110.2/24 port lag-10 no shutdown

Note:

- The **remote-ip-address** must match the BFD **local-ip-address** configured on the remote system.
- For LAG null encapsulation, an interface must be created and the micro-BFD IP addresses must match the interface IP address.

Table 17: Configuring micro-BFD for network LAG using dot1q encapsulation with no interface

Local LAG node configuration	Remote LAG node configuration
*A:7705:Dut-A# configure lag 12 *A:7705:Dut-A>config>lag# info ----------	*A:7705:Dut-A# /configure lag 12 *A:7705:Dut-A>config>lag# info ----------

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Local LAG node configuration	Remote LAG node configuration
description "NETWORK LAG - DOT1Q ENCAP" encap-type dot1q port 1/2/2 port 1/ 3/2 bfd family ipv4 local-ip-address 120.120.120.11 remote-ip-address 120.120.120.12 no shutdown exit exit no shutdown	description "NETWORK LAG - DOT1Q ENCAP" encap-type dot1q port 1/4/2 port 1/ 6/2 bfd family ipv4 local-ip-address 120.120.120.12 remote-ip-address 120.120.120.11 no shutdown exit exit no shutdown

Note:

- The **remote-ip-address** must match the BFD **local-ip-address** configured on the remote system.
- For LAG dot1q encapsulation with no interface, the micro-BFD IP addresses can be any valid addresses.

Table 18: Configuring micro-BFD for network LAG using dot1q encapsulation with multiple non-zero VLAN interfaces

Local LAG node configuration	Remote LAG node configuration
*A:7705:Dut-A# configure lag 12 *A:7705:Dut-A>config>lag# info ---------- description "NETWORK LAG - DOT1Q ENCAP" encap-type dot1q port 1/2/2 port 1/3/2 bfd family ipv4 local-ip-address 120.120.120.11 remote-ip-address 120.120.120.12 no shutdown exitexitno shutdown	*A:7705:Dut-A# /configure lag 12 *A:7705:Dut-A>config>lag# info ---------- description "NETWORK LAG - DOT1Q ENCAP" encap-type dot1q port 1/4/2port 1/6/2bfd family ipv4 local-ip-address 120.120.120.12 remote-ip-address 120.120.120.11 no shutdown exitexitno shutdown
*A:7705:Dut-A # configure router *A:7705:Dut-A>config>router# info ---------- echo "IP Configuration" #---------- interface "int-lag-12” address 1.2.3.4/24 port lag-12:999 no shutdown exit	*A:7705:Dut-A # configure router *A:7705:Dut-A>config>router# info ---------- echo "IP Configuration" #---------- interface "int-lag-12” address 1.2.3.4/24 port lag-12:999 no shutdown exit

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Local LAG node configuration	Remote LAG node configuration
interface "int-lag-12-1"	interface "int-lag-12-1"
address 2.3.4.1/24	address 2.3.4.1/24
port lag-12:998	port lag-12:998
no shutdown	no shutdown
exit	exit
interface "int-lag-12-2"	interface "int-lag-12-2"
address 3.4.1.1/24	address 3.4.1.1/24
port lag-12:997	port lag-12:997
no shutdown	no shutdown
exit	exit

Note:

- The **remote-ip-address** must match the BFD **local-ip-address** configured on the remote system.
- For LAG dot1q encapsulation with multiple non-zero VLAN interfaces, the micro-BFD IP addresses can be any valid addresses and the interfaces must have non-zero VLANs.

Table 19: Configuring micro-BFD for network LAG using dot1q encapsulation with a zero VLAN interface

Local LAG node configuration	Remote LAG node configuration
*A:7705:Dut-A# configure lag 12	*A:7705:Dut-A# configure lag 12
*A:7705:Dut-A>config>lag# info	*A:7705:Dut-A>config>lag# info
----------	----------
description "NETWORK LAG - DOT1Q ENCAP"	description "NETWORK LAG - DOT1Q ENCAP"
encap-type dot1q	encap-type dot1q
port 1/2/2	port 1/4/2
port 1/3/2	port 1/6/2
bfd	bfd
family ipv4	family ipv4
local-ip-address 120.120.120.11	local-ip-address 120.120.120.12
remote-ip-address 120.120.120.12	remote-ip-address 120.120.120.11
no shutdown	no shutdown
exit	exit
exit	exit
no shutdown	no shutdown
*A:7705:Dut-A /configure router	*A:7705:Dut-A /configure router

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Local LAG node configuration	Remote LAG node configuration
*A:7705:Dut-A>config>router# info ---------- #---------- echo "IP Configuration" #---------- interface "int-lag-12" address 120.120.120.11/24 port lag-12:0 no shutdown exit	*A:7705:Dut-A>config>router# info ---------- #---------- echo "IP Configuration" #---------- interface "int-lag-12" address 120.120.120.12/24 port lag-12:0 no shutdown exit

Note:

- The **remote-ip-address** must match the BFD **local-ip-address** configured on the remote system.
- For LAG dot1q encapsulation with a zero VLAN interface, the micro-BFD IP addresses must match the interface addresses of the zero VLAN interface.

3.2.14 LAG and ECMP hashing

If it is necessary to increase the available bandwidth for a logical link that exceeds the physical bandwidth or to add redundancy for a physical link, typically one of two methods is applied: LAG or ECMP. A system can also deploy both at the same time using ECMP of two or more LAGs or single links.

The 7705 SAR supports per-flow and per-service hashing, as described in the following sections:

- Per-flow hashing
- Per-service hashing
- LSR hashing
- Layer 4 load balancing
- TEID hashing for GTP-encapsulated traffic
- Entropy labels
- SPI load balancing

Note: For general information about LAG, see LAG. For general information about ECMP, see the 7705 SAR Router Configuration Guide, "Static routes, dynamic routes, and ECMP".

3.2.14.1 Per-flow hashing

The 7705 SAR supports per-flow hashing for LAG and ECMP. Per-flow hashing uses information in a packet as an input to the hash function, ensuring that any given traffic flow maps to the same egress LAG port or ECMP path.

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Depending on the type of traffic that needs to be distributed in an ECMP or LAG path, different variables are used as the input to the hashing algorithm that determines the selection of the next hop (ECMP) or port (LAG). The hashing result can be changed using the options described in Per-service hashing, LSR hashing, Layer 4 load balancing, TEID hashing for GTP-encapsulated traffic, and Entropy labels.

The following table summarizes the possible inputs to the hashing algorithm for ECMP and LAG.

Fragmented packets cannot use Layer 4 UDP/TCP ports or tunnel endpoint IDs (TEIDs). The datapath looks at IP source address and destination address only, even if configured to use Layer 4 UDP/TCP ports or TEID.

In the table, the hashing inputs in the Service ID column and the inputs in the other columns are mutually exclusive. Where checkmarks appear on both the per-service and per-flow sides of the table, see the table note in the Service ID column to determine when per-service hashing is used.

Table 20: Hashing algorithm inputs (ECMP and LAG)

Traffic type	Per-service	Per-flow								
	Service ID	System IPv4 address [1]	Ingress port [2]	Source and destination			TEID [4]	Internal multicast group ID [5]	MPLS label stack	Entropy label
				MAC address	IP address	UDP/ TCP port [3]				
ECMP										
IPv4 routed	✓[6]	✓			✓	✓	✓	✓		
IPv6 routed	✓[6]	✓			✓	✓	✓	✓		
MPLS LSR		✓	✓		✓[7,8]	✓[7]	✓[7]		✓[9]	✓[9]
MPLS MVPN (LSR, eLER)										
VPLS	✓[10]									
Epipe	✓									
Apipe, Cpipe, Fpipe, Ipipe, Hpipe	✓									
LAG										
IPv4 routed		✓			✓	✓	✓	✓		
IPv6 routed		✓			✓	✓	✓	✓		
MPLS LSR		✓	✓		✓[7,8]	✓[7]	✓[7]		✓[9]	✓[9]

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Traffic type	Per-service	Per-flow								
	Service ID	System IPv4 address [1]	Ingress port [2]	Source and destination			TEID [4]	Internal multicast group ID [5]	MPLS label stack	Entropy label
				MAC address	IP address	UDP/ TCP port [3]				
MPLS MVPN (LSR, eLER)		✓	✓		✓			✓	✓	
VPLS	✓[11]			✓	✓	✓	✓	✓		
Epipe	✓[11]			✓	✓	✓	✓			
Apipe, Cpipe, Fpipe, Ipipe, Hpipe	✓									

Notes:

1. The system IP address can be included as a hashing input using the **system-ip-load-balancing** command at the system level. For MPLS LSR, this configuration is ignored when the hashing algorithm is configured as **lbl-only** using the **lsr-load-balancing** command.
2. Optional hashing input that is included when the **use-ingress-port** option is enabled in the **lsr-load-balancing** command.
3. Optional hashing input that is included when the **l4-load-balancing** command is enabled (for all except MPLS LSR) or when the hashing algorithm is configured as **lbl-ip-l4-teid** using the **lsr-load-balancing** command (for MPLS LSR only). Layer 4 load balancing at the service level is not affected by Layer 4 load balancing at the system, router interface, or service interface levels (IES and VPRN).
4. Optional hashing input that is included when the **teid-load-balancing** command is enabled (for all except MPLS LSR) or when the hashing algorithm is configured as **lbl-ip-l4-teid** using the **lsr-load-balancing** command (for MPLS LSR only). TEID load balancing at the service level is not affected by TEID load balancing at the router interface or service interface levels (IES and VPRN).
5. Only applies to multicast traffic. The internal multicast group ID is generated from either the (S,G) record (IGMP snooping, MLD snooping, and PIM snooping), the point-to-multipoint label binding, or the VPLS service creation.
6. Only for Layer 3 traffic going to a Layer 3 spoke SDP interface.
7. Only included when the first 4 bits (first nibble) after the last MPLS header (bottom of stack = 1) has a value of 4 (decimal), in which case the next header encapsulation is considered to be an IPv4 header.
8. Optional hashing input that is included when LSR hashing is configured as **lbl-ip** or **label-ip-l4-teid** using the **lsr-load-balancing** command.
9. MPLS label stack and entropy label are mutually exclusive hashing inputs. When an entropy label indicator (ELI) and entropy label (EL) are found in the label stack, the MPLS labels are not used as hashing inputs.
10. When the **per-service-hashing** command is enabled in a VPLS service, the service ID and an internal spoke SDP binding ID are included as inputs to the hashing algorithm.

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11. When the **per-service-hashing** command is enabled in a VPLS or Epipe service, only the service ID is included as an input to the hashing algorithm.

3.2.14.2 Per-service hashing

The 7705 SAR supports load balancing based on service ID, as shown in Table 20: Hashing algorithm inputs (ECMP and LAG) , The 7705 SAR uses the service ID as the input to the hash function. Per-service and per-flow hashing are mutually exclusive features.

For IPv4 and IPv6 routed traffic under ECMP operation, the service ID is used as the hashing input for Layer 3 traffic going to a Layer 3 spoke SDP interface. Otherwise, per-flow load balancing is used.

For Epipe and VPLS services under LAG operation, the **per-service-hashing** command and the **l4-load-balancing** and **teid-load-balancing** commands are mutually exclusive. Load balancing via per-service hashing is configured under the **config>service> epipe>load-balancing** and **config>service>vpls> load-balancing** contexts.

Note:

- If **per-service-hashing** is not enabled, a 4-byte hash value will be appended to internal overhead for VPLS multicast traffic at ingress. The egress internal hash value is discarded at egress before scheduling. Therefore, shaping rates at access and network ingress and for fabric policies may need to be adjusted accordingly. In addition, the 4-byte internal hash value may be included in any affected statistics counters.
- The 7705 SAR supports multiple LSPs (RSVP-TE or segment routing TE (SR-TE)) in the same SDP as part of the mixed-LSP SDP feature (see the "Mixed-LSP SDPs" section in the 7705 SAR Services Guide for details). When an SDP is configured with multiple LSPs of the same type, it allows load balancing of the traffic in a similar manner as load balancing for LDP ECMP, but only at the iLER point. Therefore, the per-flow hashing and per-service hashing behavior described in this section for LDP ECMP at the iLER also applies to multiple LSPs (RSVP-TE or SR-TE) in the same SDP.

3.2.14.3 LSR hashing

LSR hashing operates on the label stack and can also include hashing on the IP header if the packet is an IPv4 packet. The label-IP hashing algorithm can also include the Layer 4 header and the TEID field. The default hash is on the label stack only. IPv4 is the only IP hashing supported on a 7705 SAR LSR.

When a 7705 SAR is acting as an LSR, it considers a packet to be IP if the first nibble following the bottom of the label stack is 4 (IPv4). This allows the user to include an IP header in the hashing routine at an LSR in order to spray labeled IP packets over multiple equal-cost paths in ECMP in an LDP LSP and/or over multiple links of a LAG group in all types of LSPs.

Other LSR hashing options include label stack profile options on the significance of the bottom-of-stack label (VC label), the inclusion or exclusion of the ingress port, and the inclusion or exclusion of the system IP address.

Note: The global IF index is no longer a hash input for LSR ECMP load balancing. It has been replaced with the **use-ingress-port** configurable option in the **lsr-load-balancing** command. As well, the default treatment of the MPLS label stack has changed to focus on the bottom-of-stack label (VC label). In previous releases, all labels had equal influence.

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LSR load balancing is configured using the **config>system>lsr-load-balancing** or **config>router>if>load-balancing>lsr-load-balancing** command. Configuration at the router interface level overrides the system-level configuration for the specified interface.

If an ELI is found in the label stack, the entropy label is used as the hash result. Hashing continues based on the configuration of label-only (**lbl-only**), label-IP (**lbl-ip**), or label-IP with Layer 4 header and TEID (**lbl-ip-l4-teid**) options.

3.2.14.3.1 LSR label-only hashing

ECMP operation consists of an initial hash based on the system IP address, then on the global port number if the **use-ingress-port** option is enabled.

Each label in the stack is then hashed separately with the result of the previous hash, up to a maximum of 16 labels. The net result is used to select which LDP FEC next hop to send the packet to using a threshold hashing operation of the net result with the number of next hops. Threshold hashing is described in RFC 2992, *Analysis of an Equal-Cost Multi-Path Algorithm*.

If an ELI is found in the label stack, the entropy label replaces the MPLS label stack hashing result and hashing continues.

If the selected LDP FEC or LSP has its NHLFE programmed with a LAG interface, a second round of hashing is needed, using the net result of the first round of hashing as the hashing input.

3.2.14.3.2 LSR label-IP hashing

In the first round of hashing for LSR label IP hashing, the algorithm parses down the label stack as described in LSR label-only hashing.

When the algorithm reaches the bottom of the stack, it checks the next nibble. If the nibble value is 4, the packet is assumed to be an IPv4 packet and the result of the label hash is fed into another hash along with the source and destination address fields in the IP packet header. If the nibble value is not 4, the algorithm will just use the label stack hash already calculated for the ECMP path selection.

The second round of hashing for LAG reuses the net result of the first round of hashing.

3.2.14.3.3 LSR label-IP hashing with Layer 4 header and TEID

If the **lbl-ip-l4-teid** option is configured, the Layer 4 source and destination UDP or TCP port fields and the TEID field in the GTP header are included in the label-IP hashing calculation. See Layer 4 load balancing and TEID hashing for GTP-encapsulated traffic for more information.

3.2.14.3.4 Label stack profile options

The **lsr-load-balancing** command includes a **bottom-of-stack** option that determines the significance of the bottom-of-stack label (VC label) based on which label stack profile option is specified. The profiles are:

- profile 1 – favors better load balancing for pseudowires when the VC label distribution is contiguous (default)
- profile 2 – similar to profile 1 where the VC labels are contiguous, but provides an alternate distribution
- profile 3 – all labels have equal influence in hash key generation

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3.2.14.3.5 Ingress port

The **use-ingress-port** option, when enabled, specifies that the ingress port will be used by the hashing algorithm at the LSR. This option should be enabled for ingress LAG ports because packets with the same label stack can arrive on all ports of a LAG interface. In this case, using the ingress port in the hashing algorithm will result in better egress load balancing, especially for pseudowires.

The option should be disabled for LDP ECMP so that the ingress port is not used by the hashing algorithm. For ingress LDP ECMP, if the ingress port is used by the hashing algorithm, the hash distribution could be biased, especially for pseudowires.

3.2.14.4 Layer 4 load balancing

The IP Layer 4 load-balancing option includes the TCP/UDP source and destination port numbers in addition to the source and destination IP addresses in per-flow hashing of IP packets. By including the Layer 4 information, a source address/destination address default hash flow can be subdivided into multiple finer-granularity flows if the ports used between a source address and destination address vary.

Layer 4 load balancing is configured at the system level using the **config>system>l4-load-balancing** command. It can also be configured at the router interface level or the service interface level (IES and VPRN). Configuration at the router interface or service interface level overrides the system-level configuration for the specified interface or service.

For LSR LDP ECMP, Layer 4 load balancing is configured using the **lbl-ip-l4-teid** option in the **lsr-load-balancing command** at the system level or router interface level. Configuration at the router interface level overrides the system-level configuration for the specified interface.

Layer 4 load balancing can also be configured at the service level for Epipe and VPLS services. Layer 4 load balancing at the service level is not impacted by Layer 4 load balancing at the system, router interface, or service interface levels.

3.2.14.5 TEID hashing for GTP-encapsulated traffic

GTP is the GPRS (general packet radio service) tunneling protocol. The tunnel endpoint identifier (TEID) is a field in the GTP header. TEID hashing can be enabled on Layer 3 interfaces. The hash algorithm identifies the GTP-U protocol by checking the UDP destination port (2152) of an IP packet to be hashed. If the value of the port matches, the packet is assumed to be GTP-U. For GTPv1 packets, the TEID value from the expected header location is then included in the hash. For GTPv2 packets, the TEID flag value in the expected header is additionally checked to verify whether the TEID is present. If the TEID is present, it is included in the hash algorithm inputs.

TEID load balancing is configured at the router interface level using the **config> router>if>teid-load-balancing** command. It can also be configured at the IES or VPRN service interface level.

For LSR LDP ECMP, TEID load balancing is configured using the **lbl-ip-l4-teid** option in the **lsr-load-balancing command** at the system level or router interface level. Configuration at the router interface level overrides the system-level configuration for the specified interface.

TEID load balancing can also be configured at the service level for Epipe and VPLS services. TEID load balancing at the service level is not impacted by TEID load balancing at the router interface or service interface levels.

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3.2.14.6 Entropy labels

The 7705 SAR supports MPLS entropy labels on RSVP-TE and SR-TE LSPs, as per RFC 6790. The entropy label provides greater granularity for load balancing on an LSR where load balancing is typically based on the MPLS label stack.

If an ELI is found in the label stack, the entropy label is used as the hash result and hashing continues based on the configuration of label-only (**lbl-only**) or label-IP (**lbl-ip**) options. For information about the behavior of LSR hashing when entropy label is enabled, see LSR hashing.

To support entropy labels on RSVP-TE and SR-TE LSPs:

- the eLER must signal to the ingress node that entropy label capability (ELC) is enabled, meaning that the eLER can receive and process an entropy label for an LSP tunnel. Entropy labels are supported on RSVP-TE and SR-TE tunnels. Entropy labels are not supported on point-to-multipoint LSPs, BGP tunnels, or LDP FECs.
- the iLER must receive the entropy label capability signal and be configured to enable the insertion of entropy labels for the spoke SDP, mesh SDP, or EVPN endpoint. Inserting an entropy label adds two labels in the MPLS label stack: the entropy label itself and the ELI.

At the eLER, use the **config>router>rsvp>entropy-label-capability** command to enable entropy label capability on RSVP-TE LSPs.

At the iLER, use the **entropy-label** command to enable the insertion of the entropy label into the label stack. The command is found under the following services and protocols:

- Epipe and VPLS
  - **config>service>epipe>spoke-sdp**
  - **config>service>epipe>bgp-evpn>mpls**
  - **config>service>vpls>spoke-sdp**
  - **config>service>vpls>mesh-sdp**
  - **config>service>vpls>bgp-evpn>mpls**
- IS-IS, OSPF, and MPLS
  - **config>router>isis>segment-routing**
  - **config>router>ospf>segment-routing**
  - **config>router>mpls**

For details on entropy labels, see the "MPLS entropy labels" section in the 7705 SAR MPLS Guide.

3.2.14.7 SPI load balancing

Security parameter index (SPI) load balancing provides a mechanism to improve the hashing performance of IPSec encrypted traffic. IPSec-tunneled traffic transported over a LAG typically relies on IP header hashing only. For example, in LTE deployments, TEID hashing cannot be performed because of encryption, and the system performs IP-only tunnel-level hashing. Because each SPI in the IPSec header identifies a unique SA, and therefore a unique flow, these flows can be hashed individually without impacting packet ordering. In this way,

The 7705 SAR allows enabling SPI hashing per Layer 3 interface (this is the incoming interface for hash on system egress) or per Layer 2 VPLS service. When SPI hashing is enabled, an SPI value from the ESP/

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AH header is used in addition to any other IP hash input based on the per-flow hash configuration: source/destination IPv4/IPv6 addresses and Layer 4 source/destination ports in case NAT traversal is required and Layer 4 load balancing is enabled. If the ESP/AH header is not present in a packet received on a given interface, the SPI will not be part of the hash inputs and the packet is hashed as per other hashing configurations. SPI hashing is not used for fragmented traffic in order to ensure that first and subsequent fragments use the same hash inputs.

SPI hashing is supported for IPv4 and IPv6 tunnel unicast traffic.

3.2.15 SONET/SDH

This section contains information about the following topics:

- SONET
- SDH
- SONET/SDH path support

The 7705 SAR supports SONET/SDH ports on the following adapter cards:

- 4-port OC3/STM1 Clear Channel Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

SONET/SDH ports can be clear channel (non-channelized) and channelized. The 4-port OC3/STM1 Clear Channel Adapter card supports only clear channel ports. The 2-port OC3/STM1 Channelized Adapter card supports channelized ports. The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card is a mixed-use adapter card that supports clear channel and channelized ports. The **mda-mode** command is used to configure the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card for 4-port or 1-port mode. See Configuring cards for details.

Clear channel ports use the whole port—other than overhead bytes—as a single stream of bits. Channelized ports use various channel hierarchies to split the larger bandwidth into smaller channels, such as DS1, E1, DS3, or E3. Figure 11: SONET hierarchy at STS-12 and Figure 12: SDH hierarchy at STM-4 show the standards-based channel mapping for SONET and SDH, respectively. Channelized ports on the 2-port OC3/STM1 Channelized Adapter card and the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card support a subset of the standards-based mapping options, as shown in Table 21: SONET/SDH paths supported on the 7705 SAR .

For SONET, the basic frame format unit is STS-1 (51.84 Mb/s), which is carried in the optical carrier level 1 (OC-1) signal, and three STS-1 frames can be carried in an STS-3 frame at the OC-3 level. For SDH, the basic frame format unit is STM-1 (155.52 Mb/s), which is carried in an OC-3 signal. SDH STM-1 using OC-3 and SONET STS-3 are functionally equivalent.

3.2.15.1 SONET

The following figure shows the SONET hierarchy at STS-12 (OC-12).

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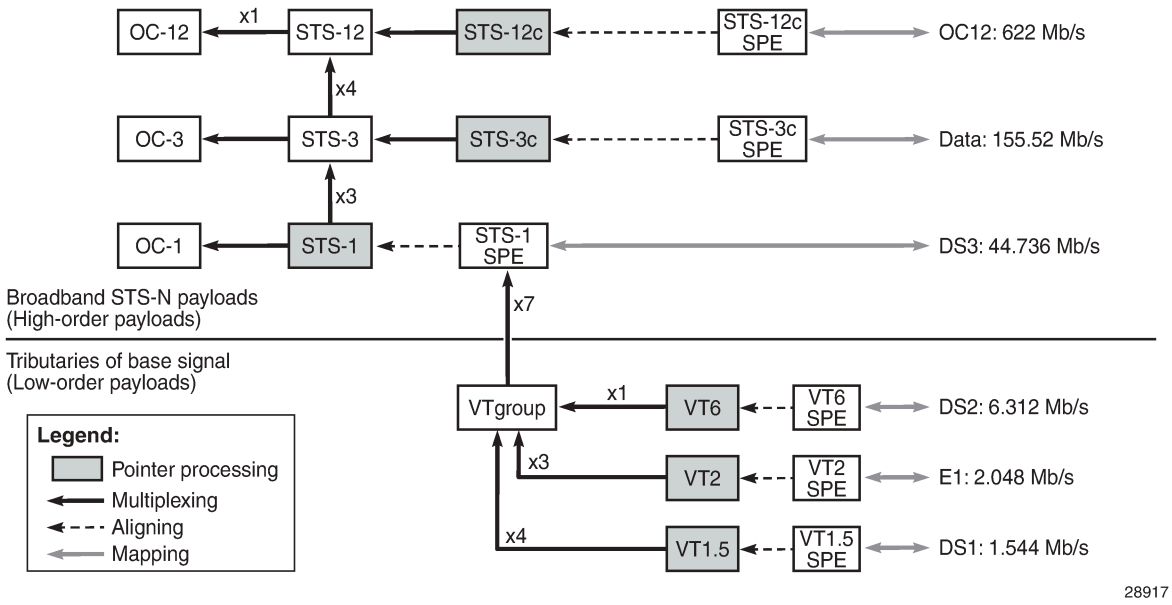
Figure 11: SONET hierarchy at STS-12



A SONET multiplexing structure allows several combinations of signal transportation. For example, at the STS-3 (OC-3) level:

- STS-3 is achieved by interleaving three STS-1s byte by byte
- an STS-1 payload can be subdivided into virtual tributary groups (VTGs) and virtual tributaries (VTs). Each STS-1 may contain seven VTGs, which in turn carry sub-STS traffic in VTs. There are four VT sizes:
  - VT1.5 (1.728 Mb/s) (typically used for DS1, indicated in the CLI as **vt15**)
  - VT2 (2.304 Mb/s) (typically transports one E1)
  - VT3 (3.456 Mb/s) (not shown in the figure)
  - VT6 (6.912 Mb/s)
- each VTG can contain four VT1.5s, three VT2s, two VT3s, or one VT6
- each VTG can carry only VTs of the same size

3.2.15.2 SDH

The following figure shows the SDH hierarchy at STM-4 (OC-12).

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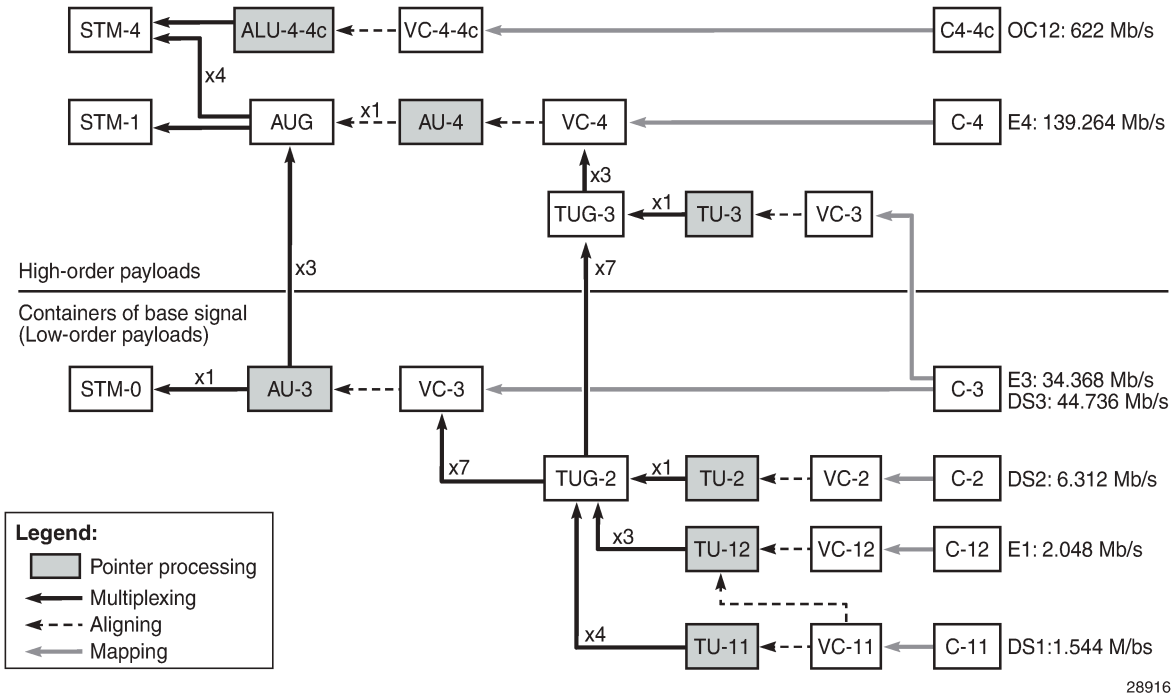
Figure 12: SDH hierarchy at STM-4



An SDH multiplexing structure allows several combinations of signal transportation. For example, at the STM-1 (OC-3) level:

- one STM-1 payload supports one administrative unit group (AUG)
- each AUG can contain either three administrative units (AU-3s) or a single AU-4

For example, the hierarchical possibilities for a single AU-4 are:

- each AU-4 transports data via a virtual container (VC-4)
- a VC-4 consists of three tributary unit groups (TUG-3s), where either:
  - a single tributary unit (TU-3) can be multiplexed via a TUG-3, containing a VC-3 plus the VC-3 path overhead (POH) and TU-3 pointer
  - seven TUG-2s can be multiplexed via a TUG-3, where each TUG-2 can contain one TU-2, three TU-12s, or four TU-11s
- the AU-4 structure addresses the data as (K, L, M), where K is the TUG-3 number, L is the TUG-2 number, and M is the TU-11/TU-12 number

3.2.15.3 SONET/SDH path support

The 7705 SAR supports a subset of the standards-based channel mapping options. The following table shows path support on the 7705 SAR.

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Note: When configuring a port for SDH framing, the 7705 SAR CLI uses SONET STS-*n* frame conventions. That is, SONET command syntax and nomenclature is used to configure both a SONET port and an SDH port.

The 7705 SAR CLI always uses the SONET VT frame convention. For example, the same SONET CLI syntax and nomenclature would be used to configure both a VT1.5 and a VC11. The **framing** {**sonet** | **sdh**} command determines whether VTs or VCs are being configured. Use the **show**>**port-tree** *port-id* command to display the SONET/SDH path containers.

Table 21: SONET/SDH paths supported on the 7705 SAR

Path type	Port framing	Path configuration	2-port OC3/STM1 Channelized Adapter card	4-port OC3/STM1 / 1-port OC12/STM4 Adapter card	
				4-port mode	1-port mode
OC3 clear channel	SDH	STM1>AUG1>VC4		Yes	
OC3 clear channel	SONET	OC3>STS3>STS3c SPE		Yes	
E1	SDH	STM1>AUG1>VC4>TUG3>TUG2>VC12	Yes	Yes	
E1	SDH	STM1>AUG1>VC3>TUG2>VC12	Yes	Yes	
E1	SDH	STM1>AUG1>VC4>TUG3>VC3>DS3	Yes		
E1	SDH	STM1>AUG1>VC3>DS3	Yes		
E1	SONET	OC3>STS1 SPE>DS3	Yes		
DS1	SDH	STM1>AUG1>VC4>TUG3>TUG2>TU11>VC11	Yes	Yes	
DS1	SDH	STM1>AUG1>VC3>TUG2>VC11	Yes	Yes	
DS1	SDH	STM1>AUG1>VC4>TUG3>VC3>DS3	Yes		
DS1	SDH	STM1>AUG1>VC3>DS3	Yes		
DS1	SONET	OC3>STS1 SPE>VT GROUP>VT1.5 SPE	Yes	Yes	
DS1	SONET	OC3>STS1 SPE>DS3	Yes		
OC12 clear channel	SDH	STM4>AUG4>VC4-C4			Yes
OC12 clear channel	SONET	OC12>STS12>STS12c SPE			Yes
E1 using STS-3	SDH	STM4>AUG4>AUG1>VC4>TUG3> TUG2> VC12			Yes

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Path type	Port framing	Path configuration	2-port OC3/STM1 Channelized Adapter card	4-port OC3/STM1 / 1-port OC12/STM4 Adapter card	
				4-port mode	1-port mode
E1 using STS-1	SDH	STM4>AUG4>AUG1>VC3> TUG2> VC12			Yes
DS1 using STS-3	SDH	STM4>AUG4>AUG1>VC4>TUG3> TUG2> TU11> VC11			Yes
DS1 using STS-1	SDH	STM4>AUG4>AUG1>VC3>TUG2>VC11			Yes
DS1 using STS-1	SONET	OC12>STS12>STS1 SPE >VT GROUP >VT1.5 SPE			Yes

3.2.15.3.1 SONET/SDH channelized port ID

When configuring a SONET/SDH port, users configure both SONET/SDH and TDM aspects of a channel. The CLI uses the *sonet-sdh-index* variable to identify a channel in order to match SONET/SDH parameters with TDM parameters for the channel.

A channelized port ID has one of the syntaxes shown in the following table, as applicable to channelization and mapping options. In the table, the syntax contains port and path components, where the port is *slot/mda/port* and the path is the *sonet-sdh-index*. The *sonet-sdh-index* has one or more indexes (indicated by braces separated by a dot) and can have a high-level path label (indicated by bold text).

For example, in the highlighted row, *port*.**sts1-**{1 to 3} represents a SONET/SDH port divided into STS-1 (or STM-0) payloads identified as **sts1-**1, **sts1-**2, and **sts1-**3.

Table 22: SONET/SDH channelized port syntax examples

Port ID for physical port speed			
Channel speed	**OC12/STM4**	**OC3/STM1**	**DS3/E3**
SONET/SDH			
STS12/STM4	*port*.**sts12**	N/A	N/A
STS3/STM1	*port*.**sts3-**{1 to 4}	*port*.**sts3**	N/A
STS1/STM0	*port*.**sts1-**{1 to 4}.{1 to 3}	*port*.**sts1-**{1 to 3}	N/A
TUG3	*port*.**tug3-**{1 to 4}.{1 to 3}	*port*.**tug3-**{1 to 3}	N/A
TU3	N/A	*port*.**tu3-**{1 to 3}	N/A
VT1.5/VC1.1[1]	*port*.**vt15-**{1 to 4}.{1 to 3}.{1 to 4}.{1 to 7}	*port*.**vt15-**{1 to 3}.{1 to 4}.{1 to 7}	N/A

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Port ID for physical port speed			
Channel speed	**OC12/STM4**	**OC3/STM1**	**DS3/E3**
VT2/VC12 [1]	*port*.**vt2-**{1 to 4}.{1 to 3}.{1 to 3}.{1 to 7}	*port*.**vt2-**{1 to 3}.{1 to 3}.{1 to 7}	N/A
TDM			
DS3/E3	N/A	*port*.{1 to 3}	*port*
DS1 in DS3	N/A	*port*.{1 to 3}.{1 to 28}	*port*.{1 to 28}
DS1 in VT2	*port*.{1 to 4}.{1 to 3}.{1 to 3}.{1 to 7}	*port*.{1 to 3}.{1 to 3}.{1 to 7}	N/A
DS1 in VT1.5	*port*.{1 to 4}.{1 to 3}.{1 to 4}.{1 to 7}	*port*.{1 to 3}.{1 to 4}.{1 to 7}	N/A
E1 in DS3	N/A	*port*.{1 to 3}.{1 to 21}	*port*.{1 to 21}
E1 in VT2	*port*.{1 to 4}.{1 to 3}.{1 to 3}.{1 to 7}	*port*.{1 to 3}.{1 to 3}.{1 to 7}	N/A
N*DS0 in DS1 in DS3	N/A	*port*.{1 to 3}.{1 to 28}.{1 to 24}	*port*.{1 to 28}.{1 to 24}
N*DS0 in DS1 in VT2	*port*.{1 to 4}.{1 to 3}.{1 to 3}.{1 to 7}.{1 to 24}	*port*.{1 to 3}.{1 to 3}.{1 to 7}.{1 to 24}	N/A
N*DS0 in DS1 in VT1.5	*port*.{1 to 4}.{1 to 3}.{1 to 4}.{1 to 7}.{1 to 24}	*port*.{1 to 3}.{1 to 4}.{1 to 7}.{1 to 24}	N/A
N*DS0 in E1 in DS3	N/A	*port*.{1 to 3}.{1 to 21}.{2 to 32}	*port*.{1 to 21}.{2 to 32}
N*DS0 in E1 in VT2	*port*.{1 to 4}.{1 to 3}.{1 to 3}.{1 to 7}.{2 to 32}	*port*.{1 to 3}.{1 to 3}.{1 to 7}.{2 to 32}	N/A

Note:

1. Supported by TDM satellite.

3.2.16 Automatic protection switching

This section contains information about the following topics:

- APS overview
- SC-APS
- MC-APS
- K1 and K2 bytes
- Revertive mode
- APS tools commands
- APS failure codes

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3.2.16.1 APS overview

Automatic protection switching (APS) allows users to protect a SONET/SDH port or link with a backup (protection) facility of the same speed but from a different adapter card. APS provides protection against a port, signal, or adapter card failure. The 7705 SAR supports 1+1 APS protection in compliance with GR-253-CORE and ITU-T Recommendation G.841 to provide SONET/SDH carrier-grade reliability. All SONET/SDH paths and channels within a SONET/SDH port are protected.

When APS is enabled, the 7705 SAR constantly monitors the health of the APS links, APS ports, and APS-equipped adapter cards. If the signal on the active (working) port degrades or fails, the network proceeds through a predefined sequence of steps to transfer (or switch over) traffic processing to the protection port. This switchover is done very quickly to minimize traffic loss. Traffic is streamed from the protection port until the fault on the working port is cleared, at which time the traffic may optionally revert to the working port.

The 7705 SAR supports 1+1 single-chassis APS (SC-APS) and 1+1 multi-chassis APS (MC-APS). In an SC-APS group, both the working and protection circuit must be configured on the same node. In an MC-APS group, the working and protection circuits are configured on two separate nodes, providing protection from node failure in addition to protection from link and hardware failure.

Unidirectional and bidirectional modes are supported:

- unidirectional APS (Uni-1Plus1) – in unidirectional mode, only the port in the failed direction switches to the protection port. Unidirectional mode is supported only on SC-APS.
- bidirectional APS – in bidirectional mode, a failure in either direction causes both the near-end and far-end equipment to switch to the protection port in each direction. Bidirectional mode is the default mode and is supported on both SC-APS and MC-APS.

For SC-APS and MC-APS with MEF 8 services where the remote device performs source MAC validation, the MAC address of the channel group in each of the redundant interfaces may be configured to the same MAC address using the **mac** CLI command.

3.2.16.2 SC-APS

In an SC-APS group, both the working and protection circuits terminate on the same node. SC-APS is supported in unidirectional or bidirectional mode on:

- 2-port OC3/STM1 Channelized Adapter cards for TDM CES (Cpipes) and TDM CESoETH with MEF 8 with DS3/DS1/E1/DS0 channels
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards for MLPPP access ports or TDM CES (Cpipes) and TDM CESoETH (MEF 8) access ports with DS1/E1 channels, or on a network port configured for POS
- 4-port OC3/STM1 Clear Channel Adapter cards network side (configured for POS operation)

SC-APS with TDM access is supported on DS3, DS1, E1, and DS0 (64 kb/s) channels.

The working and protection circuits of an SC-APS group must be on two ports on different adapter cards.

The following figure shows an SC-APS group with physical port and adapter card failure protection. Figure 14: SC-APS application shows a packet network using SC-APS.

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Figure 13: SC-APS with physical port and adapter card protection

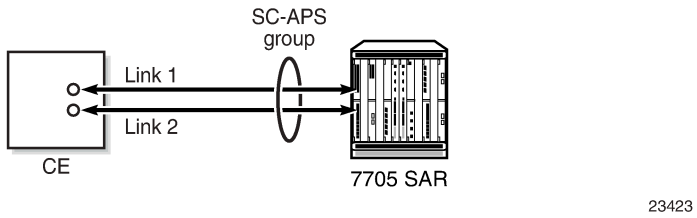
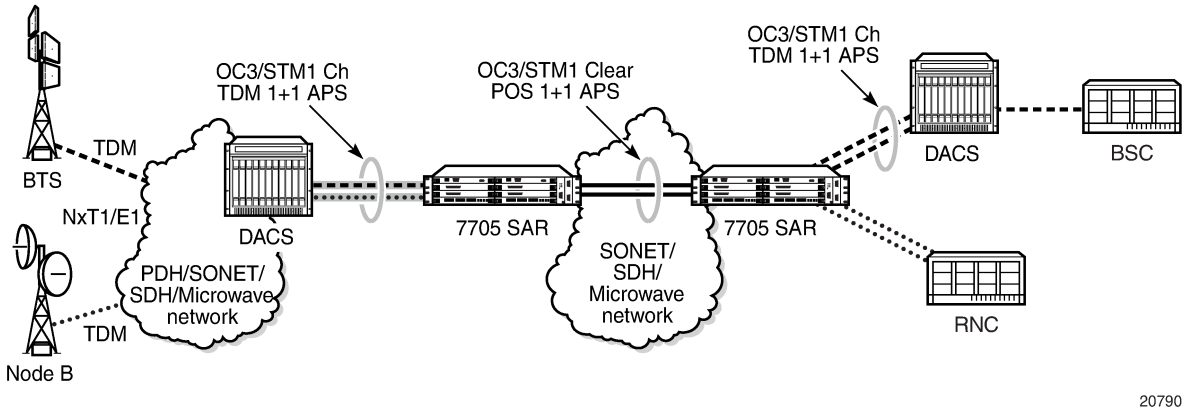


Figure 14: SC-APS application



3.2.16.3 MC-APS

MC-APS extends the functionality offered by SC-APS to include protection against 7705 SAR node failure. MC-APS is supported in bidirectional mode on:

- 2-port OC3/STM1 Channelized Adapter cards for TDM CES (Cpipes) and TDM CESoETH with MEF 8 with DS3/DS1/E1/DS0 channels
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards for MLPPP access ports or CES (Cpipes) and TDM CESoETH (MEF 8) access ports with DS1/E1 channels

MC-APS with TDM access is supported on DS3, DS1, E1, and DS0 (64 kb/s) channels.

TDM SAP-to-SAP with MC-APS is supported on:

- 2-port OC3/STM1 Channelized Adapter cards for TDM CES (Cpipes)
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards for CES (Cpipes)

TDM SAP-to-SAP with MC-APS is not supported with MEF 8 service types.

With MC-APS, the working circuit of an APS group can be configured on one 7705 SAR node while the protection circuit of the same APS group is configured on a different 7705 SAR node. The working and protection nodes are connected by an IP link that establishes an MC-APS signaling path between the nodes.

The working and protection circuits must have compatible configurations, such as the same speed, framing, and port type. The circuits in an APS group on both the working and protection nodes must also

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have the same group ID, but they can have different port descriptions. In order for MC-APS to function correctly, pseudowire redundancy must be configured on both the working and protection circuits. For more information, see the 7705 SAR Services Guide. MC-APS with pseudowire redundancy also supports inter-chassis backup (ICB); see MC-APS and inter-chassis backup for more information.

The working and protection nodes can be different platforms, such as a 7705 SAR-8 Shelf V2 and a 7705 SAR-18. However, to prevent possible switchover performance issues, avoid mixing different platform types in the same MC-APS group. The 7705 SAR does not enforce configuration consistency between the working circuit and the protection circuit. Additionally, no service or network-specific configuration data is signaled or synchronized between the two routers.

An MC-APS signaling path is established using the IP link between the two routers by matching APS group IDs. A heartbeat protocol can also be used to add robustness. The signaling path verifies that one router is configured as the working circuit and the other is configured as the protection circuit. In case of a mismatch, an incompatible neighbor trap is generated. The protection router uses K1/K2 byte data, member circuit status, and the settings configured for the APS tools commands to select the working circuit. Changes in working circuit status are sent across the MC-APS signaling link from the working router to keep the protection router synchronized. External requests such as lockout, force, and manual switches are allowed only on the node with the protection circuit.

The following figure shows an MC-APS group with physical port, adapter card, and node protection. Figure 16: MC-APS application shows a packet network using MC-APS.

Figure 15: MC-APS with physical port, adapter card, and node protection

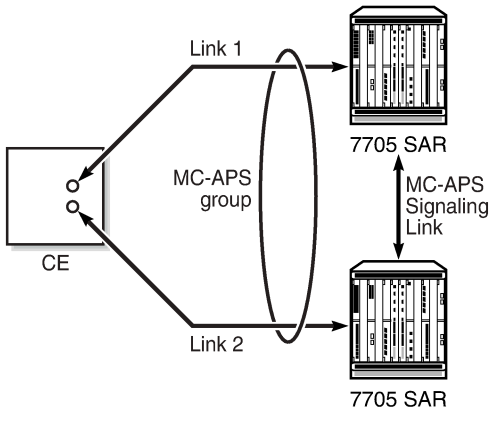
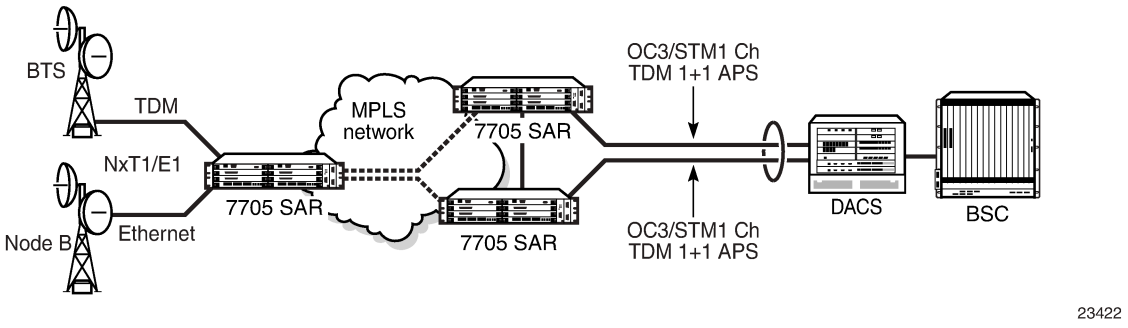


Figure 16: MC-APS application



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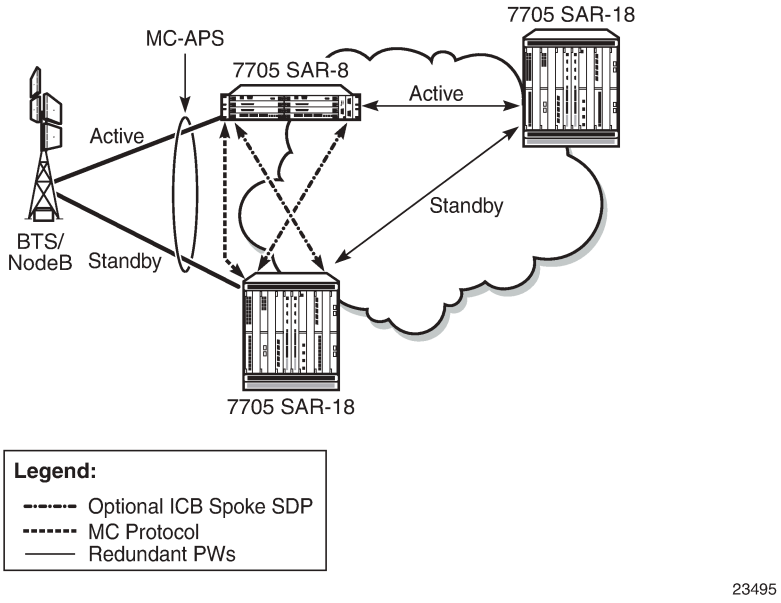
3.2.16.3.1 MC-APS and inter-chassis backup

Inter-chassis backup (ICB) spoke SDPs are supported for use with Cpipe services in an MC-APS configuration. ICB improves switch times, provides additional protection in case of network failures, and reduces packet loss when an active endpoint is switched from a failed MC-APS node to the protection node. The following figure shows an MC-APS group with pseudowire redundancy and ICB protection.

Figure 17: MC-APS with pseudowire redundancy and ICB



If the active link on the access side fails, an MC-APS switchover is triggered and a pseudowire switchover occurs. A failure on the network side triggers a pseudowire switchover but not an MC-APS switchover. For detailed information about pseudowire redundancy with ICB protection, see the 7705 SAR Services Guide, "PW Redundancy and Inter-Chassis Backup".

3.2.16.4 K1 and K2 bytes

The APS protocol uses the K1 and K2 bytes of the SONET/SDH header to exchange commands and replies between the near end and far end.

The switch priority of a request is assigned by bits 1 through 4 of the K1 byte, as shown in the following table.

Table 23: K1 byte switch priorities

Bits	Condition
1111	Lockout of Protection
1110	Forced Switch

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Bits	Condition
1101	SF - High Priority (not used in 1+1 APS)
1100	SF - Low Priority
1011	SD - High Priority (not used in 1+1 APS)
1010	SD - Low Priority
1001	Not used
1000	Manual Switch
0111	Not used
0110	Wait-to-Restore
0101	Not used
0100	Exercise
0011	Not used
0010	Reverse Request
0001	Do Not Revert
0000	No Request

In unidirectional mode, the K1 and K2 bytes are not used to coordinate switch action; however, the K1 byte is still used to inform the other end of the local action, and bit 5 of the K2 byte is set to 0 to indicate 1+1 APS mode (see Table 24: K2 byte functions).

In bidirectional mode, the highest-priority local request is compared to the remote request (received from the far-end node using an APS command), and whichever request has the greater priority is selected. The requests can be automatically initiated (such as Signal Failure or Signal Degrade), external (such as Lockout, Forced Switch, Request Switch), or state requests (such as Revert-Time timers).

The channels requesting the switch action are assigned by bits 5 through 8. Only channel number codes 0 and 1 are supported on the 7705 SAR. If channel 0 is selected, the condition bits show the received protection channel status. If channel 1 is selected, the condition bits shows the received working channel status.

The K2 byte is used to indicate bridging actions performed at the line termination equipment (LTE), the provisioned architecture, and mode of operation, as shown in the following table.

Table 24: K2 byte functions

Bits	Function	
1 to 4	—	Channel number codes
5	0	Provisioned for 1+1 mode
	1	Provisioned for 1:n mode

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Bits	Function	
6 to 8	111	Line AIS
	110	Line RDI
	101	Provisioned for bidirectional switching
	100	Provisioned for unidirectional switching
	011	Reserved for future use
	010	Reserved for future use
	001	Reserved for future use
	000	Reserved for future use

3.2.16.4.1 Bidirectional 1+1 APS example

The following table outlines the steps that the bidirectional APS process will go through during a typical automatic switching event. The example is read row by row, from left to right, to provide the complete process of the bidirectional switching event.

Table 25: 1+1 APS for bidirectional mode – actions

Status	APS commands sent in K1 and K2 bytes on protection line		Action	
	B to A	A to B	At Site B	At Site A
No failure (protection line is not in use)	"No request"	"No request"	No action	No action
Working line degraded in direction A to B	"SD" on working channel 1	"No request"	Failure detected, notify A and switch to protection line	No action
Site A receives SD failure condition	Same	"Reverse request"	No action	Remote failure detected, acknowledge and switch to protection line
Site B receives "Reverse request"	Same	Same	No action	No action

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3.2.16.5 Revertive mode

1+1 APS provides revertive and non-revertive modes; non-revertive mode is the default option. In revertive mode, the activity is switched back to the working port after the working line has recovered from a failure (or the manual switch is cleared). In non-revertive mode, a switch to the protection line is maintained even after the working line has recovered from a failure (or the manual switch is cleared).

To prevent frequent automatic switches that result from intermittent failures, a **revert-time** is defined for revertive switching. The **revert-time** is configurable from 0 to 60 min in increments of 1 min; the default value is 5 min. In some scenarios, performance issues can occur if the **revert-time** is set to 0; therefore, it is recommended that the **revert-time** always be set to a value of 1 or higher. Any change in the **revert-time** value takes effect upon the next initiation of the wait-to-restore (WTR) timer. The change does not modify the duration of a WTR timer that has already been started. The WTR timer of a non-revertive switch can be assumed to be infinite.

If both working and protection lines fail, the line that has less-severe errors will be active. If there is signal degradation on both ports, the active port that failed last will stay active. If there is signal failure on both ports, the working port will always be active because signal failure on the protection line is a higher priority than on the working line.

3.2.16.6 APS tools commands

3.2.16.6.1 Lockout protection

The lockout protection command (**tools>perform>aps>lockout**) disables use of the protection line. Because the command has the highest priority, a failed working line using the protection line is switched back to itself even if it is in a fault condition. No switches to the protection line are allowed when the line is locked out. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the APS **lockout** command.

3.2.16.6.2 Request switch of active to protection

The request or manual switch of active to protection command (**tools>perform>aps> request**) switches the active line to use the protection line (by issuing a manual switch request) unless a request of equal or higher priority is already in effect. If the active line is already on the protection line, no action takes place. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the APS **request** command.

3.2.16.6.3 Request switch of active to working

The request or manual switch of active to working command (**tools>perform>aps> request**) switches the active line back from the protection line to the working line (by issuing a manual switch request) unless a request of equal or higher priority is already in effect. If the active line is already on the working line, no action takes place. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the APS **request** command.

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3.2.16.6.4 Forced switch from working to protection

The command **tools>perform>aps>force>working** forces an activity switch away from the working line to the protection line unless a request of equal or higher priority is already in effect. When the forced switch of working to protection command is in effect, it may be overridden either by a **lockout** command or by a signal fault on the protection line. If the active line is already on the protection line, no action takes place. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the APS **force** command.

3.2.16.6.5 Forced switch from protection to working

The command **tools>perform>aps>force>protect** forces an activity switch away from the protection line and back to the working line unless a request of equal or higher priority is already in effect. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the APS **force** command.

3.2.16.6.6 Exercise

The **exercise** command (**tools>perform>aps>exercise**) is only supported in 1+1 APS bidirectional mode. The command exercises the protection line by sending an exercise request over the protection line to the far end and expecting a reverse request response back. The switch is not completed during the exercise routine. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the APS **exercise** command.

3.2.16.7 APS failure codes

3.2.16.7.1 Protection switching byte failure (APS-PSB)

This failure indicates that the received K1 byte is either invalid or inconsistent. An invalid code defect occurs if the same K1 value is received for three consecutive frames and is either an unused code or irrelevant for the specific switching operation. An inconsistent code defect occurs when no 3 consecutive received K1 bytes of the last 12 frames are the same.

If the failure persists for 2.5 s, a Protection Switching Byte alarm is raised. When this failure is declared, the protection line is treated as if it were in the SF state. The received signal is then selected from the working line.

When the failure is absent for 10 s, the alarm is cleared and the SF state of the protection line is removed.

This alarm can only be raised by the active port operating in bidirectional mode.

3.2.16.7.2 Channel mismatch failure (APS-CM)

This failure indicates that there is a channel mismatch between the transmitted K1 bytes and the received K2 bytes. A defect is declared when the received K2 channel number differs from the transmitted K1 channel number for more than 50 ms after 3 identical K1 bytes are sent. The monitoring for this condition is continuous, not just when the transmitted value of K1 changes.

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If the failure persists for 2.5 s, a Channel Mismatch Failure alarm is raised. When this failure is declared, the protection line is treated as if it were in the SF state. The received signal is then selected from the working line.

When the failure is absent for 10 s, the alarm is cleared and the SF state of the protection line is removed.

This alarm can only be raised by the active port operating in bidirectional mode.

3.2.16.7.3 APS mode mismatch failure (APS-MM)

This failure can occur for two reasons. The first reason is that the received K2 byte indicates that 1:N protection switching is being used by the far end of the OC-N line, instead of 1+1 protection switching. The second reason is that the received K2 byte indicates that unidirectional mode is being used by the far end while the near end is using bidirectional mode. This defect is detected within 100 ms of receiving a K2 byte that indicates either of these conditions.

If the failure persists for 2.5 s, a Mode Mismatch Failure alarm is raised. When this failure is declared, if the defect indicates that the far end is configured for unidirectional mode, then the OC-N port reverts from its current bidirectional mode to unidirectional mode. However, the port continues to monitor the received K2 byte, and if the K2 byte indicates that the far end has switched to bidirectional mode, the OC-N port then reverts to bidirectional mode as well. The monitoring stops if the user explicitly reconfigures the local port to operate in unidirectional mode.

When the failure is absent for 10 s, the alarm is cleared, and the configured mode, which is 1+1 bidirectional, is used.

This alarm can only be raised by the active port operating in bidirectional mode.

3.2.16.7.4 Far-end protection line failure (APS-FEPL)

This failure occurs when a K1 byte is received in three consecutive frames that indicates a signal fail (SF) at the far end of the protection line. This failure forces the received signal to be selected from the working line.

If the failure persists for 2.5 s, a Far-End Protection Line Failure alarm is raised. This alarm can only be raised by the active port operating in bidirectional mode. When the failure is absent for 10 s, the alarm is cleared.

3.2.17 T1/E1 line card redundancy

This section contains information about the following topics:

- T1/E1 LCR overview
- SC-LCR
- MC-LCR
- Revertive mode
- LCR tools commands

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3.2.17.1 T1/E1 LCR overview

T1/E1 line card redundancy (LCR) uses redundant adapter cards to protect T1/E1 services in case of hardware failures. T1/E1 LCR provides protection against adapter card or node failures. When T1/E1 LCR is used in conjunction with pseudowire redundancy, the network path between the endpoints is also protected. Protection is provided specifically for Cpipe services at the clear channel level and at the channelized level.

When T1/E1 LCR is enabled, the 7705 SAR constantly monitors the health of the adapter cards. If the active (working) adapter card fails (for example, because a card has been removed or due to a bus error), the system proceeds through a predefined sequence of steps to transfer (or switch over) traffic processing to the protection MDA. This switchover is done very quickly to minimize traffic loss. Traffic is moved to the protection adapter card until the fault on the working adapter card is cleared, at which time the traffic may optionally revert to the working adapter card.

T1/E1 LCR is supported on the following cards on the 7705 SAR-8 Shelf V2 and the 7705 SAR-18:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card

T1/E1 LCR includes support for single-chassis LCR (SC-LCR) and multi-chassis LCR (MC-LCR). In an SC-LCR group, both the working and protection adapter cards must be configured on the same node. In an MC-LCR group, the working adapter card and protection adapter card are configured on two separate nodes, providing protection from node failure in addition to protection from adapter card hardware failure.

3.2.17.2 SC-LCR

In an SC-LCR group, both the working and protection adapter cards are configured with the same LCR group ID on the same node. The working and protection adapter cards are required to be the same type.

SC-LCR is supported for TDM CES (Cpipes). SC-LCR with TDM access is supported on DS1, E1, and DS0 (64 kb/s) channels.

SC-LCR supports TDM SAP-to-SAP connections when both SAPs are configured as LCR SAPs.

SC-LCR also supports TDM SAP-to-spoke SDP connections over an MPLS network. In this configuration, the far-end connection may or may not be configured for LCR.

3.2.17.3 MC-LCR

MC-LCR extends the functionality offered by SC-LCR to include protection against 7705 SAR node failure. With MC-LCR, the working adapter card of an LCR group is configured on one 7705 SAR node while the protection adapter card of the same LCR group is configured on a different 7705 SAR node. The working and protection nodes are connected by an IP link (directly or indirectly) that establishes a multi-chassis protocol (MCP) link between the nodes.

MC-LCR is supported for TDM CES (Cpipes). MC-LCR with TDM access is supported on DS1, E1, and DS0 (64 kb/s) channels.

MC-LCR supports TDM SAP-to-SAP connections when both LCR SAPs are configured using the same adapter card on each node.

MC-LCR also supports TDM SAP-to-spoke SDP connections over an MPLS network. In this configuration, the far-end connection may or may not be configured for LCR.

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The working and protection adapter cards must be the same type and must have compatible configurations, such as the same speed, framing, and port type. The adapter cards in an LCR group on both the working and protection nodes must also have the same group ID. The LCR groups can have different descriptions. In order for MC-LCR to function correctly, pseudowire redundancy must be configured on both the working and protection adapter cards. For information about pseudowire redundancy, see the 7705 SAR Services Guide, "Pseudowire Redundancy". MC-LCR with pseudowire redundancy also supports inter-chassis backup (ICB); see MC-LCR and inter-chassis backup for more information.

Note: The working and protection nodes can be different platforms, such as a 7705 SAR-8 Shelf V2 and a 7705 SAR-18. However, to prevent possible switchover performance issues, avoid mixing different adapter card types in the same MC-LCR group. The 7705 SAR does not enforce configuration consistency between the working adapter card and the protection adapter card. Additionally, no service or network-specific configuration data is signaled or synchronized between the two nodes.

An MCP link can be established using the IP link between the two nodes by matching LCR group IDs. The signaling path verifies that one node is configured as the working adapter card and the other is configured as the protection adapter card. In case of a mismatch, an incompatible neighbor trap is generated. The protection node uses member adapter card status and the settings configured in the LCR tools commands to select the working adapter card. Changes in working adapter card status are sent across the MC-LCR signaling link from the working node to keep the protection node synchronized. External requests such as lockout and force switch are allowed only on the node with the protection adapter card.

3.2.17.3.1 MC-LCR and inter-chassis backup

ICB spoke SDPs are supported for use with Cpipe services in an MC-LCR configuration. ICB improves switch times, provides additional protection in case of network failures, and reduces packet loss when an active endpoint is switched from a failed MC-LCR node to the protection node.

If the active link on the access side fails, an MC-LCR switchover is triggered and a pseudowire switchover is subsequently triggered. A failure on the network side triggers a pseudowire switchover but not an MC-LCR switchover. For detailed information about pseudowire redundancy with ICB protection, see the 7705 SAR Services Guide, "PW Redundancy and Inter-Chassis Backup".

3.2.17.4 Revertive mode

T1/E1 LCR provides revertive and non-revertive modes; non-revertive mode is the default option. In revertive mode, the activity is switched back to the working adapter card after it has recovered from a failure. In non-revertive mode, a switch to the protection adapter card is maintained even after the working adapter card has recovered from a failure.

To prevent frequent automatic switches that result from intermittent failures, a **revert-time** is defined for revertive switching. The **revert-time** is configurable from 0 to 60 min in increments of 1 min; the default value is 5 min. In some scenarios, performance issues can occur if the **revert-time** is set to 0; therefore, it is recommended that the **revert-time** always be set to a value of 1 or higher. Any change in the **revert-time** value takes effect upon the next initiation of the wait-to-restore (WTR) timer. The change does not modify the duration of a WTR timer that has already been started. The WTR timer of a non-revertive switch can be assumed to be infinite.

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3.2.17.5 LCR tools commands

The LCR **tools** commands can only be executed on the node used in an SC-LCR group or on the protection node of an MC-LCR group. The commands cannot be executed on the working node of an MC-LCR group.

3.2.17.5.1 Force activity from working card

The **tools>perform>lcr>force>working** command forces activity away from the working adapter card to the protection adapter card so that the protection adapter card becomes active unless an internal request of equal or higher priority is already in effect. When this command is in effect, it can be overridden either by a **tools>perform>lcr>lockout** command or by a signal fault on the protection adapter card. If the protection adapter card is already the active adapter card, no action takes place. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the LCR **force** command.

3.2.17.5.2 Force activity from protection card

The **tools>perform>lcr>force>protect** command forces activity away from the protection adapter card to the working adapter card so that the working adapter card becomes active unless an internal request of equal or higher priority is already in effect. See the 7705 SAR OAM and Diagnostics Guide, "Tools", for information about the LCR **force** command.

3.2.18 Deploying preprovisioned components

When a CSM or adapter card is installed in a preprovisioned slot, the system tests for discrepancies between the preprovisioned card and card type configurations and the types actually installed. Error messages are displayed if there are inconsistencies, and the card will not initialize. When the correct preprovisioned cards are installed in the appropriate chassis slot, then alarm, status, and performance details will be displayed on the CLI.

3.2.19 Microwave link

This section contains information about the following topics:

- Microwave link overview
- Standalone mode
- Single NE mode
- Frequency synchronization
- RSL history

3.2.19.1 Microwave link overview

A microwave link allows a 7705 SAR-8 Shelf V2 or 7705 SAR-18 to be connected to a 9500 MPR-e radio node. The MPR-e is the zero-footprint (outdoor) microwave solution offered by Nokia that allows

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customers to migrate from TDM microwave to pure packet microwave. The following MPR-e radio variants are supported:

- MPT-MC - Microwave Packet Transport, Medium Capacity (ODU)
- MPT-HC V2/9558HC - Microwave Packet Transport, High Capacity Version 2 (ODU)
- MPT-XP - Microwave Packet Transport, High Capacity (very high power version of the MPT-HC V2/9558HC) (ODU)
- MPT-HQAM - Microwave Packet Transport, High Capacity (MPT-HC-QAM) or Extended Power (MPT-XP-QAM) with 512/1024 QAM (ODU)
- MPT-HLC and MPT-HLC plus - Microwave Packet Transport, High-Capacity Long-Haul Cubic (ANSI) (IDU)

A microwave link is configured on a 7705 SAR-8 Shelf V2 or 7705 SAR-18 as a virtual port object (not as a physical port) using the CLI command **mw-link-***id* (for more information about how to configure a microwave link, see Microwave link commands).

Note: Before a microwave link can be configured, the current 7705 SAR software package that includes the MPR-e radio software must be downloaded from OLCS to the 7705 SAR-8 Shelf V2 or 7705 SAR-18. See MPR-e radio software and upgrade management for more information.

The supported microwave link types are 1+0 and 1+1 Hot Standby (HSB). To deploy an N+0 link (with N ≥ 2), multiple links of 1+0 can be configured separately.

A microwave link connection is made from ports 1 through 4 on a Packet Microwave Adapter card to an MPR-e radio using one of the methods described in the 7705 SAR Packet Microwave Adapter Card Installation Guide, "Delivering Data to an MPR-e Radio". The radio can be configured in standalone mode to provide a basic microwave connection as described in Standalone mode or in single network element (single NE) mode to provide the advanced networking capabilities described in Single NE mode. The default configuration is single NE mode.

When connected to an MPR-e radio, these ports, with a microwave link configured, operate as Gigabit Ethernet ports and provide the same features as the other ports (ports 5 through 8), except for the following:

- 802.1x authentication
- active/standby operation on Ethernet access ports configured as LAGs
- hard policing on Ethernet ports

If a microwave link is not configured on ports 1 through 4, they provide all of the same features as the other Gigabit Ethernet ports (ports 5 through 8).

3.2.19.2 Standalone mode

A microwave link from ports 1 through 4 on a Packet Microwave Adapter card to an MPR-e radio that is configured in standalone mode provides a basic microwave connection to the MPR-e radio. In standalone mode, each MPR-e radio that is connected to a 7705 SAR-8 Shelf V2 or 7705 SAR-18 is managed as a separate standalone NE by the MPT Craft Terminal (MCT) Element Manager.

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3.2.19.3 Single NE mode

A microwave link from ports 1 through 4 on a Packet Microwave Adapter card to an MPR-e radio that is configured in single NE mode provides the following networking capabilities to the radio over the microwave link:

- Single NE management
- Microwave link fast fault detection
- 1+1 HSB
- 1+1 switching operation

3.2.19.3.1 Single NE management

MWA allows the 7705 SAR-8 Shelf V2 or 7705 SAR-18 and the MPR-e radios to which it is connected to be integrated and managed as a single NE. The following features are part of single NE management:

- One management IP address
- MPR-e radio configuration management
- MPR-e radio alarm management
- MPR-e radio software and upgrade management
- MPR-e radio configuration database file management
- MPR-e radio inventory and microwave link performance statistics
- MPR-e radio reset control
- MPR-e radio mute control

3.2.19.3.1.1 One management IP address

The individual management and IP addresses of the MPR-e radios are no longer required for network management. When managing a microwave network (consisting of a 7705 SAR-8 Shelf V2 or 7705 SAR-18 that is connected to one or more MPR-e radios) using an element/network manager, only the IP address of the 7705 SAR-8 Shelf V2 or 7705 SAR-18 needs to be entered. This capability optimizes the microwave network's IP addressing plan.

3.2.19.3.1.2 MPR-e radio configuration management

For an MPR-e configuration, the required MWA-specific parameters are configured on the 7705 SAR side using the CLI and the required non-MWA parameters are configured on the MPR-e side using the MCT.

The following MWA-specific parameters are configured on the 7705 SAR side:

- 1+1 HSB parameters
- Epipe VLAN SAP parameters (in a mixed microwave link scenario, where there is interworking between a 7705 SAR MPR-e system and a Wavence MSS system using a TDM2Ethernet service, specific MPR-e system parameters are configured under the Epipe VLAN SAP; for more information, see the

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7705 SAR Services Guide, "Configuring Epipe SAP Microwave Link Parameters for Interworking with TDM2 Ethernet").

The following parameters are configured on the MPR-e side:

- radio link parameters
- QoS classification parameters

Configuration done on the MPR-e side is collected in a configuration file; this file can be saved to a 7705 SAR-8 Shelf V2 or 7705 SAR-18 using the Commit button function on the MCT or an **admin>save** CLI command on the 7705 SAR-8 Shelf V2 or 7705 SAR-18.

3.2.19.3.1.3 MPR-e radio alarm management

An MPR-e radio generates alarms for fault conditions pertaining to the MPR-e hardware and to the microwave link over which it is connected. The alarms are sent to the 7705 SAR-8 Shelf V2 or 7705 SAR-18, which turns the alarm notifications into SNMP traps and log events. These log events are controlled in the same way as all other events on the 7705 SAR-8 Shelf V2 and 7705 SAR-18 and can be displayed using the **show>log>event-control>mwmgr** command. See the 7705 SAR System Management Guide, "Event and accounting logs", for more information.

3.2.19.3.1.4 MPR-e radio software and upgrade management

The single NE capability optimizes the MPR-e radio software installation and upgrade process. The MPR-e radio software is bundled with the 7705 SAR software as one package, there is no need to look for and download the MPR-e radio software separately. The 7705 SAR software package containing the MPR-e radio software can be downloaded from a directory on OLCS. The operator can copy the software package onto a compact flash or network store on the 7705 SAR-8 Shelf V2 or 7705 SAR-18.

Note: There are two TiMOS .zip files on OLCS that contain the current 7705 SAR software package; the file that contains the MPR-e radio software has the .MWA annotation in the filename. Only the MPR-e radio software that is bundled with this 7705 SAR software package is recognized as being valid by the 7705 SAR-8 Shelf V2 or 7705 SAR-18.

3.2.19.3.1.5 MPR-e radio configuration database file management

An MPR-e radio's database file is stored and backed up on a 7705 SAR-8 Shelf V2 or 7705 SAR-18. If an old MPR-e radio is replaced by a new one, the new MPR-e radio downloads the MPR-e radio software from the 7705 SAR-8 Shelf V2 or 7705 SAR-18, along with the backed-up database file of the old MPR-e radio. This means that the MPR-e radio does not need to be reconfigured after a radio hardware replacement.

A separate database file is required for each managed MPR-e radio. The user specifies the filename of the database file to be used during provisioning of the radio on the 7705 SAR-8 Shelf V2 or 7705 SAR-18 using the **config>port>mw>radio> database** CLI command.

3.2.19.3.1.6 MPR-e radio inventory and microwave link performance statistics

The following MPR-e radio system information and microwave link information and statistics can be accessed through a CLI session on the 7705 SAR-8 Shelf V2 or 7705 SAR-18:

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- MPR-e radio system information
  - equipment type
  - inventory information
  - radio frequency band
  - temperature
  - radio transmit status
- microwave link statistics
  - MPR-e radio Ethernet statistics
  - local Tx power
  - local Rx power
  - remote Tx power
  - remote Rx power

Note: Local/remote Rx power monitoring and local/remote Tx power monitoring are also known as receive signal level (RSL) monitoring and transmit signal level (TSL) monitoring, respectively.

3.2.19.3.1.7 MPR-e radio reset control

MPR-e radio reset control is provided on the 7705 SAR-8 Shelf V2 or 7705 SAR-18. During an MPR-e radio reset, the microwave link is brought down and an upper layer applications action is triggered, such as message rerouting and clock source switching by the system synchronization unit (SSU).

3.2.19.3.1.8 MPR-e radio mute control

MPR-e radio mute control can be enabled through the CLI/SNMP or by using the MCT. The MCT and CLI are synchronized to show the current state of the MPR-e radio mute function.

Note: Administratively disabling the microwave link with which the MPR-e radio is associated (using the **config>port>mw-link-*id*>shutdown** command) causes the main and spare MPR-e radios to be muted.

3.2.19.3.2 Microwave link fast fault detection

The microwave link fast fault detection (FFD) capability allows a 7705 SAR-8 Shelf V2 or 7705 SAR-18 to directly detect MPR-e radio or microwave link faults using proprietary messaging. The following fault types are detected by FFD:

- a radio signal failure
- an MPR-e radio hardware failure
- an incompatible MPR-e radio setting
- a high bit error rate (HBER) condition

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- a remote defect indication (RDI) condition

Note:

- FFD does not cause the SSU to disqualify the microwave link as a clock source if a fault condition is detected; SSM must be enabled in order to provide this function.
- The microwave link hold time (hold-up time and hold-down time) must be configured in order to suppress link flapping. The hold-up and hold-down times delay advertising the transition of the microwave link status to the upper layer applications, including IP/MPLS and SSU. The hold-time range is between 0 and 900 s.

If microwave link faults are detected, an event is logged and the link is disabled. Some detected faults may be selectively suppressed using the **suppress-faults** command. When faults are suppressed, the event is still logged, but the microwave link is not disabled. Operators can suppress HBER faults, RSL threshold crossing faults, or RDI faults. By default, the system does not suppress faults for FFD.

3.2.19.3.3 1+1 HSB

MWA uses 1+1 HSB to protect against microwave link, MPR-e radio, and Packet Microwave Adapter card failures, as well as frequency channel selective fading. Additionally, hitless (errorless) switching provides zero packet loss if a switchover occurs from a main to a spare MPR-e radio.

The following are required for 1+1 HSB:

- one frequency channel
- two MWA Gigabit Ethernet ports (configured in network mode) on two different Packet Microwave Adapter cards installed in adjacent slots (for example, slot 1/2 or slot 5/6); port 1 on one card protects port 1 on the adjacent card, port 2 protects port 2 on the adjacent card, and so on.
- two MPR-e radios (one main and one spare), each connected to one of the MWA Gigabit Ethernet ports on a Packet Microwave Adapter card

Note: An MPR-e radio that is connected to an odd-numbered port on the Packet Microwave Adapter card must be configured as the main radio.

The following protection schemes make up 1+1 HSB:

- 1+1 equipment protection switching (EPS)
- 1+1 transmission protection switching (TPS)
- 1+1 radio protection switching (RPS)
- 1+1 HSB transmit diversity antenna (TDA)

These protection schemes are enabled using the **config>port>mw>protection** command, with the exception of transmit diversity antenna, which is enabled via the MCT. They interwork with each other as described in the sections that follow.

3.2.19.3.3.1 1+1 equipment protection switching (EPS)

EPS protects against MPR-e radio, MWA Gigabit Ethernet link, and Packet Microwave Adapter card failures. After the radio frames are processed by the active EPS MPR-e radio, the radio sends the Ethernet

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traffic down to the 7705 SAR-8 Shelf V2 or 7705 SAR-18. The standby EPS MPR-e radio does not send any Ethernet traffic down to the 7705 SAR-8 Shelf V2 or 7705 SAR-18.

The switching criteria for EPS are:

- an MPR-e radio hardware failure
- an MWA Gigabit Ethernet link failure between the 7705 SAR-8 Shelf V2 or 7705 SAR-18 and an MPR-e radio
- a Packet Microwave Adapter card connected to an active EPS MPR-e going into a missing or failure state

3.2.19.3.3.2 1+1 transmission protection switching (TPS)

In a 1+1 HSB configuration, TPS protects against a microwave link transmission failure by ensuring that only one MPR-e radio at a time uses the antenna for signaling. The 7705 SAR-8 Shelf V2 or 7705 SAR-18 sends traffic to both the active and standby TPS MPR-e radios. Upon receiving the baseband traffic, both radios modulate it and up-convert it to signals. However, only the active TPS MPR-e radio transmits the RF signals; the standby TPS MPR-e radio suppresses the signals. When the active TPS MPR-e radio fails, standby radio becomes active and restores the microwave link channel.

The switching criteria for TPS are identical to EPS.

Note:

- The states of the EPS and TPS MPR-e radios are linked to each other. If an alarm occurs, an automatic switchover for EPS and TPS is activated simultaneously. However, if a manual switchover is configured, the switchover is decoupled and the state of the EPS and TPS MPR-e radios is no longer identical.
- A manual switchover can be configured for EPS but not for TPS.

3.2.19.3.3.3 1+1 radio protection switching (RPS)

RPS is a hitless radio function that provides space diversity protection for the microwave channel. On the receive side, each MPR-e radio monitors the same radio frequency channel, with the main MPR-e radio being the active receiver by default. Both active and standby RPS MPR-e radios receive both streams of radio frames. The standby RPS MPR-e radio sends the stream of radio frames that it receives to the active EPS MPR-e radio.

Note: To provide space diversity (SD) for the two radio frequency channels, RPS requires that a separate antenna be mounted for each MPR-e radio.

The following figure shows a typical application of 1+1 HSB with SD deployment. Only one microwave frequency channel is active and only the main MPR-e radio is transmitting data to the remote ends; the spare MPR-e radio is acting as a standby.

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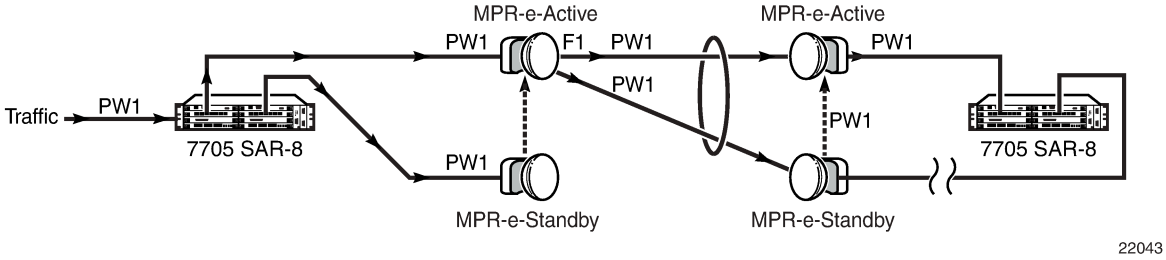
Figure 18: 1+1 HSB with SD deployment



3.2.19.3.3.4 1+1 HSB transmit diversity antenna (TDA)

The TDA feature provides another layer of protection over a microwave link. The TDA configuration uses a main antenna mounted on one MPT-HLC or HLC plus radio and a diversity antenna mounted on another MPT-HLC or HLC plus radio. In combination with the 1+1 HSB radio configuration (redundant MPR-e radios), the traffic is transmitted on either the main antenna or the diversity antenna to achieve the space diversity (SD) receiver configuration.

TDA provides protection switching independent of TPS. TDA is capable of counter-acting either negative propagation conditions or permanent antenna failure.

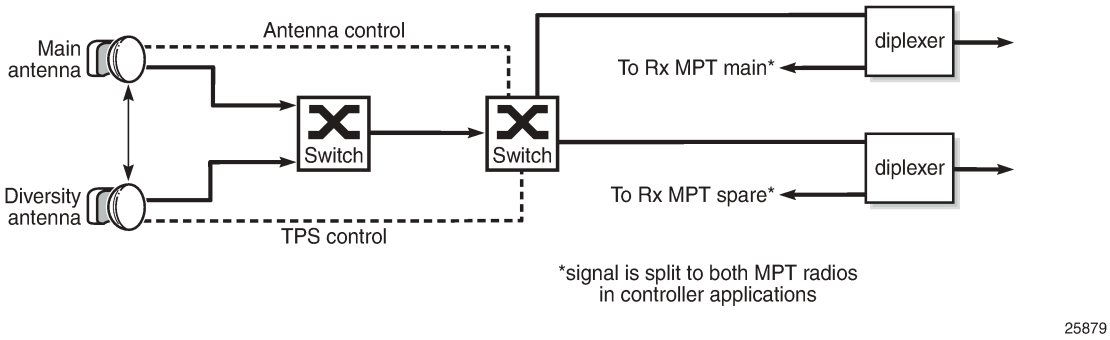
The main antenna is the default main unit that controls the antenna traffic flow using the TDA algorithm. If the main unit fails, the TDA algorithm is no longer operational on the main unit; its transmission switches over to the diversity antenna.

The non-operation of the main antenna switch does not affect transmission, even while the TDA algorithm is being transmitted on the diversity antenna.

TDA configuration is done via the MCT. TDA status is available using the 7705 SAR CLI/SNMP and via the MCT. The CLI command that is used is **show>mw>link**. The status information includes the current TDA configuration, which antenna is active, and the active antenna position.

The following figure shows an example of a TDA application.

Figure 19: Example of a TDA application



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3.2.19.3.3.5 Communication method between the main and spare MPR-e radios

In a 1+1 HSB configuration, the communication path between the main (active) and spare (standby) MPR-e radios installed on a tower is set up using a tight cable.

Note: A tight cable is required with MPT-HC V2, MPT-XP, MPT-HLC, MPT-HLC plus, and MPT-QAM radios (1+ 1 HSB is not supported on MPT-MC radios).

3.2.19.3.4 1+1 switching operation

The following list defines the types of EPS, TPS, and RPS MPR-e radio switching operations that can be enabled using the **tools>perform>mw>link** command:

- lockout – prevents the spare MPR-e radio from ever becoming the main radio, even when the main MPR-e radio fails; this operation overrides any forced, automatic, or manual operation
- forced – forces the spare MPR-e radio to become the main MPR-e radio, even though it may not be in a fit state to assume the role. A forced switch operation overrides any automatic or manual switch operation that is in place.
- automatic – allows an MPR-e radio to perform an automatic switchover if a fault condition exists. An automatic switch operation overrides any manual switch operation that is in place.
- manual – attempts to switch the main/spare status of an MPR-e radio; however, if port failures, equipment failures, and reception failures do not allow the switchover, an automatic switch operation is triggered.

Note: TDA switching operation is enabled via the MCT.

See the 7705 SAR OAM and Diagnostics Guide, “Tools command reference”, “Tools perform commands”, for more information.

Revertive switching can also be configured for RPS and EPS/TPS (when revertive switching is configured for EPS, it is also applied to TPS; revertive switching for TPS cannot be configured separately). Revertive switching occurs when the MPR-e radio operation switches from the spare radio back to the main radio after a fault condition is cleared.

3.2.19.4 Frequency synchronization

Depending on the type of Gigabit Ethernet microwave link used to connect the Packet Microwave Adapter card and an MPR-e radio, different frequency synchronization mechanisms can be used.

When using optical 1000Base-SX to connect the Packet Microwave Adapter card and an MPR-e radio, synchronous Ethernet and SSM are the frequency synchronization mechanisms that are used. SSM is used as the mechanism to detect a microwave link failure, including loss of frame and MPR-e radio hardware failure.

When using electrical 1000Base-T to connect the Packet Microwave Adapter card and an MPR-e radio, PCR is the frequency synchronization mechanism that is used (a copper SFP is mandatory on ports 3 and 4).

For more information about PCR, synchronous Ethernet, and SSM, see the 7705 SAR Basic System Configuration Guide, "Node timing”.

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3.2.19.5 RSL history

An MPR-e radio that is connected to the 7705 SAR can automatically upload its received signal level (RSL) history file to the 7705 SAR host. The RSL file contains a history of radio attributes and alarms that radio operators can use to isolate and diagnose radio-layer problems that may exist in the network.

Up to 24 MPR-e radios can independently upload their RSL history file every 15 minutes when the **rsl-history** command is configured on the 7705 SAR for each radio. When uploaded, the file is stored on the 7705 SAR compact flash. Each RSL file can be up to 1 MB and contain up to 10 000 lines. Each time a new file from a specific MPR-e radio is sent to the 7705 SAR, the new file overwrites the previous version for that radio. When uploaded to the 7705 SAR, the operator can view the file in its raw format using the **file>type** command or FTP it to an external server.

The following table lists the attributes in the RSL history file.

Table 26: RSL history attributes

Attribute	Description
Time	Time of record
LocTxPower	Local transmit power
RemTxPower	Remote transmit power
LocRxPower	Local received power
RemRxPower	Remote received power
LocDivRxPower	Local diversity received power (significant for diversity configuration only)
RemDivRxPower	Remote diversity received power (significant for diversity configuration only)
LocXPD	Local cross-polar discrimination (significant for XPIC configuration only)
RemXPD	Remote cross-polar discrimination (significant for XPIC configuration only)
LocMSE	Local mean squared error
RemMSE	Remote mean squared error
TxMod	Transmitter modulation
RxMod	Receiver modulation
LocEPS	Local equipment protection switching
RemEPS	Remote equipment protection switching
LocRPS	Local radio protection switching

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Attribute	Description
RemRPS	Remote radio protection switching
LocTPS	Local transmit protection switching
RemTPS	Remote transmit protection switching
LocHBERAlm	Local high bit error rate alarm
RemHBERAlm	Remote high bit error rate alarm
LocEWAlm	Local early warning alarm
RemEWAlm	Remote early warning alarm
LocDemFailAlm	Local demodulation failure alarm
RemDemFailAlm	Remote demodulation failure alarm

3.2.20 Custom alarms on Ethernet ports

The 7705 SAR supports custom alarms on Ethernet ports without the need to deploy a dry-contact alarm aggregator. Custom alarms can be created and assigned to any RJ45 port; the port must be configured for 100Base-Tx operation with autonegotiation disabled. One alarm input can be configured for each port with the following:

- name
- description
- association with a user-defined alarm

Alarm inputs must be associated with an alarm in order for them to be triggered. Alarm inputs consist of an Ethernet LOS event caused by breaking contact loops between pins 1 and 3 or 2 and 6 on the Ethernet port. Breaking either loop will trigger the port alarm, and reconnecting the loops will clear the alarm.

For information about configuring the alarm inputs, see Configuring Auxiliary Alarm card, chassis, and Ethernet port external alarm parameters.

3.3 802.1x network access control

The 7705 SAR supports network access control over client devices on an Ethernet network using the IEEE 802.1x standard. 802.1x is a standard for authenticating Ethernet devices before they can access the network. In the case of the 7705 SAR, authentication is performed using Extensible Authentication Protocol (EAP) over LAN (EAPOL).

802.1x provides protection against unauthorized access by forcing the device connected to the 7705 SAR to go through an authentication phase before it is able to send any non-EAP packets. Only EAPOL frames can be exchanged between the aggregation device (called the authenticator; for example, the 7705 SAR) and the customer device (called the supplicant) until authentication is successfully completed. The 7705 SAR enables the port after successful authentication. While the port is unauthenticated, the port will be "down" to all upper layer protocols or services.

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A typical use for EAPOL would involve a 7705 SAR and some type of Ethernet device, such as a laptop, a set-top box, or a Node B. An authentication server would negotiate with the Ethernet device through the 7705 SAR (whose role is authenticator). For example, a technician using a laptop to gain access to his or her network at a cell site would have his or her laptop subject to the 802.1x access control, just as the Node B would. In every case, the Ethernet device connected to the 7705 SAR must negotiate for network access. Essentially, with EAPOL in use, any Ethernet device that connects to the 7705 SAR must negotiate for permission to send traffic through the 7705 SAR Ethernet port.

The 7705 SAR supports the following EAP methods: MD5, TLS, TTLS, and PEAPv0.

MAC authentication can be used to authenticate client devices that do not support EAP. For more information, see MAC authentication.

This section describes the following:

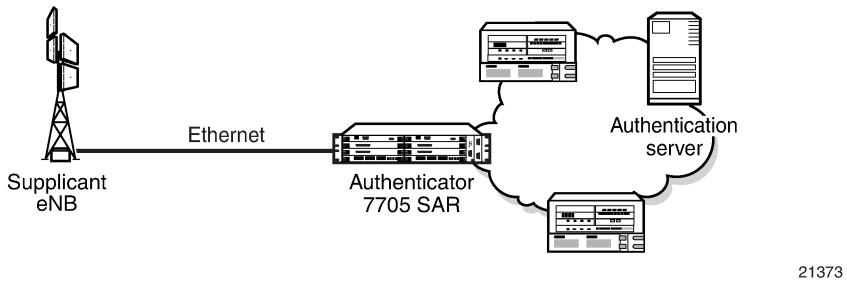
- 802.1x basics
- 802.1x modes
- 802.1x timers
- 802.1x tunneling
- 802.1x configuration and limitations

3.3.1 802.1x basics

The IEEE 802.1x standard defines three participants in an authentication conversation (see Figure 20: 802.1x architecture):

- the supplicant – the end-user device that requests access to the network
- the authenticator – controls access to the network. Both the supplicant and the authenticator are referred to as port authentication entities (PAEs).
- the authentication server – performs the actual processing of the user information

Figure 20: 802.1x architecture



The authentication exchange is carried out between the supplicant and the authentication server; the authenticator acts only as a bridge. The communication between the supplicant and the authenticator is done using EAPOL. The communication between the authenticator and the authentication server is done using the RADIUS protocol. The authenticator is therefore a RADIUS client, and the authentication server is a RADIUS server.

The following figure shows an example of the messages transmitted during an authenticator-initiated, one-time password (OTP) authentication process.

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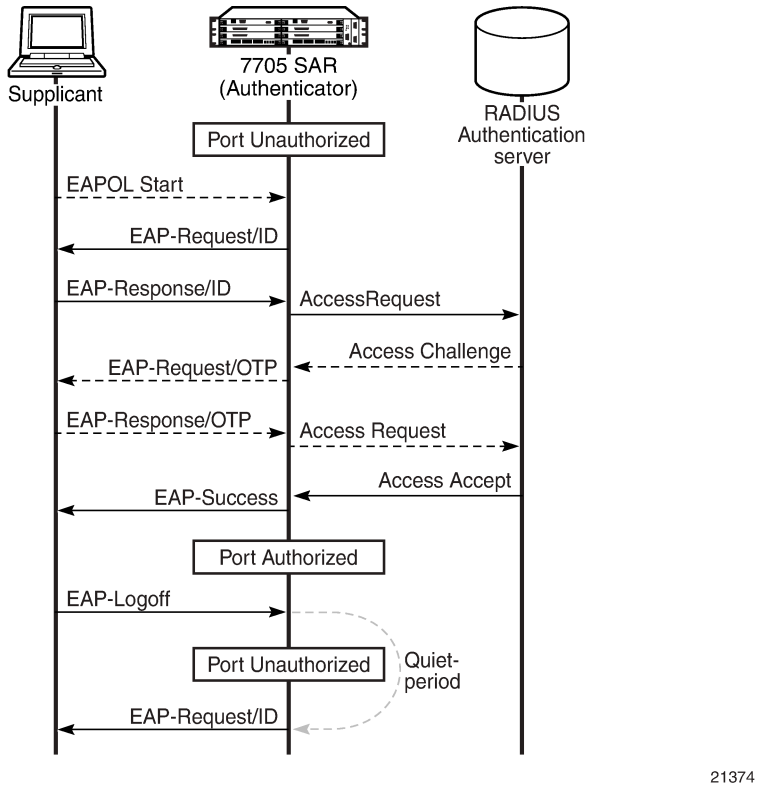
Note: OTP is one of many authentication mechanisms that are available for use between the supplicant and the authentication server. These authentication mechanisms (protocols) are transparent to the 7705 SAR.

Figure 21: Authentication scenario



The authenticator initiates the procedure when the Ethernet port becomes operationally up by sending a special PDU called an EAP-Request/ID to the supplicant. The supplicant can also initiate the exchange by sending an EAPOL-Start PDU if it does not receive the EAP-Request/ID frame during boot-up. The supplicant responds to the EAP-Request/ID with an EAP-Response/ID frame containing its identity (typically username + password).

After receiving the EAP-Response/ID frame, the authenticator encapsulates the identity information into a RADIUS Access Request packet, and sends it off to the configured RADIUS server. The RADIUS Access Request packet contains the following attributes:

- User-Name – the name of the supplicant to be authenticated
- Calling-Station-Id – the MAC address of the supplicant
- NAS-IP-Address – the IP address of the device acting as the authenticator
- NAS-Port – the physical port number of the device acting as the authenticator
- State – allows state information to be maintained between the authenticator and the RADIUS server
- EAP-Message – used to encapsulate EAP packets for transmission from the authenticator to the RADIUS server

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- Message-Authenticator – used to authenticate and protect the integrity of Access Request messages in order to prevent spoofing attacks

The RADIUS server checks the supplied credentials using an authentication algorithm to verify the supplicant's identity. If approved, the RADIUS server returns an Access Accept message to the authenticator. The authenticator notifies the supplicant with an EAP-Success message and puts the port in the authorized state.

If the supplicant sends an EAP-Logoff message, the authenticator puts the supplicant in an unauthorized state and continues searching for supplicants to authenticate.

After sending an EAP-Failure message, the authenticator puts the supplicant in an unauthorized state, waits for the number of seconds defined by the quiet-period timer, then continues searching for supplicants to authenticate.

The 7705 SAR conforms to the relevant sections of the 802.1X-2001 implementation.

3.3.2 802.1x modes

The 7705 SAR supports port-based network access control for Ethernet ports only. Each Ethernet port can be configured to operate in one of three different modes, controlled by the **port-control** command:

- auto – enables 802.1x authentication. The port starts in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. Both the authenticator and the host (supplicant) can initiate an authentication process as described earlier. The port will remain in the unauthorized state until the first supplicant is authenticated successfully. After this, traffic is allowed on the port for all connected hosts.
- force-auth – disables 802.1x authentication and causes the port to transition to the authorized state without requiring any authentication exchange. The port transmits and receives normal traffic without requiring 802.1x-based host authentication. This is the default setting.
- force-unauth – causes the port to remain in the unauthorized state, ignoring all attempts by the hosts to authenticate. The authenticator cannot provide authentication services to the host through the interface.

3.3.3 802.1x timers

The 802.1x authentication process is controlled by a number of configurable timers. There are two separate sets, one for the EAPOL message exchange and one for the RADIUS message exchange. The following figure shows an example of the timers.

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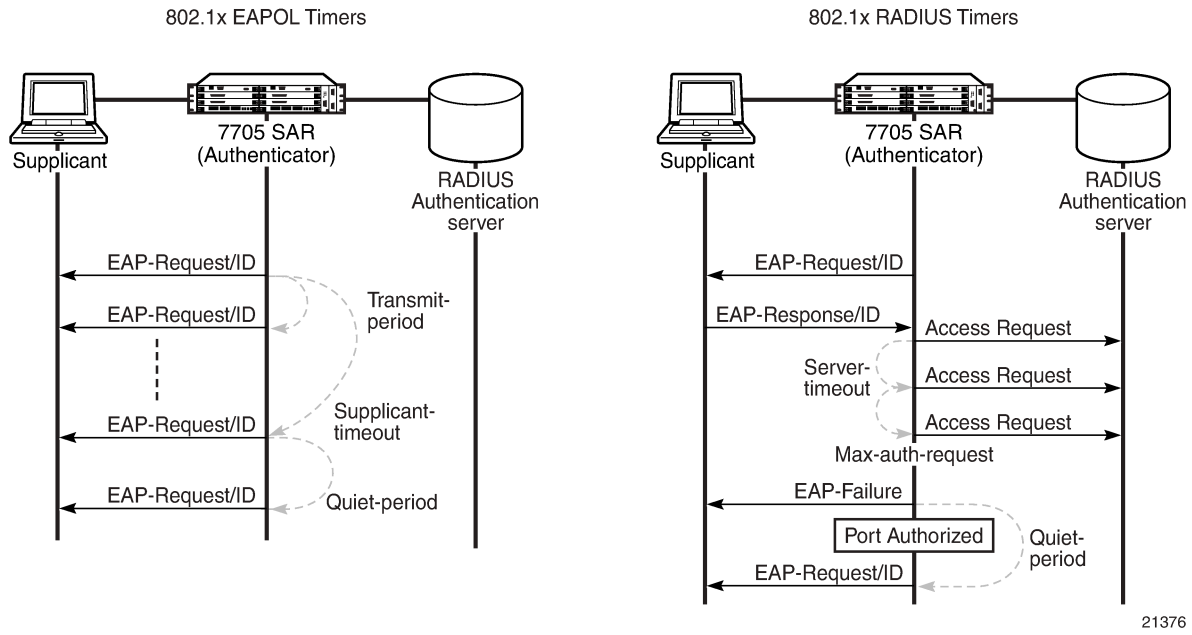
Figure 22: 802.1x EAPOL timers and RADIUS timers



EAPOL timers:

- transmit-period – indicates how many seconds after sending an EAP-Request/ID frame that the 7705 SAR will listen for a supplicant to authenticate (by sending a EAP-Response/ID frame). If the timer expires before a response is received, a new EAP-Request/ID frame will be sent and the timer restarted. The default value is 30 s. The range is 1 to 3600 s.
- supplicant-timeout – indicates how many seconds to allow the 7705 SAR to complete the authentication process. This timer is started at the beginning of a new authentication process (transmission of first EAP-Request/ID frame and receipt of an EAP-Response/ID frame). If the timer expires, the 802.1x authentication session is considered to have failed and the 7705 SAR waits for the quiet-period timer to expire before processing another authentication request. The default value is 30 s. The range is 1 to 300 s.
- quiet-period – indicates the number of seconds that the authenticator will not search for clients after an unsuccessful EAP authentication. The timer is started after sending an EAP-Failure message or after expiry of the supplicant timeout timer. The default value is 60 s. The range is 1 to 3600 s.

RADIUS timers:

- max-auth-req – indicates the maximum number of times that the authenticator will send an authentication request to the RADIUS server before the process is considered as to have failed. The default value is 2. The range is 1 to 10.
- server-timeout – indicates how many seconds the authenticator will wait for a RADIUS response message. If the timer expires, the access request message is sent again, up to the max-auth-req value, and the timer is reset. The default value is 30 s. The range is 1 to 300 s.

The authenticator can also be configured to periodically trigger the authentication process automatically. This is controlled by the enable reauthentication and reauthentication period parameters. Re-auth-period indicates the time in seconds (since the last time that the authorization state was confirmed) before a new

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authentication process is started. The range of re-auth-period is 1 to 9000 s (the default is 3600 s). The port stays in an authorized state during the reauthentication process.

3.3.4 802.1x tunneling

The 7705 SAR supports tunneling of untagged 802.1x frames received on a port for both Epipe and VPLS services using either null or default SAPs (for example1/1/1:0 or 1/1/1:*) when the **port-control** command is set to **force-auth**.

When tunneling is enabled on a port, untagged 802.1x frames are treated like user frames and are switched into Epipe or VPLS services that have a corresponding null SAP or default SAP on that port. If a port has a default SAP, other non-default SAPs could also be on the port. When received on a spoke SDP or mesh SDP, untagged 802.1x frames are tunneled by default. Untagged 802.1x frames received on other service types, or on network ports, are dropped.

802.1x tunneling must be enabled consistently across all ports in the LAG where 802.1x frames are expected. This is not enforced by the system.

3.3.5 802.1x configuration and limitations

Configuration of 802.1x network access control on the authenticator consists of two parts:

- generic parameters, which are configured under **config>system>security>dot1x**

  See the Basic System Configuration Guide, "System command reference".

- port-specific parameters, which are configured under **config>port>ethernet>dot1x**

802.1x provides access to the port for any device, even if only a single client has been authenticated. Additionally, it can only be used to gain access to a predefined SAP. It is not possible to dynamically select a service (such as a VPLS service) depending on the 802.1x authentication information.

3.4 MAC authentication

The 7705 SAR supports the 802.1x EAP standard for authenticating Ethernet devices before they can access the network. However, if a client device does not support 802.1x EAP, MAC authentication can be used to prevent unauthorized traffic from being transmitted through the 7705 SAR.

802.1x EAP must be enabled for MAC authentication to be used, as MAC authentication is a fallback mechanism. To authenticate a port using MAC authentication, 802.1x authentication must first be configured on the 7705 SAR by enabling **port-control auto**, and then **mac-auth** must be configured on the 7705 SAR to enable MAC authentication.

When a port becomes operationally up with MAC authentication enabled, the following steps are performed by the 7705 SAR (as the authenticator):

1. After transmission of the first EAP-Request/ID PDU, the 7705 SAR starts the **mac-auth-wait** timer and begins listening on the port for EAP-Response/ID PDUs. At this point, the 7705 SAR only listens to EAPOL frames. If EAPOL frames are received, 802.1x authentication is chosen.

Note: If the attached equipment does not support EAP, **no mac-auth-wait** can be configured so that MAC authentication can be used as soon as the port is operationally up.

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2. If the **mac-auth-wait** timer expires, and no EAPOL frames have been received, the 7705 SAR begins listening on the port for any Ethernet frames.
3. If the 7705 SAR receives an Ethernet frame, the 7705 SAR scans the client source MAC address in the frame and transmits the MAC address to the configured RADIUS server for comparison against the MAC addresses configured in its database.

   The following attributes are contained in the RADIUS message:

   - User-Name – the source MAC address of the client device
   - User-Password – the source MAC address of the client device in an encrypted format
   - Service-Type – the type of service that the client has requested; the value is set to 10 (call-check) for MAC authentication requests
   - Calling-Station-Id – the source MAC address of the client device
   - NAS-IP-Address – the IP address of the device acting as the authenticator
   - NAS-Port – the physical port of the device acting as the authenticator
   - Message-Authenticator – used to authenticate and protect the integrity of Access Request messages in order to prevent spoofing attacks
4. If the MAC address is approved by the RADIUS server, the 7705 SAR enables the port for traffic transmission.

   If the MAC address is rejected by the RADIUS server, the 7705 SAR enters a quiet period, configured using the **quiet-period** command, and will not authenticate the port via either 802.1x or MAC authentication. After the quiet period expires, the 7705 SAR returns to step1.
5. If a port that was previously authenticated with MAC authentication receives an EAPOL-Start frame, the port will reauthenticate using 802.1x EAPOL.

While the port is unauthenticated, the port will be "down" to all upper layer protocols or services.

3.5 MACsec

Media Access Control security (MACsec) is an industry standard security technology that provides secure communication for almost all types of traffic on Ethernet links. MACsec provides point-to-point and point-to-multipoint security on Ethernet links between directly connected nodes or nodes connected via a Layer 2 cloud. MACsec can identify and prevent most security threats, including:

- denial of service
- intrusion
- man-in-the-middle
- masquerading
- passive wiretapping
- playback attacks

MACsec Layer 2 encryption is standardized in IEEE 802.1AE. MACsec encrypts anything from the 802.1AE header to the end of the payload, including 802.1Q; it leaves the destination MAC address and source MAC address in clear text. The destination MAC address (DMAC) is used for MACsec packet forwarding.

The following figure shows the 802.1AE LAN mode structure.

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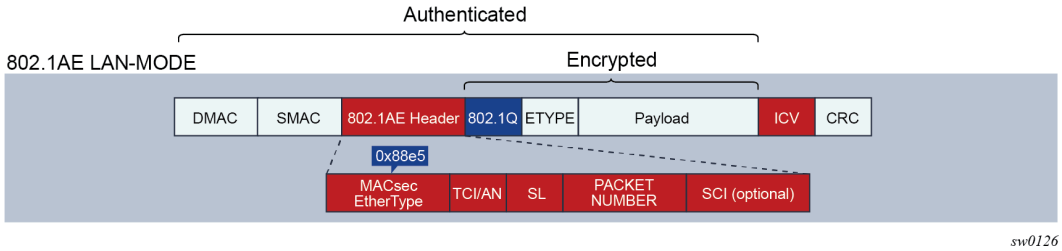
Figure 23: 802.1AE LAN mode



MACsec is supported on the 6-port Ethernet 10Gbps Adapter card, version 2.

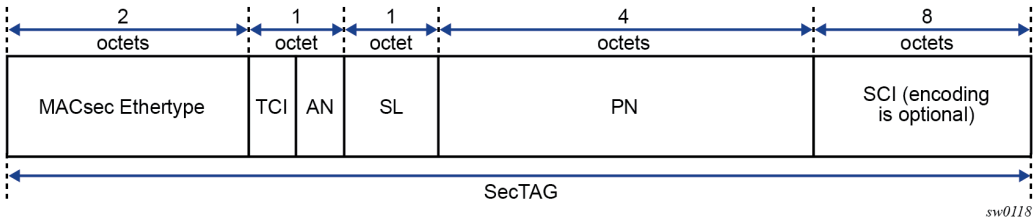
3.5.1 MACsec 802.1AE header – security TAG

The MACsec 802.1AE header includes a security TAG (SecTAG) field, which is identified by the MACsec Ethertype. The SecTAG field contains the following information:

- association number (AN) within the channel
- packet number (PN) to provide a unique initialization vector for encryption and authentication algorithms, as well as protection against replay attacks
- optionally encoded LAN-wide secure channel identifier (SCI)
- TAG control information (TCI)
- short length (SL)

The following figure shows the format of the SecTAG.

Figure 24: SecTAG format



3.5.2 MACsec encryption mode

The main modes of encryption in MACsec are:

- VLAN in clear text (WAN mode)
- VLAN encrypted

The 802.1AE standard dictates that the 802.1Q VLAN must be encrypted. However, some vendors provide the option of configuring MACsec on a port with the VLAN in clear text.

The 7705 SAR supports both modes.

The following figure shows the encrypted VLAN and the VLAN in clear text.

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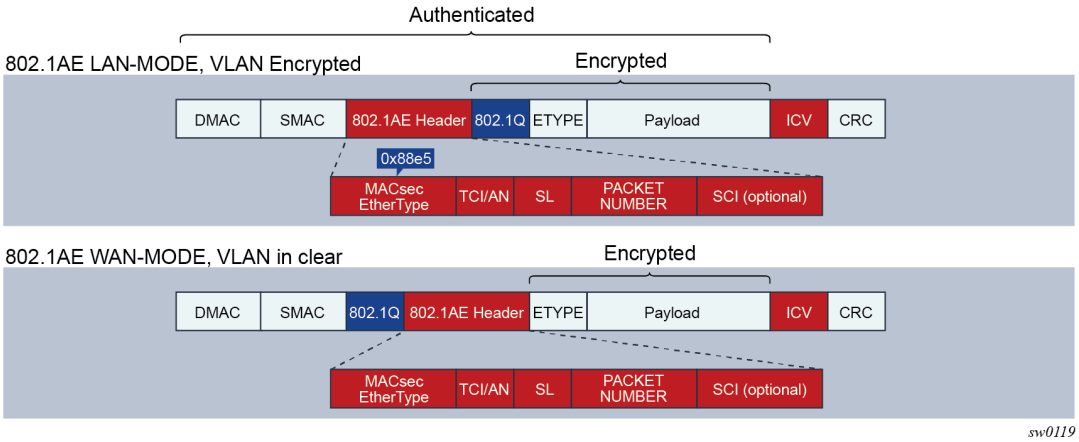
Figure 25: 802.1AE LAN and WAN modes and VLAN encrypted and clear



3.5.2.1 MACsec encryption per traffic flow encapsulation matching

MACsec can be applied to a selected subset of the port traffic, based on the type and value of the packet encapsulation. The 7705 SAR can be configured to match and encrypt the following traffic encapsulation types:

- all encapsulated traffic arriving on the port, including untagged, single-tag, and double-tag traffic. This is the default behavior of MACsec.
- untagged-only traffic
- single-tag or dot1q traffic. In this mode, MACsec can be applied to a specific tag or wildcard tag where all single-tag traffic is matched.
- double-tag or QinQ traffic. In this mode, MACsec can be applied to a specific service tag (S-tag), a specific service tag and customer tag (S-tag and C-tag), or a wildcard for any QinQ traffic.

MACsec key agreement PDUs (MKPDUs) are generated specifically for the traffic encapsulation type that is being matched.

3.5.3 MACsec key management modes

The following table describes the main key management modes in MACsec.

Table 27: MACsec key management modes

Keying	Description	7705 SAR support	Where used
Static SAK	Manually configures each node with a static security association key (SAK), SAM, or CLI		Switch to switch
Static CAK PRE SHARED KEY	Uses a dynamic MACsec key agreement (MKA) and a configured	✓	Switch to switch

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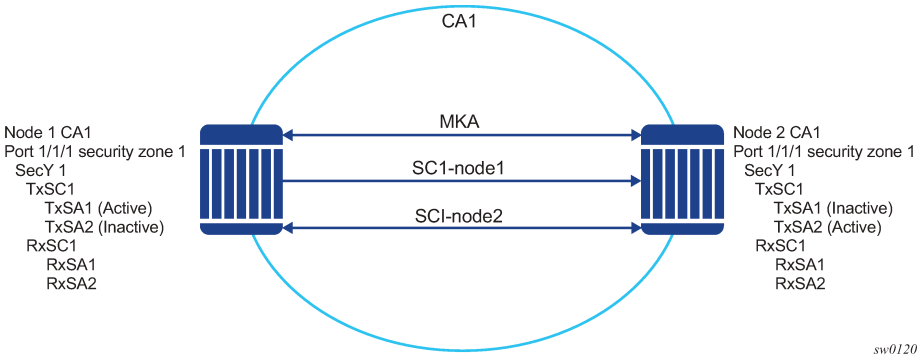
Keying	Description	7705 SAR support	Where used
	pre-shared key to drive the connectivity association key (CAK) The CAK encrypts the SAK between two peers and authenticates the peers.		
Dynamic CAK EAP authentication	Uses a dynamic MKA and an EAP master system key (MSK) to drive the CAK The CAK encrypts the SAK between two peers and authenticates the peers.		Switch to switch
Dynamic CAK MSK distribution via RADIUS and EAP-TLS	Stores the MSKs in the RADIUS server and distributes to the hosts via EAP-TLS. This is typically used in access networks where a large number of hosts use MACsec and connect to an access switch. MKA uses MSK to drive the CAK. The CAK encrypts the SAK between two peers and authenticates the peers.		Host to switch

3.5.4 MACsec terminology

The following figure illustrates some of the main concepts used in MACsec for the static CAK scenario.

Figure 26: MACsec concepts for static CAK



The following table describes MACsec terminology.

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Table 28: MACsec terminology

MACsec term	Description
CA: connectivity association	Provides a security relationship, established and maintained by key agreement protocols (MKA), that comprises a fully connected subset of the SAPs in stations attached to a single LAN that are to be supported by MACsec
MKA: MACsec key agreement protocol	Provides a control protocol between MACsec peers, which is used for peer aliveness and encryption key distribution. MACsec key agreement is responsible for discovering, authenticating, and authorizing the potential participants in a CA.
SecY: MAC security entity	Operates the MAC security protocol within a system and manages and identifies the SC and corresponding active SA
SC:security channel	Provides a unidirectional point-to-point or point-to-multipoint communication. Each SC contains a succession of SAs, and each SC has a different SAK.
SA: security association	The 7705 SAR has two SAs per SC, each with a different SAK, and each SC comprises a succession of SAs. Each SA is identified by the SC identifier, concatenated with a two-bit association number. The secure association identifier (SAI) that is created allows the receiving SecY to identify the SA and the SAK used to decrypt and authenticate the received frame. The AN, and consequently the SAI, is only unique for the SAs that can be used or recorded by participating SecYs at any time. The MACsec key agreement creates and distributes SAKs to each of the SecYs in a CA. This key creation and distribution is independent of the cryptographic operation of each of the SecYs. The decision to replace one SA with its successor is made by the SecY that transmits using the SC, after the MKA has informed it that all the other SecYs are prepared to receive using that SA. No notification, other than receipt of a secured frame with a different SAI, is sent to the receiver. A SecY must always be capable of storing SAKs for two SAs for each inbound SC and of swapping from one SA to another without notice. Certain LAN technologies can reorder frames of different priority, so reception of frames on a single SC can use interleaved SAs.
SAK: security association key	The encryption key used to encrypt the datapath of MACsec

3.5.5 MACsec static CAK

MACsec uses SAs to encrypt packets. An SA is a security relationship that provides security guarantees for frames transmitted from one member of a CA to the other members. Each SA contains a single SAK with the cryptographic operations used to encrypt the datapath PDUs.

An SAK is the secret key used by an SA to encrypt the channel.

When enabled, MACsec uses a static CAK security mode. Two security keys, a CAK that secures control plane traffic and a randomly generated SAK that secures data plane traffic, are used to secure the point-to-point or point-to-multipoint Ethernet link. Both keys are regularly exchanged between both devices at each end of the Ethernet link to ensure link security.

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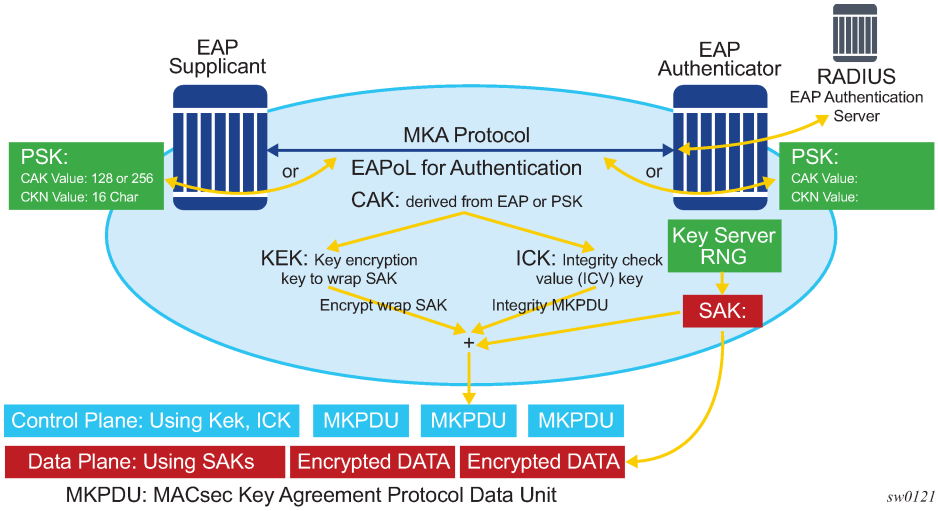
The following figure shows MACsec generating the CAK.

Figure 27: MACsec generating the CAK



The node initially needs to secure the control plane communication to distribute the SAKs between two or more members of a CA domain.

The CAK is used to secure the control plane. There are two main methods to generate the CAK:

- using EAPOL (the 7705 SAR does not support this method)
- using a pre-shared key, where CAK and connectivity association key name (CKN) values are configured manually using the CLI. The following CAK and CKN rules apply:
  - The CAK has 32 hexadecimal characters for a 128-bit key and 64 hexadecimal characters for a 256-bit key depending on which algorithm is used for control plane encryption (for example, **aes-128-cmac** or **aes-256-cmac**).
  - The CKN has 32 octets (64 hexadecimal characters) and is the connectivity association key name that identifies the CAK. This allows each of the MKA participants to select which CAK to use to process a received MKPDU. The MKA places no restrictions on the format of the CKN, except that it must comprise an integral number of octets between 1 and 32 (inclusive) and all potential members of the CA must use the same CKN.
  - the CKN and CAK must match on peers to create a MACsec secure CA.

The following figure shows the MACsec control plane authentication and encryption.

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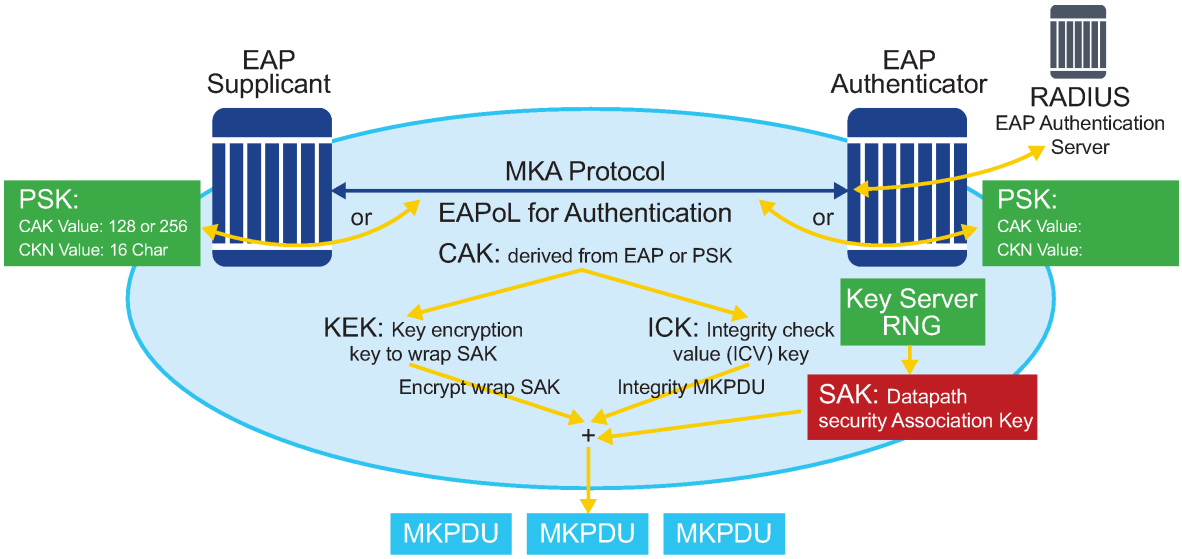
Figure 28: MACsec control plane and encryption



MKPDU: MACsec Key Agreement Protocol Data Unit

sw0122

A generated CAK can obtain the following additional keys:

- a key encryption key (KEK), used to wrap and encrypt the SAKs
- an integrity connection value (ICV) key (ICK), used for an integrity check of each MKPDU sent between two CAs

The key server then creates a SAK, which is shared with the CAs of the security domain, and that SAK secures all data traffic traversing the link. The key server continues to periodically create and share a randomly created SAK over the point-to-point link for as long as MACsec is enabled.

The SAK is encrypted via the AES-CMAC, using the KEK as the encryption key and the ICK as the integration key.

3.5.6 SAK rollover

The 7705 SAR regenerates the SAK after the following events:

- when a new host has joined the CA domain and MKA hellos are received from this host
- when the sliding window is reaching the end of its 32-bit or 64-bit length
- when a new PSK is configured and a rollover of PSK is executed

3.5.7 MKA

Each MACsec peer operates the MACsec key agreement (MKA). Each node can operate multiple MKAs based on the number of CAs the node belongs to. Each MKA instance is protected by a distinct secure CAK, which allows each port authentication entity (PAE) to ensure that information for an MKA instance is only accepted from other peers that also possess that CAK, identifying the peers as members or potential

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members of the same CA. See MACsec static CAK for information about the CAK identification process performed via the CKN.

Note: For an MKA session to establish, the MTU configured in the network must be as large or larger than the size of the MACsec control plane signaling messages. The size of these signaling messages depends on a number of factors, such as the number of peers and the cipher suite selected.

3.5.7.1 MKAPDU generation

The following table describes the MKAPDUs generated for different traffic encapsulation matches.

Table 29: MKAPDU generation

Configuration	Configuration example (<s-tag>.<c-tag>)	MKA packet generation	Traffic pattern match/behavior
All-encap	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match all-encap ca-name 10**	Untagged MKA packet	Matches all traffic on port, including untagged, single-tag, and double-tag (default behavior)
Untagged	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match untagged ca-name 2**	Untagged MKA packet	Matches only untagged traffic on port
802.1Q single S-TAG (specific S-TAG)	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match single-tag 1 ca-name 3**	MKA packet generated with S-TAG=1	Matches only single-tag traffic on port with tag ID of 1
802.1Q single S-TAG (any S-TAG)	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match single-tag * ca-name 4**	Untagged MKA packet	Matches any dot1q single-tag traffic on port
802.1ad double tag (both tags have specific TAGs)	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match double-tag 1.1 ca-name 4**	MKA packet generated with S-TAG=1 and C-TAG=1	Matches only double-tag traffic on port with service tag of 1 and customer tag of 1
802.1ad double tag (specific S-TAG, any C-TAG)	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match double-tag 1.* ca-name 7**	MKA packet generated with S-TAG=1	Matches only double-tag traffic on port with service tag of 1 and customer tag of any
802.1ad double tag (any S-TAG, any C-TAG)	**config>port>ethernet>dot1x.macsec>sub-port 10>encap-match double-tag *.* ca-name 8**	Untagged MKA packet	Matches any double-tag traffic on port

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3.5.7.2 Tags in clear text behavior by traffic encapsulation type

The following table describes how single or double tags in clear text configuration under a connectivity association affect different traffic flow encryptions.

By default, all tags are encrypted in a CA. An MKA can be generated without any tags (untagged), but the data being matched can be based on dot1q or QinQ.

Table 30: Behavior of tags in clear text

Configuration	Traffic pattern match/behavior	Subport CA configuration: no tag in clear text	Subport CA configuration: single-tag in clear text	Subport CA configuration: double-tag in clear text
All-encap	Matches all traffic on port, including untagged, single-tag, double-tag	MKAPDU: untagged Untagged traffic: encrypted Single-tag traffic: encrypted, no tag in clear Double-tag traffic: encrypted, no tag in clear	MKAPDU: untagged Untagged traffic: in clear Single-tag traffic: encrypted, single-tag in clear Double-tag traffic: encrypted, single-tag in clear	MKAPDU: untagged Untagged traffic: in clear Single-tag traffic: in clear Double-tag traffic: encrypted, double-tag in clear
Untagged	Matches only untagged traffic on port	MKAPDU: untagged Untagged traffic: encrypted Single-tag traffic: not matched by this MACsec policy Double-tag traffic: not matched by this MACsec policy	N/A	N/A
802.1Q single tag (specific tag)	Matches only single-tag traffic on port with the configured tag value	MKAPDU: untagged Untagged traffic: not matched by this MACsec policy Single-tag traffic: tag is encrypted Double-tag traffic: not matched by this MACsec policy	MKAPDU: same tag as the one configured under **encap-match** Untagged traffic: not matched by this MACsec policy Single-tag traffic: tag is in clear Double-tag traffic: not matched by this MACsec policy	N/A

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Configuration	Traffic pattern match/behavior	Subport CA configuration: no tag in clear text	Subport CA configuration: single-tag in clear text	Subport CA configuration: double-tag in clear text
802.1Q single tag (any tag)	Matches all single-tag traffic on port	MKAPDU: untagged Untagged traffic: not matched by this MACsec policy Single-tag traffic: encrypted Double-tag traffic: not matched by this MACsec policy	MKAPDU: untagged Untagged traffic: not matched by this MACsec policy Single-tag traffic: encrypted with single tag in clear Double-tag traffic: not matched by this MACsec policy	N/A
802.1ad double tag (both tags have specific values)	Matches only double-tag traffic on port with both configured tag values	MKAPDU: untagged Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic matching both configured tags: encrypted, no tag in clear	MKAPDU: single tag, equal to S-TAG Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic matching both configured tags: single S-TAG in clear	MKAPDU: double tag, equal to the values configured under **encap-match** Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic matching both configured tags: encrypted, both tags in clear
802.1ad double tag (specific S-TAG, any C-TAG)	Matches only double-tag traffic on port with the configured S-TAG	MKAPDU: untagged Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic matching the configured S-TAG: encrypted, no tag in clear	MKAPDU: single tag, equal to S-TAG Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic matching the configured S-TAG: S-TAG tag in clear	MKAPDU: single tag, equal to S-TAG Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic matching the configured S-TAG: both tags in clear
802.1ad double tag (any S-TAG, any C-TAG	Matches all double-tag traffic on port	MKAPDU: untagged	MKAPDU: untagged	MKAPDU: untagged

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Configuration	Traffic pattern match/behavior	Subport CA configuration: no tag in clear text	Subport CA configuration: single-tag in clear text	Subport CA configuration: double-tag in clear text
		Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic: encrypted, no tag in clear	Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic: S-TAG tag in clear	Untagged traffic: not matched by this MACsec policy Single-tag traffic: not matched by this MACsec policy Double-tag traffic: both tags in clear

3.5.8 Pre-shared key

MKA protects the integrity of MKPDUs and secures the SAK using keys that are derived from the CAK. The CAK and CKN are configured as part of a pre-shared key (PSK) entry under the static CAK configuration.

The 7705 SAR supports the following methods for configuring a static CAK:

- Active PSK index
- Keychain

Active PSK and MACsec keychain configurations do not operate simultaneously. When a keychain is configured, it takes precedence over the active PSK configuration. When a keychain is not configured, the active PSK is used.

3.5.8.1 Active PSK index

With an active PSK, a peer can support the use of one or more PSK entries identified by indexes 1 and 2. An instance of MKA operates for each PSK that is administratively configured as active.

A PSK can be created manually using the CLI.

Each PSK is configured with the following fields:

- CKN
- CAK value

The CKN must be unique per port among the configured subports and can be used to identify the key in subsequent management operations.

Each static CAK configuration can have two PSK entries for rollover. The active PSK index dictates the CAK that is used for encrypting the MKAPDUs. This method uses a single MKA session. Each time the active PSK is rotated, the CKN and the derived keys are replaced for the same MKA session. A new PSK does not instantiate a new MKA session.

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3.5.8.2 Keychain

With a keychain, up to 64 PSK entries (keys) can be configured. Each PSK creates a new dedicated MKA session, active for the duration of the key lifetime plus the configured tolerance.

The 7705 SAR can use the keychain for MACsec PSK rotation. A new MACsec container holds the keychain's key entries, where the PSK CAK and CKN values can be configured as hexadecimal characters. A keychain contains multiple key entries. Each entry is activated at its begin time; it remains valid up to the begin time of the next key entry, plus its own tolerance time.

A MACsec keychain supports the same ciphers as an active PSK. The **aes-128-cmac** and **aes-256-cmac** ciphers can be configured per keychain key entry for MACsec.

When a keychain is configured with a MACsec key entry, other key entry types, such as bidirectional, received, or send, can no longer be added to the keychain. All MACsec key entries in the keychain must be removed before using it for other key entry types. Conversely, when a keychain is configured with any bidirectional, received, or send key entries, MACsec key entries can no longer be added. All existing key entries in the keychain must be removed before using it for MACsec.

Only a keychain with at least one MACsec key entry can be assigned to a MACsec static CAK. When a keychain is assigned to a MACsec static CAK, deleting the MACsec key entry is rejected.

MACsec requires a unique CKN for each port. Identical CKNs are not allowed for consecutive keychain entries. Identical CKNs can be programmed on multiple keychains that are used for different MACsec ports.

For example, the following CKN configurations are not be permitted:

- Port 1/1/1, subport 1 is using keychain 1 and has one entry with CKN "1234"
- Port 1/1/1, subport 2 is using keychain 2 and also has one entry with CKN "1234"
- Port 1/1/1, subport 3 is using static CAK PSK 1 that has CKN "1234"

Note: Users must avoid configuring multiple keychains and static CAK PSKs with the same CKN on the same port.

3.5.8.2.1 Key tolerance and backup key

The MKA instance created by the first active key entry serves as the principal session from its begin time and remains functional until the end of its tolerance period. When the next key entry becomes active at its begin time, a new MKA instance is created. When the new MKA instance becomes operationally up, it becomes the principal session, and the MKA instance created by the first key entry becomes the backup session until its tolerance timer expires. If the principal session fails, the backup session takes over and becomes the principal. The switch from principal to backup session is seamless.

Unlike other applications that allow a keychain key entry tolerance of 0, MACsec requires a minimum tolerance of 20 seconds to allow time for the new MKA instance to become operationally up. If the new MKA session does not become operationally up by the time the tolerance of the first key entry expires, the MACsec sub-port becomes operationally down because neither the first nor second key entry has an operational MKA instance.

The following figure shows an example of tolerance with three key entries.

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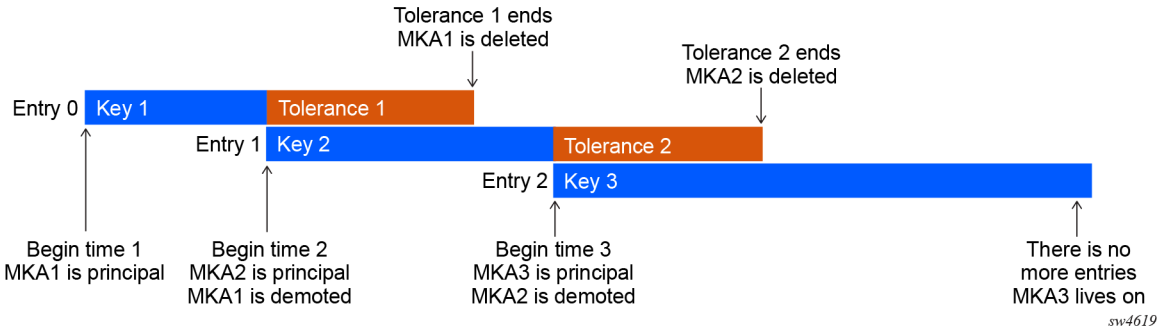
Figure 29: Tolerance with three key entries

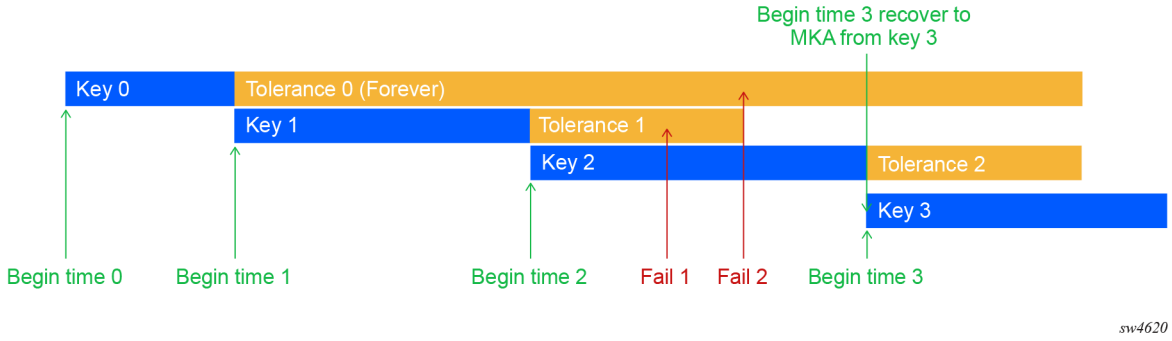


The 7705 SAR supports a maximum of three concurrent MKA sessions per sub-port at any one time, however, one of the sessions must be from key entry 0.

Key entry 0 is intended to be a permanent backup key and is the only key that can be configured with a tolerance of **forever**. This means the MKA session for Key 0 exchanges MKA hellos, but it is not intended to be the principal session.

The following figure shows an example where key 0 is a backup key with the tolerance set to forever.

Figure 30: Backup key with the tolerance set to forever



In this example:

- If the MKA session of Key 1 fails or if Key 2 fails beyond Fail 2 point and before Begin time 3, the MKA session of Key 0 takes over as the principal MKA session.
- At Fail point 1 of Key 2, the fallback is Key 1 because its tolerance has not expired.
- At Fail point 2 of Key 2, the fallback key is the Key 0 backup key entry.
- If at the end of the Key 1 Tolerance period, Key 2 has not established an MKA session (for example, Key 2 has a mismatch in its CKN between the peers), the Key 0 MKA session takes over and becomes the principal MKA session.

3.5.8.2.2 Transitioning from an active PSK to a keychain

For greenfield deployments, it is recommended that the user choose between an active PSK or a keychain for PSK rotation, as the two methods behave differently.

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Existing deployments can upgraded from an active PSK implementation by configuring a keychain on the CA's static CAK. The keychain always takes precedence over an active PSK configuration under the static CAK, even if the keychain key entries are not active or the MKA sessions for the keychain are not operationally up.

To configure a keychain, the CA must be administratively disabled first. When a CA is administratively disabled, all MKA sessions using that CA are deleted.

Active PSK configuration can be restored by administratively disabling the CA again and removing the keychain.

3.5.9 MKA Hello timer

MKA uses a member identifier (MI) for each node in the CA domain.

A participant proves liveness to each of its peers by including its MI and an acceptably recent message number (MN) in an MKPDU.

To avoid having a new participant respond to each MKPDU from each partner as it is received, or trying to delay its reply until it is likely that MI MN tuples have been received from all potential partners, each participant maintains and advertises both of the following:

- live peers list
- potential peers list

A live peers list includes all the peers that included the participant MI and a recent MN in a recent MKPDU.

A potential peers list includes all the other peers that transmitted an MKPDU that was directly received by the participant or peers that were included in the live peers list of an MKPDU transmitted by a peer that has proved liveness.

Peers are removed from each list when an interval between MKA Life Time and MKA Life Time plus MKA Hello Time has elapsed since the most recent participant MN transmission. This interval is sufficient to ensure that two or more MKPDUs have been lost or delayed prior to the incorrect removal of a live peer.

Note: The specified use of the live and potential peers lists allows for the rapid removal of participants that are no longer active or attached to the LAN while reducing the number of MKPDUs transmitted during group formation; for example, a new participant is admitted to an established group after receiving, then transmitting, one MKPDU.

The following table describes the MKA participant timer values supported on the 7705 SAR.

Table 31: MKA participant timer values

Timer use	Timer	Timeout (option) in seconds
Per participant periodic transmission, initialized for each transmission on expiry	MKA Hello Time or MKA Bounded Hello Time	2.0

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Timer use	Timer	Timeout (option) in seconds
Per peer lifetime, initialized when adding to or refreshing the potential peers list or live peers list; expiry causes removal from the list	MKA Life Time	6.0
Participant lifetime, initialized when the participant is created or following the receipt of an MKPDU; expiry causes the deletion of the participant		
Delay after last distributing a SAK, before the Key Server distributes a fresh SAK following a change in the live peers list while the potential peers list is still not empty		

3.5.10 MACsec capability and encryption offset

The IEEE 802.1x-2010 standard identifies the following fields in the MKAPDU:

- MACsec capability
- desired

MACsec capability signals whether MACsec is capable of integrity and confidentiality. The following table describes the basic settings for MACsec capability.

Table 32: MACsec capability settings

Setting	Description
0	MACsec is not implemented
1	Integrity without confidentiality
2	The following are supported: • integrity without confidentiality • integrity and confidentiality with a confidentiality offset of 0
3	The following are supported: • Integrity without confidentiality • Integrity and confidentiality with a confidentiality offset of 0, 30, or 50

The 7705 SAR supports setting 3.

An encryption offset of 0, 30, or 50 starts from the byte after the SecTAG field (802.1AE header). Ideally, the encryption offset should be configured for IPv4 (offset 30) and IPv6 (offset 50) to leave the IP header in clear text. This allows routers and switches to use the IP header for LAG or ECMP hashing.

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3.5.11 Key server

The participants in an MKA instance agree on a key server and are responsible for the following:

- deciding on the use of MACsec
- cipher suite selection
- SAK generation and distribution
- SA assignment
- identifying the CA when two or more CAs merge

Each participant in an MKA instance uses the key server priority (an 8-bit integer) encoded in each MKPDU to agree on the key server. Each participant selects the live participant advertising the highest priority as its key server whenever the live peers list changes, unless the highest-priority participant has selected another participant as its key server or is unwilling to act as the key server. If a key server cannot be selected, SAKs are not distributed. In the event of a tie for the highest-priority key server, the member with the highest-priority SCI is chosen. For consistency with other uses of the SCI MAC address component as a priority, numerically lower values of the key server priority and SCI are afforded the highest priority.

Note: Each SC is identified by an SCI that comprises a globally unique MAC address and a port identifier unique within the system that is allocated that address.

3.5.12 SA limits and network design

MACsec is supported on the 6-port Ethernet 10Gbps Adapter card, version 2. The card has two MACsec PHY devices, referred to as MACsec security zones.

In accordance with the IEEE 802.1AE standard, each SecY contains a security channel (SC), which is a unidirectional concept; for example, Rx-SC or Tx-SC. Each SC contains at least one SA for encryption on Tx-SC and decryption on Rx-SC. For extra security, each SC should be able to roll over the SA. The system allocates resources for two SAs on each SC for rollover purposes, as defined in the standard. An SA is the key to encrypt or decrypt the data.

On the 6-port Ethernet 10Gbps Adapter card, version 2, one MACsec PHY device has ports 1, 2, 3, and 4. Each port is mapped to its own security zone: port 1 maps to security zone 1, port 2 maps to security zone 2, port 3 maps to security zone 3, and port 4 maps to security zone 4. Each port, and therefore each zone, supports 8 Tx-SCs and 8 Rx-SCs, resulting in 16 Tx-SAs and 16 Rx-SAs.

The other MACsec PHY device on the 6-port Ethernet 10Gbps Adapter card, version 2 has ports 5 and 6. Ports 5 and 6 both map to security zone 5. Security zone 5 supports 32 Tx-SCs and 32 Rx-SCs, resulting in 64 Tx-SAs and 64 Rx-SAs. Each port in security zone 5 is limited to a maximum of 32 Tx-SCs and 32 Rx-SCs.

3.5.13 Point-to-point (switch-to-switch) topology

In a point-to-point topology, each router needs a single security zone and single Tx-SC for encryption and a single Rx-SC for decryption. Each SC has two SAs. In total for a point-to-point topology, four SAs are needed: two Rx-SAs for Rx-SC1 and two Tx-SAs for Tx-SC1. The following figure shows the point-to-point topology.

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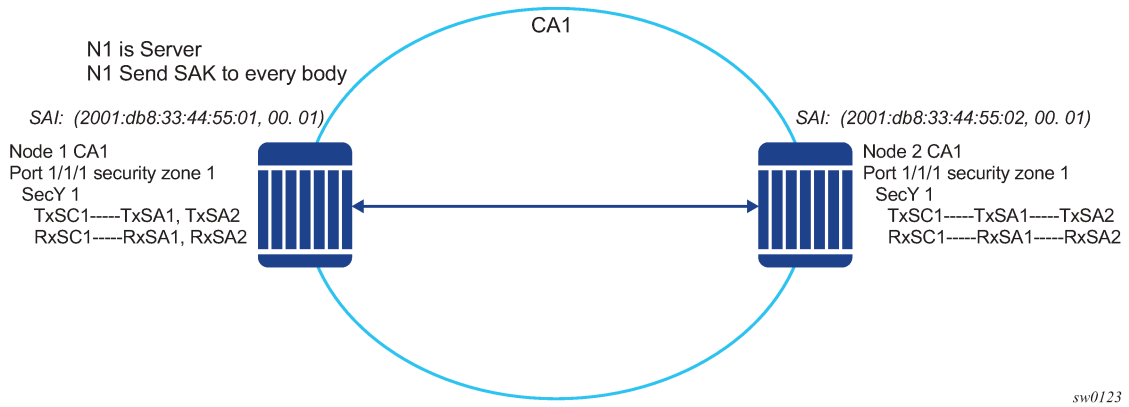
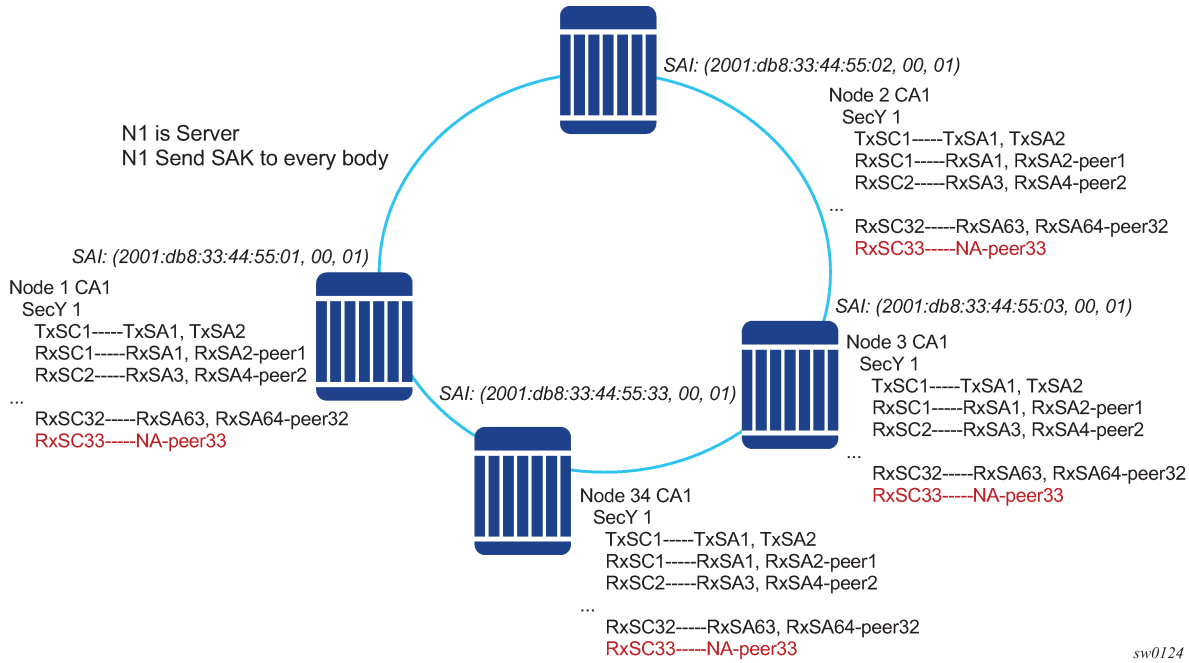
Figure 31: Switch point-to-switch point topology



3.5.14 Point-to-multipoint (switch-to-switch) topology

In a multipoint topology with *N* nodes, each node needs a single Tx-SC and *N* Rx-SCs, one for each of the peers. For example, 64 Rx-SAs per security zone translates to 32 Rx-SCs, which breaks down to only 32 peers (only 33 nodes in the multipoint topology per security zone, where each node has one Tx-SC and 32 Rx-SCs).

Figure 32: Switch multipoint-to-switch multipoint topology



In the preceding figure, when the 34th node joins the multipoint topology, the other 33 nodes that are already part of this domain do not have SAs to create an Rx-SC for this 34th node. However, the 34th node has a Tx-SC and accepts 32 peers. The 34th node starts to transmit and encrypt the PDUs based on its Tx-SC but, because the other nodes do not have an SC for this SAI, they drop all Rx PDUs.

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To ensure that a multicast domain for a single security zone does not exceed 32 peers or the total of all the nodes in a security zone CA domain, Nokia recommends not exceeding 33 nodes. This is the same as if a security zone has four CAs; the total of all nodes in the four CAs must be 33 or less.

3.5.15 SA exhaustion behavior

Security zones 1 through 4 each have 16 Rx-SAs and 16 Tx-SAs and security zone 5 has 64 Rx-SAs and 64 Tx-SAs; see SA limits and network design for information. Two Rx-SAs are used for each Rx-SC for rollover purposes, and two Tx-SAs are used for each Tx-SC for rollover purposes. Security zones 1 through 4 are each allowed a maximum of 8 peers. A maximum of 32 peers is allowed in security zone 5.

Under each port, it is possible to assign the number of peers allowed on that port using the **config>port>ethernet>dot1x>macsec>sub-port>max-peer** command.

Caution: Nokia strongly recommends ensuring that the maximum peer value configured with the **max-peer** command does not exceed the maximum number of peers allowed per security zone or per port. Peers join the CA randomly on a first-come, first-served basis. If the maximum number of peers is exceeded, the peer connectivity may be random in the event of a node failure or packet loss.

3.5.16 Clear tag mode

In most Layer 2 networks, MAC forwarding is performed using the destination MAC address. According to the 802.1AE standard, any field after the source and destination MAC addresses and after the SecTAG must be encrypted. This includes the 802.1Q tags. However, some VLAN switching networks may require the 802.1Q tag to be in clear text.

On the 7705 SAR, it is possible to configure 802.1Q tags in clear text by placing them before the SecTAG or to configure the 802.1Q tags in encrypted text by placing them after the SecTAG.

The following table lists the MACsec encryption of 802.1Q tags when **clear-tag-mode** is configured on the 7705 SAR.

*Table 33: MACsec encryption of 802.1Q tags with **clear-tag-mode** configured*

Unencrypted format	clear-tag-mode configuration	Pre-encryption (Tx)	Pre-decryption (Rx)
Single tag (dot1q)	single-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTAG
Single tag (dot1q)	dual-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTAG
Double tag (QinQ)	single-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, SecTAG
Double tag (QinQ)	dual-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, IPID2, VID2, SecTAG

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3.5.17 802.1x tunneling and multihop MACsec

MACsec is an Ethernet packet and, as with any other Ethernet packet, can be forwarded through multiple switches using Layer 2 forwarding. The encryption and decryption of the packets is performed on 802.1x (MKA)-capable ports.

To ensure that MKA is not terminated on any intermediate switch or router, 802.1x tunneling can be enabled on the corresponding port using the **config>port>ethernet>dot1x** command. By enabling tunneling, the 802.1x MKA packets transit the port without being terminated. MKA negotiation does not occur on a port that has 802.1x tunneling enabled.

Note: If the intermediate port is enabled for both 802.1x tunneling and MACsec, MKA packets will still terminate on the node. However, if the port of the intermediate node is enabled only with 802.1x tunneling, the MKA packets will transit the node.

Use the **info** command to verify that 802.1x tunneling is enabled.

```
A:node-2>config>port>ethernet>dot1x# info
----------------------------------------------
      tunneling
```

3.5.18 EAPOL destination address

The MKA packets are transported over EAPOL with a multicast destination MAC address. If the MKA is required to have a point-to-point connection to a peer node over a Layer 2 multihop cloud, the EAPOL destination MAC address can be set to the peer MAC address. This forces the MKA to traverse multiple nodes and establish an MKA session with the specific peer.

3.5.19 Mirroring consideration

Mirroring is performed before the MACsec encryption engine. Therefore, if a port is MACsec-enabled and that port is mirrored, all the mirrored packets are in clear text.

3.5.20 MACsec and Network Group Encryption interaction

Both network group encryption (NGE) and MACsec cannot be enabled on the Ethernet port at the same time.

3.6 Link Layer Discovery Protocol

The IEEE 802.1ab Link Layer Discovery Protocol (LLDP) allows stations that are attached to the same IEEE 802 LAN (emulation) to advertise information for the purpose of populating physical or logical topology and device discovery management information databases. In other words, IEEE 802.1ab LLDP allows an LLDP agent to learn connectivity and management information from adjacent stations. The information obtained via this protocol is stored in standard MIBs which can be accessed via management protocols such as SNMP.

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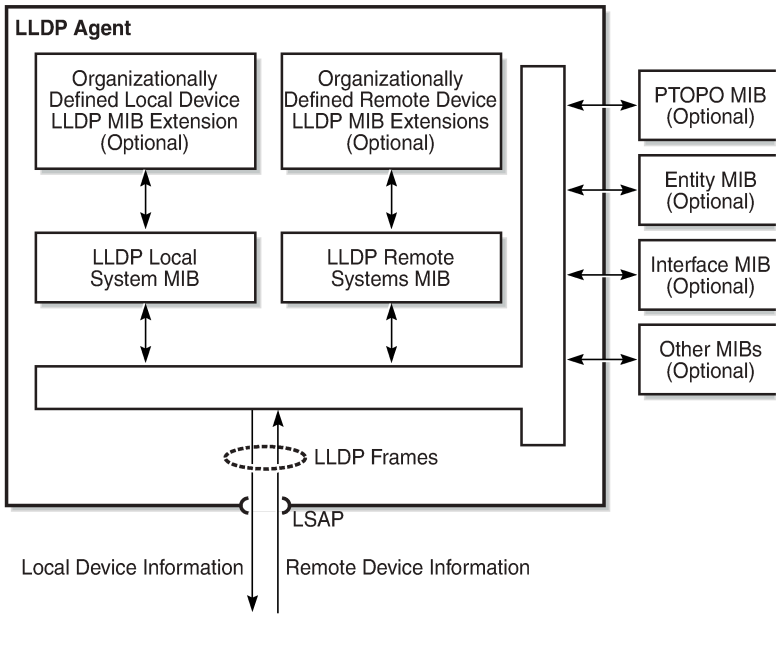
LAN emulation and logical topology is applicable to customer bridge scenarios (enterprise or carrier of carrier) connected to a provider network offering a transparent LAN emulation service to their customers. LAN emulation helps customers detect intermediate provider misconnections by offering a view of the customer topology where the provider service is represented as a LAN interconnecting customer bridges.

The IEEE 802.1ab standard defines a protocol that:

- advertises connectivity and management information about the local station to adjacent stations on the same IEEE 802 LAN
- receives network management information from adjacent stations on the same IEEE 802 LAN
- operates with all IEEE 802 access protocols and network media
- establishes a network management information schema and object definitions that are suitable for storing connection information about adjacent stations
- provides compatibility with a number of MIBs as shown in the following figure

Figure 33: LLDP internal architecture for a network node



Network operators must be able to discover the topology information in order to detect and address network problems and inconsistencies in the configuration. Standards-based tools can address complex network scenarios where multiple devices from different vendors are interconnected using Ethernet interfaces.

The 7705 SAR platforms, cards, and modules support LLDP on all Ethernet datapath ports. On the 2-port 10GigE (Ethernet) Adapter card/module, LLDP is supported on the Ethernet ports, but not on the v-port. Each Ethernet port can be configured to run up to three LLDP sessions. Each session can have up to five peers and each peer can store up to three management addresses. The 7705 SAR can have a maximum of 720 peers configured.

The following figure shows the three scopes of LLDP that are supported on the 7705 SAR. The scopes are Nearest Bridge, Nearest non-TPMR Bridge, and Nearest Customer Bridge.

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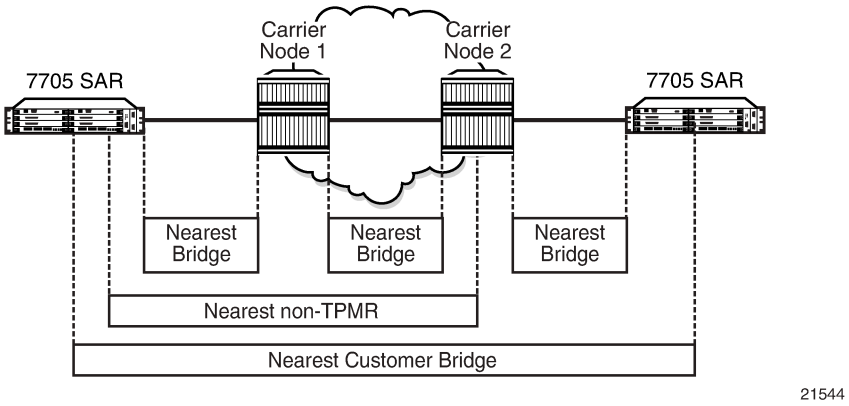
Figure 34: Network example for LLDP



3.6.1 LLDP protocol features

LLDP allows stations attached to an IEEE 802 LAN to advertise to other stations attached to the same LAN, the major capabilities provided by the system incorporating that station, the management address or addresses of the entity or entities that manage these capabilities, and the identification of the station's point of attachment to the LAN required by the management entity or entities.

The information distributed via this protocol is stored on the receiving device in a standard MIB, so that the information can be accessed by a Network Management System (NMS).

The LLDP protocol uses an LLDP agent entity that implements LLDP for a particular MAC service access point (MSAP) associated with a port.

LLDP does not contain a mechanism for soliciting specific information from other LLDP agents, nor does it provide a specific means of confirming the receipt of information. LLDP allows the transmitter and the receiver to be enabled separately; therefore, the local LLDP agent can be configured to transmit only, receive only, or both transmit and receive LLDP information.

LLDP agents transmit and receive LLDP data units (LLDPDUs). The LLDPDU contains an LLDP frame whose information fields are a sequence of variable-length information elements. Each element includes type, length, and value fields (known as TLVs):

- type identifies what kind of information is being sent
- length indicates the length of the information string in octets
- value is the actual information that needs to be sent; for example, a binary bit map or an alphanumeric string that can contain one or more fields

Each LLDPDU contains four mandatory TLVs and can contain optional TLVs as selected by network management. The following figure shows the LLDPDU format.

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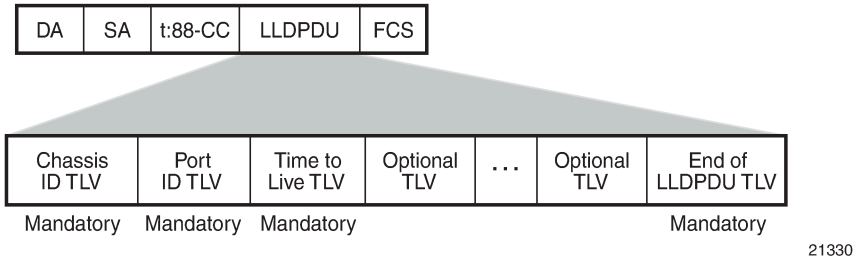
Figure 35: LLDPDU format



The chassis ID TLV identifies the chassis containing the Ethernet port responsible for transmitting the LLDPDU. The port ID TLV identifies the Ethernet port responsible for transmitting the LLDPDU. The chassis ID and the port ID values are concatenated to form a logical identifier (the MSAP identifier) that is used by the recipient to identify the sending LLDP agent and associated port. Both the chassis ID and port ID values can be defined in a number of ways. Once selected, however, the chassis ID and port ID value combination remains the same as long as the particular port remains operable.

The Time To Live TLV indicates the number of seconds (from 0 to 65535) that the receiving LLDP agent should consider the information contained in the received LLDPDU to be valid. The Time To Live TLV is calculated by the formula **tx-interval** × **tx-hold-multiplier.** The associated information is automatically discarded by the receiving LLDP agent if the sender fails to update it before this time. A zero value indicates that any information pertaining to this LLDPDU identifier is to be discarded immediately. A TTL value of zero can be used, for example, to signal that the sending port has initiated a port shutdown procedure.

The End of LLDPDU TLV marks the end of the LLDPDU.

The implementation defaults to setting the port-id field in the LLDP OAMPDU to **tx-local**. This encodes the port-id field as ifindex (subtype 7) of the associated port, which is required to support some releases of the NSP NFM-P. The NSP NFM-P may use the ifindex value to properly build the Layer 2 topology network map. However, this numerical value is difficult to interpret or readily identify the LLDP peer when reading the CLI or MIB value without using the NSP NFM-P. Including the **port-desc** option as part of the **tx-tlv** configuration allows a Nokia remote peer supporting **port-desc** preferred display logic to display the value in the port description TLV instead of the port-id field value. This does not change the encoding of the port-id field. The port-id field value continues to represent the ifindex. In some environments, it may be important to select the specific port information that is carried in the port-id field. The operator has the ability to control the encoding of the port-id information and the associated subtype using the **port-id-subtype** option. Three options are supported for the **port-id-subtype**:

- **tx-if-alias** – transmits the ifAlias string (subtype 1) that describes the port as stored in the IF-MIB, either a user-configured description or the default entry (that is, 10/100/Gig Ethernet SFP)
- **tx-if-name** – transmits the ifName string (subtype 5) that describes the port as stored in the IF-MIB, ifName information
- **tx-local** – the interface ifindex value (subtype 7)

IPv6 (address subtype 2) and IPv4 (address subtype 1) LLDP system management addresses are supported.

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3.7 Supervisory control and data acquisition support

Supervisory control and data acquisition (SCADA) systems are used in many strategic industry networks, such as utility and transportation, to monitor and maintain the networks from remote monitoring locations. SCADA systems use a master/slave architecture with a single master that supports multiple slave remote terminal units (RTUs).

Nokia addresses the needs of SCADA customers with the Integrated Services card. The Integrated Services card is a resource card that is capable of supporting software applications that specifically meet the requirements of TDM-based SCADA systems. The card is supported on the 7705 SAR-8 Shelf V2 and the 7705 SAR-18.

The Integrated Services card supports the following SCADA applications:

- multidrop data bridge (MDDB)
- pulse code modulation (PCM) multidrop bridge
- voice conference bridge (VCB)

Only one application can be active on the card at a time.

The MDDB and PCM multidrop bridge applications feature similar architecture and functionality, with the main exception being that the MDDB application uses a serial RS-232, RS-530, or X.21 interface, while the PCM multidrop bridge application uses an E&M analog interface. The VCB application builds on the PCM architecture, using A-Law or Mu-Law encoding and an E&M analog interface.

3.7.1 Multidrop data bridge

The MDDB application provides a centralized digital bridging functionality that allows a SCADA bridge to be configured between a master and remote slaves. The bridge allows a single data message stream to be broadcast from a master to multiple slaves and allows a single slave to communicate back to the master.

In a SCADA network, the 7705 SAR provides the communications infrastructure to connect the central masters to multiple RTUs at remote locations, where the masters and RTUs communicate over serial RS-232, RS-530, or X.21 links (synchronous or asynchronous). The 7705 SAR-8 Shelf V2 or 7705 SAR-18 located at the master site contains the Integrated Services card, which provides the MDDB bridge functionality and acts as the MDDB master. Remote 7705 SAR nodes connected to RTUs are referred to as MDDB slaves.

For both master and slave applications, the 7705 SAR must be physically connected to the SCADA device by one of the following:

- a 7705 SAR-8 Shelf V2 or 7705 SAR-18 using the 12-port Serial Data Interface card (supports RS-232, RS-530, and X.21 links)
- a 7705 SAR-H using the 4-port T1/E1 and RS-232 Combination module (supports RS-232 links only)
- a 7705 SAR-Hc using an on-board RS-232 serial port (supports RS-232 links only)

The 12-port Serial Data Interface card, version 2, supports the RS-530/RS-422 interface with the use of an adapter cable that connects to a DB15 connector on the front of the X.21 distribution panel. There is no configuration specifically for the RS-530/RS-422 interface; configuration is done in X.21 mode and applies to the RS-530/RS-422 interface when it is physically enabled through hardware. The 12-port Serial Data Interface card, version 3, provides RS-530 interface capability without the need for an adapter cable.

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For information about 12-port Serial Data Interface card adapter cables, see the 7705 SAR Serial Data Interface Card Installation Guide.

The remote nodes are connected to the SCADA bridge over an IP/MPLS network.

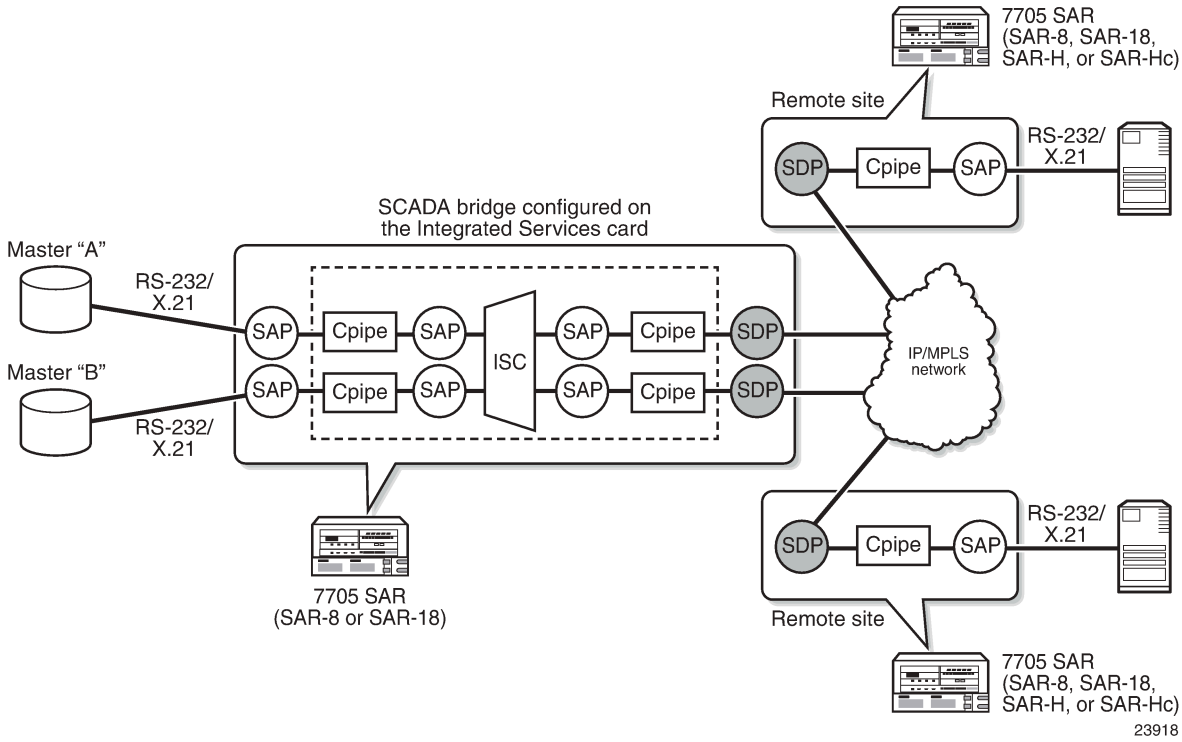
An Integrated Services card supports up to 16 SCADA bridges. Each bridge supports 32 branches. Two branches (branch 1 and branch 2) are dedicated connections to the SCADA masters; the other 30 branches connect to the slaves. An MDDB SCADA bridge is created using the **config>scada** *bridge-id* command and a branch is created using the **config>scada>branch** *branch-id* command.

Note:

- Larger bridges can be built by cascading individual bridges internally within a single Integrated Services card and using the master output from one bridge as the slave input to another bridge. Larger bridges can be cascaded across multiple Integrated Services cards by using an RS-232, RS-530, or X.21 link.
- Although the parameters for **control-lead** can be configured, they are not meaningful for MDDB SCADA bridges. Only data traffic is allowed between the master and the RTU sites.

The following figure shows a typical SCADA MDDB network. A Cpipe SAP is configured for each master and slave branch in order to transmit data to the bridge. The RS-232/X.21 traffic is converted to a 64 kb/s Cpipe using high capacity multiplexing (HCM). The Integrated Services card terminates the Cpipe (the slaves send data back over the IP/MPLS network), recovers the data directly from the Cpipe as an HCM frame, and sends the data to the bridge.

Figure 36: SCADA MDDB network



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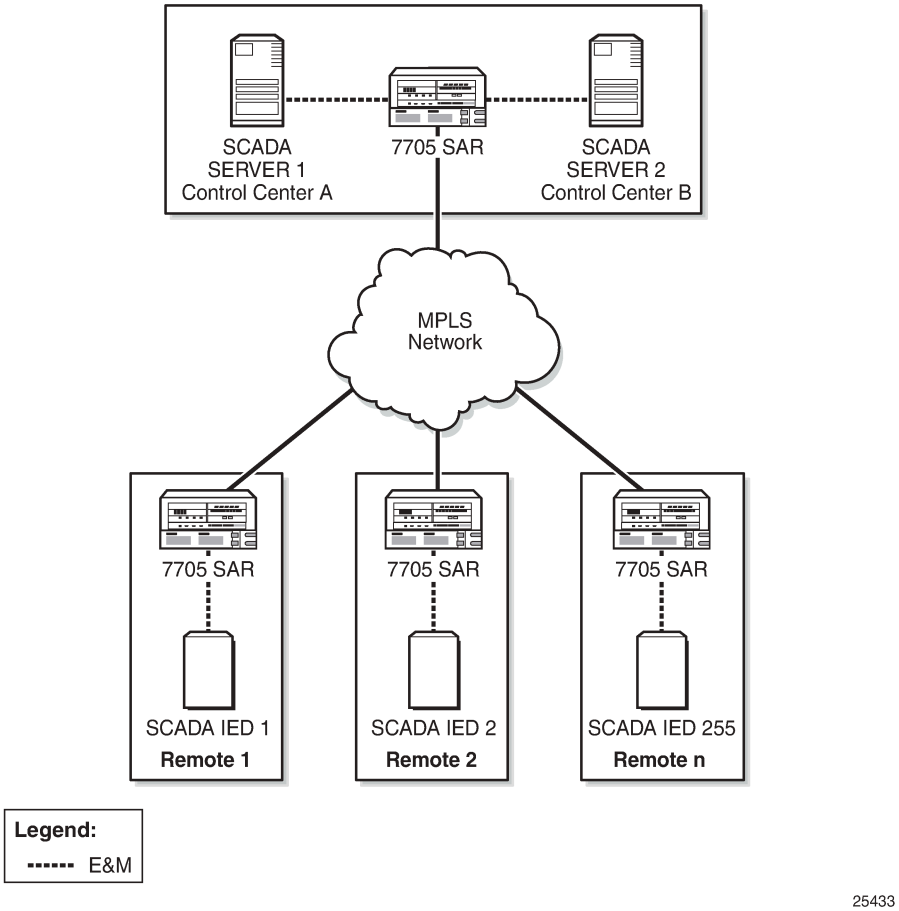
3.7.2 PCM multidrop bridge

The pulse code modulation (PCM) multidrop bridge application provides multidrop bridging for SCADA systems that use 4-wire analog modems to connect remote slaves to a master. Incoming analog signals from the master are converted to PCM (Mu-Law or A-Law) for transport between a remote slave and the master. The Integrated Services card broadcasts the master stream to all remote slaves. Only the addressed remote unit will respond to the broadcast and the response must be transported through the bridge back to the master via an E&M interface. If the network RTUs support two SCADA systems over the same interface by separating them into high-frequency and low-frequency bands, the PCM multidrop bridge always selects the two loudest branches to be passed through the bridge for communication with the master.

Note: E&M signaling transport through the bridge is not supported.

The following figure shows a typical SCADA PCM multidrop bridge network.

Figure 37: SCADA PCM multidrop bridge network



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The PCM multidrop bridge application uses Mu-Law and A-Law encoding; therefore, the modularity is different from MDDB modularity. The following table shows the modularity for a PCM multidrop bridge on the Integrated Services card.

Table 34: PCM multidrop bridge modularity

Encoding scheme	Number of bridges per Integrated Services card	Number of branches per bridge	Total number of branches per Integrated Services card
Mu-Law (North America)	16	22	352
A-Law (rest of world)	16	30	480

A PCM SCADA bridge is created using the **config>scada** *bridge-id* command and a branch is created using the **config>scada>branch** *branch-id* command.

Note: Larger bridges can be built by cascading individual bridges internally within a single Integrated Services card and using the master output from one bridge as the slave input to another bridge. Larger bridges can be cascaded across multiple Integrated Services cards by using an E&M link.

3.7.3 Redundant masters

The MDDB and PCM multidrop bridge applications support redundant masters, where both masters listen to all traffic that is being transmitted from the slaves but only the active master broadcasts data to the slaves.

There are two modes for master redundancy:

- **manual (default mode)**

  In manual mode, if a master branch fails, the second master branch must be made active manually with the **force-active** command in order to receive data from the master input. The bridge always broadcasts to both master branches.

- **auto**

  In auto mode, both master branch inputs are received simultaneously. This requires the master input behavior to be similar to an RTU; that is, only the active master transmits data and the standby master transmits either all 1s (MDDB) or no data (PCM). If the bridge is in auto mode, the **force-active** command cannot be used.

3.7.4 Squelch functionality

A condition may occur where a single slave continues to send data to the master after the normal response period has expired. This condition locks up the bridge so that no other slave can transmit data back to the master. To resolve this condition, the **squelch** command can be enabled on a bridge or on an individual slave or master branch. Squelch is enabled by configuring a timeout period that, once expired, raises an alarm and triggers the squelching function. A normal quiescent traffic pattern (all 1s for MDDB and low

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volume for PCM multidrop) is inserted toward the bridge. This blocks the problematic slave so that other slaves can continue to use the bridge.

In order to put the bridge into the normal state, it must be reset. This can be manually initiated by the operator with the **squelch reset** command, or it can occur automatically after a configured time if the **squelch-recovery** command is set to **auto**.

For MDDB, because different algorithms are needed to detect squelch conditions at low-speed and high-speed rates, interface speed selection is required. The interface speed is set at the bridge level.

3.7.5 Voice conference bridge

The voice conference bridge (VCB) application provides a simultaneous communication path between two or more voice circuits. VCBs are deployed in a central location with remote devices connected to the bridge via the 7705 SAR over an IP/MPLS or TDM network. Inputs to the VCB are 4-wire E&M analog interfaces.

VCBs can be used as a conference bridge with any-to-any connectivity (all branches participate) or as a bridge in broadcast mode where one branch broadcasts to the other branches that are in listen-only mode.

The main VCB applications are:

- land mobile radio (LMR) interconnection – both voice conference mode and broadcast mode can be used for this application
- analog multi-terminal teleprotection interconnect for electrical utilities – for multi-terminal teleprotection applications, VCBs allow all teleprotection relays to communicate with each other in order to make the appropriate switching decision in the event of a fault

The VCB application uses Mu-Law and A-Law encoding, similar to PCM. The following table shows the modularity for a VCB on the Integrated Services card.

Table 35: VCB modularity

Encoding scheme	Number of bridges per Integrated Services card	Number of branches per bridge	Total number of branches per Integrated Services card
Mu-Law (North America)	16	24	384
A-Law (rest of world)	16	32	512

A VCB SCADA bridge is created using the **config>scada** *bridge-id* command and a branch is created using the **config>scada>branch** *branch-id* command.

Note: Larger bridges can be built by cascading individual bridges internally within a single Integrated Services card. Larger bridges can be cascaded across multiple Integrated Services cards by using an E&M link or a channel group encapsulated for **cem** (TDM).

3.7.5.1 VCB applications

VCB can be configured in one of four applications. These applications are set at the card level. Each application uses a bridging algorithm that determines which branches control the management of the bridge and transmission of signals:

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- VCB

  One branch talks and all other branches on the bridge can hear.

- broadcast

  Only one branch on the bridge (fixed as branch 1) has control of the bridge to transmit, and all other branches are in listen-only mode.

- VCB branch initiate

  Branches on the bridge are only enabled (unmuted) when the attached base station signals its presence by grounding the M-lead on the interface connected to the bridge. Upon receiving the grounded M-lead via T1/E1 ABCD bits or TDM PW signaling, the bridge unmutes the associated branch. When the ground is removed, the branch is muted again.

- teleprotection

  Each teleprotection relay transmits state information on discrete frequencies so that each relay can both hear what the other relays are transmitting as well as transmit its own information to the other relays.

3.7.5.1.1 VCB mute output option

The 7705 SAR supports the VCB mute transmission output option on all VCB applications. By default, a branch transmission is broadcast to all other branches on the bridge. The mute output option blocks the transmission to a branch.

Each branch of the VCB has a SAP with an associated Cpipe that connects to an SDP or SAP. The operator can mute the output from a branch with the **config>service>cpipe>sap>cem>mute-output** command. When **mute-output** is enabled, nothing is transmitted out that branch of the VCB, meaning that none of the connected sites can hear the transmission.

For example, to configure a network where any remote site can initiate transmission but none of the remote sites can hear what is transmitted, only the central sites can listen, **mute-output** must be enabled on the SAPs of the branches on the Integrated Services cards at the central site toward the remote sites. Similarly, to configure a network where any central site can initiate transmission but only the remote sites can listen, **mute-output** must be enabled on the SAPs of the branches on the Integrated Services cards at the remote site toward the central sites.

The following figure shows an example where only the remote sites can listen to the transmission.

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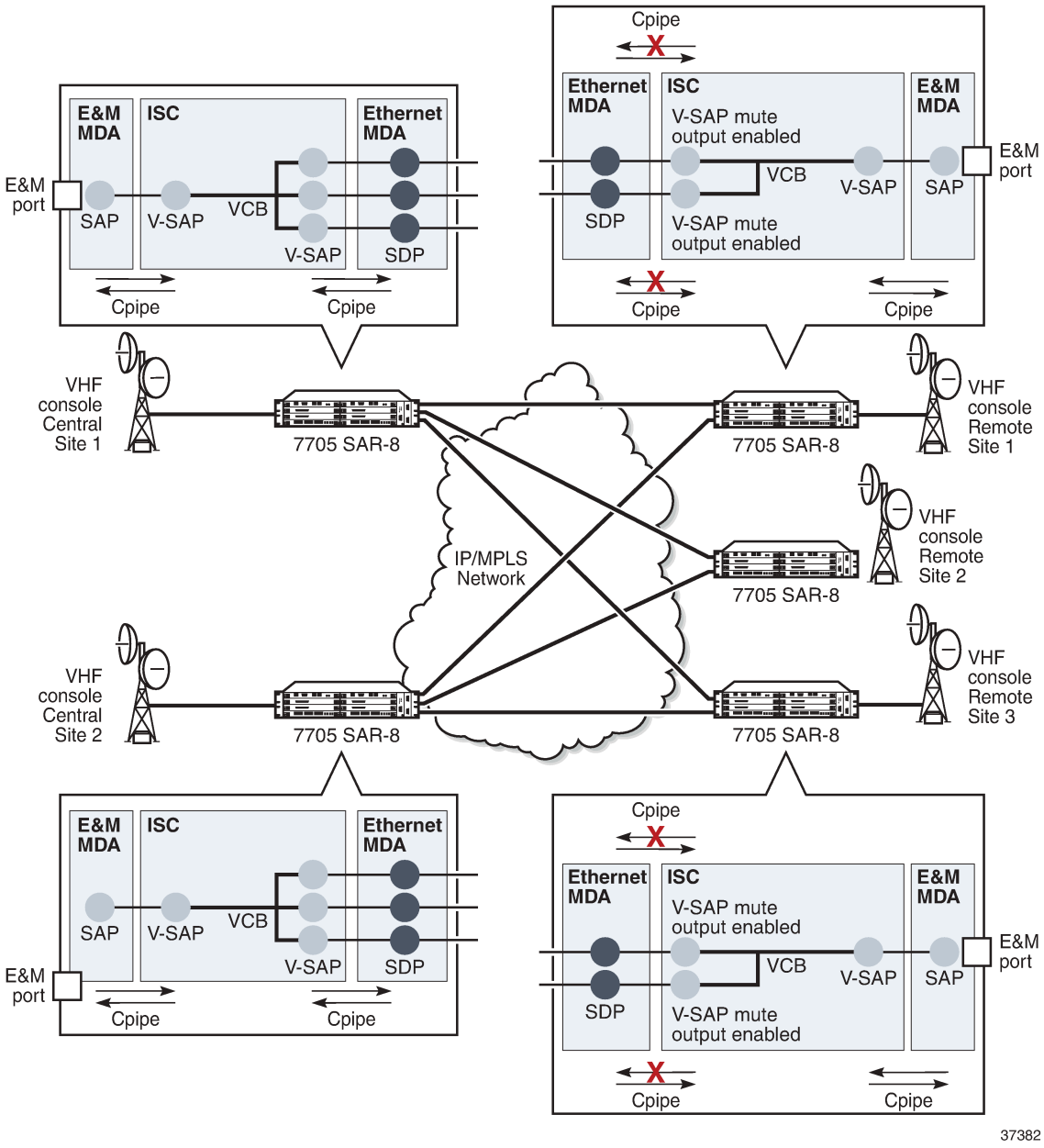
Figure 38: VCB mute output toward central sites



The following figure shows an example where only the central sites can listen to the transmission.

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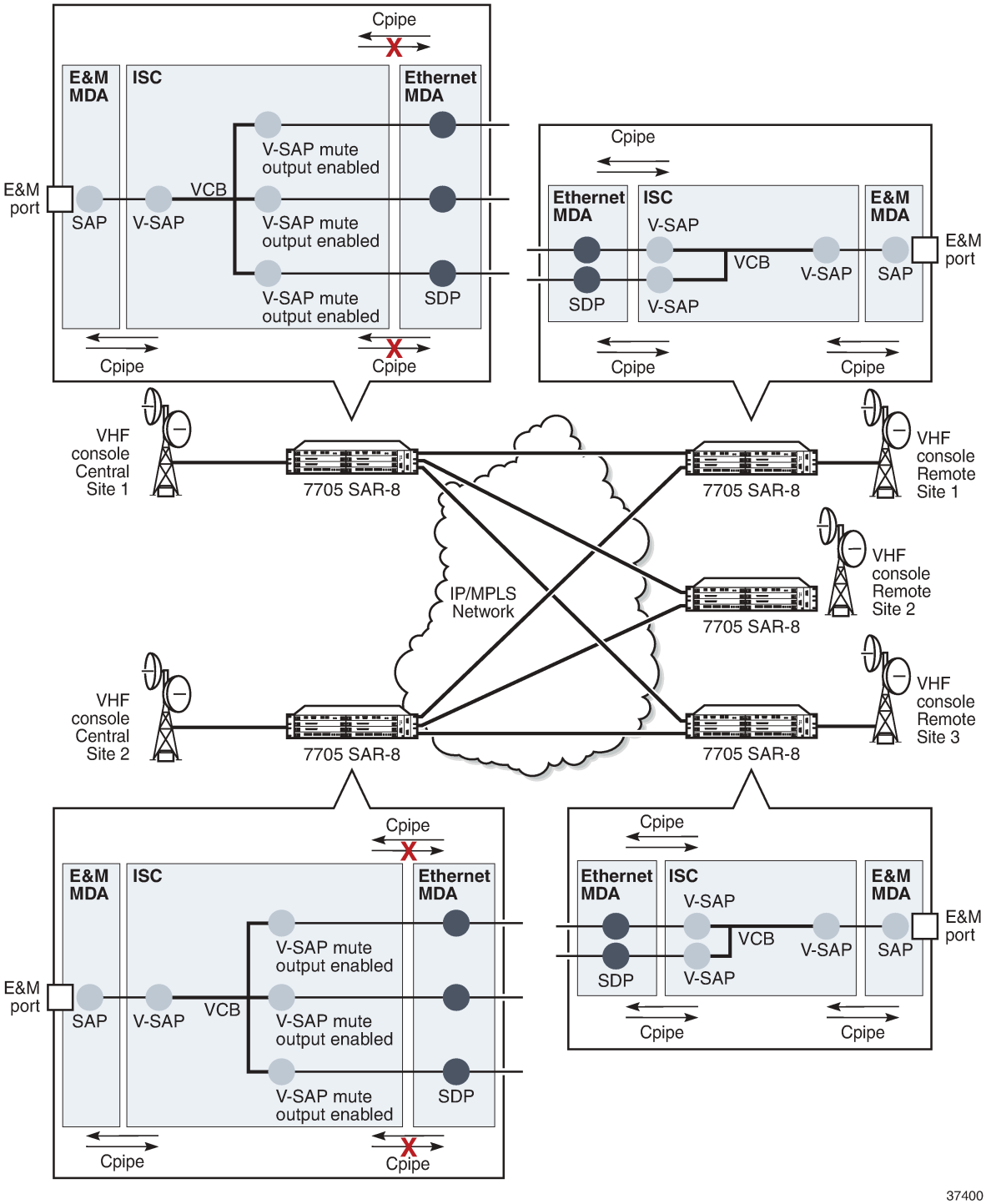
Figure 39: VCB mute output toward remote sites



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3.7.5.2 Gain

Gain is the increase or decrease in signal power or voltage that occurs in transmitting a signal from one point to another. The two types of gain are:

- input
- output

Gain is configured at the branch level.

The input gain defines the magnitude of the increase or decrease of the signal transmitted into the bridge. The input gain range is –16 to +9 dB in 1-dB increments (the default is 0 dB).

The output gain defines the magnitude of the increase or decrease of the signal received from the bridge. The output gain range is –16 to +9 dB in 1-dB increments (the default is 0 dB).

3.7.6 Serial transport over raw sockets

Serial transport over raw sockets provides the capability of transporting serial data, in the form of characters, over an IP transport service within a Layer 3 IP/MPLS service (IES or VPRN). A raw socket allows direct sending and receiving of IP packets without any protocol-specific transport layer formatting. For information about raw socket IP transport services, see the 7705 SAR Services Guide, Service Overview chapter, "Raw Socket IP Transport Service".

The feature provides the functionality for a local host to listen to and open raw socket sessions from remote hosts, and for a remote host to initiate and open raw socket sessions to local hosts. The local and remote host functions support TCP or UDP sessions (but not both concurrently) over the IP transport service.

Raw sockets are supported on the following hardware:

- RS-232 ports on the 12-port Serial Data Interface card, version 2 and version 3
- RS-232 ports on the 7705 SAR-Hc
- RS-232 ports on the 4-port T1/E1 and RS-232 Combination module

Note:

- RS-232 serial data can be carried over Cpipes or over raw sockets using IP transport. To use Cpipes, the RS-232 port must be configured with a channel ID. To use raw sockets, the RS-232 port must be configured with a socket ID.
- The 12-port Serial Data Interface card supports a mix of Cpipes and raw socket serial links on the same card.

Figure 40: Serial transport over raw socket application shows an example of a raw socket application, where serial data is transferred between RTUs and a utility's SCADA management system using an IP transport service across a Layer 3 service (IES or VPRN), that includes 7705 SAR-H or 7705 SAR-Hc and 7705 SAR-8 Shelf V2 or 7705 SAR-18 nodes.

A raw socket local host (acting as a server) at the 7705 SAR-H/SAR-Hc substation listens to TCP sessions that originate at the 7705 SAR-8 Shelf V2/SAR-18 central location network operations center (NOC). The 7705 SAR-8 Shelf V2/SAR-18 at the NOC is connected to two front-end processors (FEPs), one via a serial port and another via an Ethernet port. The serial port on the 7705 SAR-8 Shelf V2/SAR-18 is configured as a remote host (acting as a client) that initiates TCP/UDP sessions toward the RTU at the 7705 SAR-H/SAR-Hc substation when traffic is received from the FEP over the serial port. These TCP/

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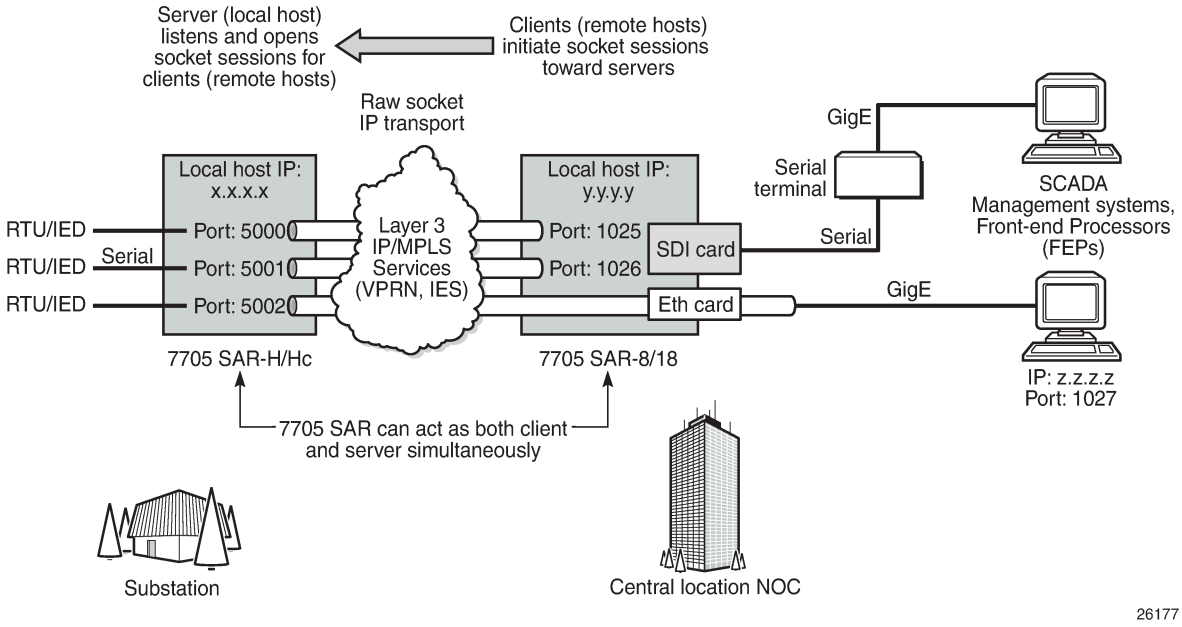
UDP sessions are transported over the IP/MPLS network using IP transport service over an IES or VPRN service. The serial data that is transported over the TCP/UDP session and received at the 7705 SAR-H/SAR-Hc is then sent over the serial link toward the RTU. TCP/UDP sessions received from the FEP over the Ethernet port are transported over an IES or VPRN service (that is, there is no need for serial remote host configuration in this case).

Multiple FEPs can poll a single RTU. If multiple sessions attempt to transmit serial data on the serial port simultaneously, the 7705 SAR queues packets per session and ensures that all data for one session is sent out before processing another session's data, ensuring that sessions do not overlap one another.

Note: A serial port can be concurrently configured as both a server (local host) and a client (remote host). This is accomplished with the **local-host** command configuration to support the server function and the **remote-host** command configuration to set up client sessions to far-end remote hosts.

Figure 40: Serial transport over raw socket application



3.7.6.1 Raw socket configuration

A raw socket IP transport interface can be configured for each RS-232 serial port on a node. This allows the serial port to receive TCP connections or UDP session packets from multiple remote hosts, or to create new sessions to remote hosts in order to send and receive serial data to and from those remote hosts.

There are port-level and service-level configuration requirements for a raw socket serial port to send and receive serial data in either server mode, client mode, or both.

Raw socket port-level configuration includes defining the end-of-packet checking parameters (idle-time, length, special character) and the inter-session delay for transmitting session data over the serial link. See Serial commands for the required information.

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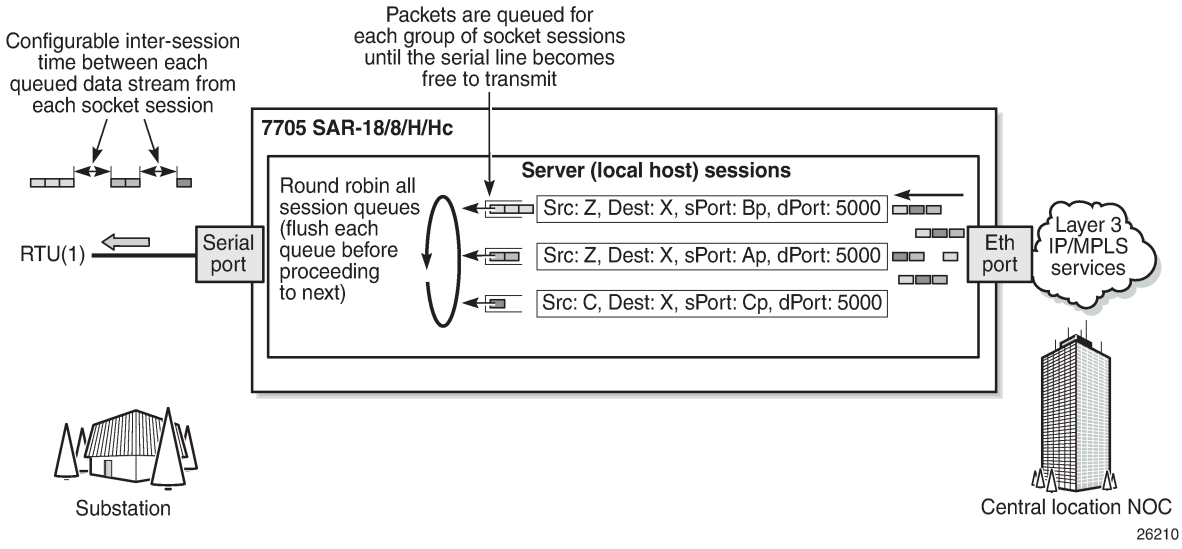
At the service level, an IP transport subservice is created within an IES or VPRN service to associate the serial port with the respective IES or VPRN service. TCP/UDP encapsulated serial data is routed within the corresponding Layer 3 IES or VPRN service. The required configuration includes IP transport subservice local-host and remote-host configuration, TCP timers, and session control. See the 7705 SAR Services Guide, "IES Raw Socket IP Transport Configuration Commands" and "VPRN Raw Socket IP Transport Configuration Commands" for the required information.

3.7.6.2 Raw socket packet processing

The following figure illustrates how raw socket packets are processed over a serial link.

Session data attempting to access the serial port is queued. One queue is maintained per session. The purpose of the session queue is to prevent two different flows of packets from interleaving out the serial port and creating unreadable messages. When data is being transmitted over the serial link for a session, any other session's data is queued until the first session has emptied its queue. The next session's data is transmitted over the serial link only after the **inter-session-delay** timer expires. Each session's data is sent out in round-robin fashion.

Figure 41: Raw socket packet processing



3.7.6.2.1 Raw socket processing for UDP sessions

When the local host receives a UDP packet from a remote host, it queues the packet and sends it over the serial link. The local host remembers the UDP session while there is still data to send from the serial link. If further packets are received for the same session, they are queued behind the already queued packet. After all the queued data has been sent over the serial link, the session is removed from the system. An associated UDP remote host for the serial link must be configured to have serial data sent back to the remote host from the serial port.

When a packet is received from the serial link based on end-of-packet (EOP) requirements, the data is copied and sent in a UDP packet to each configured remote host.

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3.7.6.2.2 Raw socket processing for TCP sessions

An open TCP session from a remote host to a raw socket's local host is kept open until either the remote host terminates the session or the TCP inactivity timer expires. When a TCP session is open, all packets received from the remote host are queued for the raw socket serial link and sent over the serial link until no packets remain in the queue.

If multiple sessions are open toward the local host, and each is receiving data, each session's data is queued and then sent over the serial link in round-robin fashion for each session until no packets remain. When a packet is received over the serial link, it is copied to each open TCP session and transmitted to the remote host.

3.7.6.3 Raw socket squelch functionality

A condition may occur where the end device connected to the serial port continues to send out a continuous stream of data after the normal response period has expired. This can prevent the far-end remote host or master equipment from receiving data from other end devices in the network. To resolve this condition, the **squelch** command can be used on the raw socket at the port level (it is disabled by default). This stops the socket from receiving any more data from the problematic device.

If the command is enabled, the 7705 SAR will monitor the serial port for a constant character stream. A configurable squelch delay period, using the **squelch-delay** command, is used to determine how long to measure the constant character stream before initiating the squelch function. If the squelch function is initiated, the port is considered locked up and an alarm is raised indicating the lock-up and that the squelching function has been triggered.

The serial port can be forced out of squelch and put back to normal, either manually using the **squelch-reset** command or automatically using the **unsquelch-delay** command. The **unsquelch-delay** command defines the time to wait after squelch is initiated before it is removed.

3.8 Configuration notes

The following is a list of provisioning guidelines and restrictions:

- The IOM can only be designated slot 1 of the chassis.
- An IOM must be preprovisioned to accept specific adapter card types; the card type is always iom-sar.

  If an adapter card type is installed in a slot provisioned for a different type, the card will not initialize.
- An adapter card installed in an unprovisioned slot remains administratively and operationally down until the IOM software is activated and the MDA slot and type is specified.
- Ports cannot be provisioned until the IOM software is activated and the MDA type is specified.

3.9 Configuring physical components with CLI

This section provides information to configure cards, adapter cards, and ports.

Topics in this section include:

- Preprovisioning guidelines

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- Basic configuration
- Common configuration tasks
- Service management tasks

3.10 Preprovisioning guidelines

The 7705 SAR platforms each have two ports on the chassis to connect terminals for management access: a console port for a terminal connection and a management port for a Telnet connection.

The console port is used to configure parameters locally through a direct connection from a system console. The management port is used to configure parameters remotely through a connection to a remote workstation, using Telnet or SSH to open a secure shell connection.

For more information about management connections, see the appropriate chassis installation guide, in the section on router management connections.

3.10.1 Preprovisioning entities

To initialize an adapter card, the IOM type and adapter card type must match the preprovisioned parameters. In this context, preprovisioning means to configure the entity type (IOM type, adapter card type, port, and interface) that is planned for an adapter card. Preprovisioned entities can be installed but not enabled, or the slots can be configured but remain empty until populated. Provisioning means that the preprovisioned entity is installed and enabled.

You can preprovision ports and interfaces after the IOM is activated (card slot and card type are designated) and adapter card types are specified.

3.10.2 Preprovisioning a port or SCADA bridge

Before a port or SCADA bridge can be configured, the adapter card slot must be preprovisioned with an allowed adapter card type (for a SCADA bridge, the only type allowed is **isc**, for the Integrated Services card).

Preprovisioning recommendations (for ports only) include:

- Ethernet
  - Configure an access port for customer-facing traffic on which services are configured.
  - Configure a network port for uplink traffic.

    An encapsulation type must be specified to distinguish services on the access port. Encapsulation types must also be specified for network ports. By default, the encapsulation type for Ethernet ports in network mode is null.
- SONET/SDH
  - SONET/SDH can be used only when configuring an OC-3 or OC-12 SONET path on an appropriate adapter card.
  - Configure a network port or channel to participate in the service provider transport or infrastructure network.

  To configure a SONET path, see Configuring SONET/SDH port parameters.

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- Channelized
  - Channelized ports can be configured on the following adapter cards and modules:
    - 16-port T1/E1 ASAP Adapter card
    - 32-port T1/E1 ASAP Adapter card
    - 2-port OC3/STM1 Channelized Adapter card
    - 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
    - 8-port Voice & Teleprotection card (access mode only)
    - 8-port C37.94 Teleprotection card (access mode only)
    - 8-port FXO Adapter card (access mode only)
    - 6-port FXS Adapter card (access mode only)
    - 4-port DS3/E3 Adapter card (DS3 ports only)
    - 12-port Serial Data Interface card (access mode only)
    - 6-port E&M Adapter card (access mode only)
    - 4-port T1/E1 and RS-232 Combination module
  - Configure an access port for customer-facing traffic on which services are configured.
  - Configure a network port for uplink traffic.

    An encapsulation type must be specified to distinguish services on the access port or channel. For network mode, the encapsulation type is set to ppp-auto and cannot be changed.

3.10.3 Maximizing bandwidth use

After ports are preprovisioned, multilink bundles (MLPPP) or IMA groups can be configured to increase the bandwidth available between two nodes.

The following cards, modules, and platforms support MLPPP:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)
- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

The following cards, modules, and platforms support IMA groups:

- 2-port OC3/STM1 Channelized Adapter card
- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 7705 SAR-M

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All physical links or channels in a bundle or group combine to form one logical connection. A bundle or group also provides redundancy in case one or more links that participate in the bundle fail. For command syntax, see Configuring multilink PPP bundles. To configure channelized ports for TDM, see Configuring channelized ports.

For 12-port Serial Data Interface cards and the RS-232 ports on the 4-port T1/E1 and RS-232 Combination module, some or all of a port bandwidth can be dedicated to a channel by aggregating a number of DS0s into a single bundle. Serial data transmission rates below the rate of a single DS0, that is, less than 64 kb/s, are achieved using the high capacity multiplexing (HCM) proprietary protocol. These rates are known as subrates, and are supported only when operating in RS-232 mode or X.21 mode.

Note: A DS0 channel operating at a rate less than 64 kb/s still uses a full 64 kb/s timeslot.

3.10.4 Using partial bandwidth

Fractional T1/E1 allows one or more DS0 channels to be bundled together (up to the maximum bandwidth of the network link), enabling the customer to use only that portion of the link that is needed. This means that the PPP service can use a selected number of timeslots (octets) in the network T1 or E1 link, therefore reducing the amount of T1 or E1 bandwidth that must be leased or purchased from the attached carrier. This leads to multiplexing efficiencies in the transport network.

The following cards and platforms support fractional T1/E1 on a PPP channel group (encapsulation type ppp-auto), or all timeslots on T1/E1 ports, in network mode:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)
- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

Only one channel group can be configured per port. When the channel group is configured for ppp-auto encapsulation and network mode, all timeslots (channels) are automatically allocated to the channel group. The user can then configure the number of timeslots needed. Timeslots not selected cannot be used.

3.11 Basic configuration

The basic 7705 SAR interface configuration must include the following tasks:

- identify chassis slot (step in activating the IOM)
- specify card type (step in activating the IOM)
- identify adapter card (MDA) slot
- specify adapter card type (**mda-type**) (must be an allowed adapter card type)
- specify adapter card mode (**mda-mode**) (supported on the 4-port DS3/E3 Adapter card, 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, and Integrated Services card)

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- identify specific port to configure

The following example displays some card and port configurations on the 7705 SAR-8 Shelf V2.

Note: The 7705 SAR-18 displays similar output with the exception being that the MDA number goes from 1 to 12 and from X1 to X4 (for XMDA cards).

```
NOK-1>config# card 1
NOK-1>config>card# info
#--------------------------------------------------
echo "Card Configuration"
#--------------------------------------------------
    card 1
        card-type iom-sar
        mda 1
            mda-type a6-em
        exit
        mda 2
            mda-type a4-oc3
        exit
        mda 3
            mda-type a16-chds1v2
        exit
        mda 4
            mda-type a4-chds3v2
            mda-mode cem-atm-ppp
        exit
        mda 5
            mda-type a8-1gb-sfp
        exit
        mda 6
            mda-type a2-choc3
        exit
    exit
#--------------------------------------------------
echo "Port Configuration"
#--------------------------------------------------
    port 1/1/1
        description "E&M"
        voice
            em
                no loopback
                signaling-mode em
                signaling-lead
                    m end-to-end
                    e end-to-end
                exit
                fault-signaling idle
                idle-code 13
                seized-code 5
                channel-group 1
                    description "DS0GRP"
                    mode access
                    encap-type cem
                    no shutdown
                exit
                no shutdown
            exit
            audio-wires four-wires
            tlp-rx 0.0
            tlp-tx 0.0
        exit
        no shutdown
```


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```
    port 1/1/2
        shutdown
        voice
        exit
    .....
    port 1/1/6
        shutdown
        voice
        exit
    exit
.....
    port 1/2/2
        shutdown
        sonet-sdh
        exit
    exit
    port 1/2/3
        shutdown
        sonet-sdh
        exit
    exit
    port 1/2/4
        shutdown
        sonet-sdh
        exit
    exit
    port 1/3/1
        shutdown
        tdm
            e1
                shutdown
                channel-group 1
                    shutdown
                    encap-type cem
                    timeslots 2-10
                exit
            exit
        exit
    exit
    port 1/3/2
        shutdown
        tdm
            e1
                shutdown
                channel-group 1
                    shutdown
                    encap-type cem
                    timeslots 2-10
                exit
            exit
        exit
    exit
    port 1/3/3
        shutdown
        tdm
        exit
    exit
.....
   port 1/3/15
       shutdown
       tdm
       exit
   exit
   port 1/3/16
```


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```
        shutdown
        tdm
            e1
                shutdown
                channel-group 1
                    shutdown
                    description "network_port"
                    mode network
                exit
            exit
        exit
exit
   port 1/4/1
        shutdown
        tdm
            ds3
                shutdown
                encap-type atm
                framing m23
                loopback line
                atm
                exit
            exit
        exit
   exit
   port 1/4/2
        shutdown
        tdm
        exit
   exit
   port 1/4/3
        shutdown
        tdm
        exit
   exit
   port 1/4/4
        shutdown
        tdm
        exit
   exit
    port 1/5/1
        shutdown
        ethernet
        exit
    exit
    port 1/5/2
        shutdown
        ethernet
        exit
    exit
.....
    port 1/5/7
        shutdown
        ethernet
        exit
    exit
    port 1/5/8
        shutdown
        ethernet
        exit
    exit
    port 1/6/1
        shutdown
        sonet-sdh
```


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```
        exit
        tdm
        exit
    exit
    port 1/6/2
        shutdown
        sonet-sdh
        exit
        tdm
        exit
    exit
#--------------------------------------------------
```

3.12 Common configuration tasks

The following basic system tasks are performed, as required:

- Configuring cards and adapter cards
- Configuring ports
- Configuring SCADA bridge parameters

3.12.1 Configuring cards and adapter cards

This section contains the following topics:

- Configuring cards
- Configuring adapter card network queue QoS policies
- Configuring ring adapter card or module network and network queue QoS policies
- Configuring adapter card fabric statistics
- Configuring adapter card fabric profile
- Configuring adapter card clock mode
- Configuring adapter card voice attributes
- Configuring ring adapter card or module parameters
- Configuring Auxiliary Alarm card, chassis, and Ethernet port external alarm parameters
- Displaying adapter card information

3.12.1.1 Configuring cards

Card configurations must include a chassis slot designation. A slot must be preconfigured with the type of card and adapter cards that are allowed to be provisioned.

The **mda-mode** command is used on the following adapter cards to configure the appropriate encapsulation methods (**cem-atm-ppp** or **cem-fr-hdlc-ppp**) that are required to support pseudowire services:

- 4-port DS3/E3 Adapter card
- 16-port T1/E1 ASAP Adapter card

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- 32-port T1/E1 ASAP Adapter card

The **mda-mode** command is used on the 10-port 1GigE/1-port 10GigE X-Adapter card to configure the card for either 10-port 1GigE mode or 1-port 10GigE mode (**x10-1gb-sfp** or **x1-10gb-sf+**).

The **mda-mode** command is used on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card to configure the card for either 4-port OC3/STM1 mode or 1-port OC12/STM4 mode (**p4-oc3** or **p1-oc12**).

The **mda-mode** command is used on the Integrated Services card to configure the card for a SCADA application: (**mddb**, **pcm**, or **vcb**).

The following CLI syntax shows an example of configuring a chassis slot and card (to activate the IOM) and adapter cards on the 7705 SAR-8 Shelf V2.

Example:

```
NOK-1>config# card 1
NOK-1>config>card# card-type iom-sar
NOK-1>config>card# mda 1
NOK-1>config>card>mda# mda-type a6-em
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 2
NOK-1>config>card>mda# mda-type a4-oc3
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 3
NOK-1>config>card>mda# mda-type a16-chds1v2
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 4
NOK-1>config>card>mda# mda-type a4-chds3v2
NOK-1>config>card>mda# mda-mode cem-fr-hdlc-ppp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 5
NOK-1>config>card>mda# mda-type a8-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 6
NOK-1>config>card>mda# mda-type a2-choc3
NOK-1>config>card>mda# exit
NOK-1>config>card# exit
```

The following CLI syntax shows an example of configuring a chassis slot and card (to activate the IOM) and adapter cards on the 7705 SAR-18.

Example:

```
NOK-1>config# card 1
NOK-1>config>card# card-type iom-sar
NOK-1>config>card# mda 1
NOK-1>config>card>mda# mda-type aux-alarm
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 2
NOK-1>config>card>mda# mda-type a8-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 2
NOK-1>config>card>mda# mda-type a8-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 3
NOK-1>config>card>mda# mda-type a8-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 4
NOK-1>config>card>mda# mda-type a8-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 5
NOK-1>config>card>mda# mda-type a8-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 6
```


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```
NOK-1>config>card>mda# mda-type a32-chds1v2
NOK-1>config>card>mda# mda-mode cem-atm-ppp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 7
NOK-1>config>card>mda# mda-type a32-chds1v2
NOK-1>config>card>mda# mda-mode cem-atm-ppp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 8
NOK-1>config>card>mda# mda-type a32-chds1v2
NOK-1>config>card>mda# mda-mode cem-atm-ppp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 9
NOK-1>config>card>mda# mda-type a32-chds1v2
NOK-1>config>card>mda# mda-mode cem-atm-ppp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 10
NOK-1>config>card>mda# mda-type a4-oc3
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 11
NOK-1>config>card>mda# mda-type a4-chds3v2
NOK-1>config>card>mda# mda-mode cem-fr-hdlc-ppp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda 12
NOK-1>config>card>mda# exit
NOK-1>config>card# mda X1
NOK-1>config>card>mda# mda-type x-10GigE-v2
NOK-1>config>card>mda# mda-mode x1-10gb-sf+
NOK-1>config>card>mda# exit
NOK-1>config>card# mda X2
NOK-1>config>card>mda# mda-type x-10GigE-v2
NOK-1>config>card>mda# mda-mode x10-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# mda X3
NOK-1>config>card>mda# mda-type x-10GigE-v2
NOK-1>config>card>mda# mda-mode x1-10gb-sf+
NOK-1>config>card>mda# exit
NOK-1>config>card# mda X4
NOK-1>config>card>mda# mda-type x-10GigE-v2
NOK-1>config>card>mda# mda-mode x10-1gb-sfp
NOK-1>config>card>mda# exit
NOK-1>config>card# exit
```

3.12.1.2 Configuring adapter card network queue QoS policies

Network queue QoS policies can optionally be applied to adapter cards. Network queue policies define the ingress network queuing at the adapter card node level. Network queue policy parameters are configured in the **config>qos** context. For more information about network queue policies, see the 7705 SAR Quality of Service Guide, "Network queue QoS policies".

Queue policies do not apply to the Auxiliary Alarm card.

Use the following CLI syntax to configure network queue policies on an adapter card.

CLI syntax:

```
config>card>mda#
    network
        ingress
            queue-policy name
    no shutdown
```


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```
no shutdown
```

3.12.1.3 Configuring ring adapter card or module network and network queue QoS policies

Network and network queue QoS policies can optionally be applied to a ring adapter card or module, such as the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module.

Network policies define ring type network policies to a ring adapter card, where a ring type is a **network-policy-type**. Network queue policies define the add/drop port network queuing at the adapter card node level.

Network and network queue policy parameters are configured in the **config>qos** context. For more information about network queue policies, see the 7705 SAR Quality of Service Guide, "Network QoS policies" and "Network queue QoS policies".

Use the following CLI syntax to configure network and network queue policies on an adapter card.

CLI syntax:

```
config>card>mda#
    network
        ring
            add-drop-port-queue-policy name
            qos-policy network-policy-id
    no shutdown
```

3.12.1.4 Configuring adapter card fabric statistics

The collection of fabric statistics can be enabled on an adapter card to report about the fabric traffic flow and potential discards.

Fabric statistics do not apply to the Auxiliary Alarm card.

Use the following syntax to configure fabric statistics on an adapter card.

CLI syntax:

```
config>card>mda#
    [no] fabric-stats-enabled
```

3.12.1.5 Configuring adapter card fabric profile

Ingress fabric profiles can be configured on an adapter card, in either a network or access context, to allow network ingress to fabric shapers to be user-configurable at rates that provide up to 1 Gb/s switching throughput from the adapter card toward the fabric. For more information about fabric profiles, see the 7705 SAR Quality of Service Guide, "QoS fabric profiles".

Fabric profiles do not apply to the Auxiliary Alarm card.

Use the following CLI syntax to assign a fabric profile on an adapter card.

CLI syntax:

```
config>card>mda#
    mda-type type
    [no] fabric-stats-enabled
    network
```


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```
        ingress
            fabric-policy fabric-policy-id
            queue-policy name
    access
        ingress
            fabric-policy fabric-policy-id
    no shutdown
```

3.12.1.6 Configuring adapter card clock mode

Clocking mode is defined at the adapter card level. There are three clocking modes available: **differential**, **adaptive**, and **dcr-acr**, which is a mixture of both differential and adaptive. The **dcr-acr** option enables differential and adaptive clocking on different ports of the same card or chassis. Differential and dcr-acr clocking modes also support a configurable timestamp frequency. To carry differential clock recover information, the RTP header must be enabled on the SAP.

The following chassis, cards, and modules support all clocking modes:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 7705 SAR-M (variants with T1/E1 ports)
- 7705 SAR-X
- 7705 SAR-A (variant with T1/E1 ports)
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

When the timestamp frequency is configured for **differential** or **dcr-acr** mode on a 4-port T1/E1 and RS-232 Combination module, the configured value takes effect on both modules installed in the 7705 SAR-H.

The following cards support differential clocking mode only:

- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card (DS1/E1 channels)
- 4-port DS3/E3 Adapter card (clear channel DS3/E3 ports and DS1/E1 channels on channelized DS3 ports (E3 ports cannot be channelized)); differential clocking mode on DS1/E1 channels is supported only on the first three ports of the card

Use the following CLI syntax to configure adaptive clocking mode.

CLI syntax:

```
config>card>mda#
    clock-mode adaptive
    no shutdown
```

Use the following CLI syntax to configure differential clocking mode or a combination of differential and adaptive clocking modes with a timestamp frequency.

CLI syntax:

```
config>card>mda#
    clock-mode {differential | dcr-acr} [timestamp-freq {19440 | 25000 |
 77760 | 103680}]
    no shutdown
```


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3.12.1.7 Configuring adapter card voice attributes

Use the following CLI syntax to assign the type of companding law and signaling to be used on a 6-port E&M Adapter card installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis.

CLI syntax:

```
config>card>mda#
    mda-type a6-em
    voice
        companding-law {a-law | mu-law}
        signaling-type {type-1 | type-2 | type-v}
    no shutdown
```

Use the following CLI syntax to assign the type of companding law to be used on the FXO and FXS ports on an 8-port Voice & Teleprotection card installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis.

CLI syntax:

```
config>card>mda#
    mda-type a8-vt
    voice
        companding-law {a-law | mu-law}
    no shutdown
```

Use the following CLI syntax to assign the type of companding law to be used on the FXO ports on an 8-port FXO Adapter card installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis.

CLI syntax:

```
config>card>mda#
    mda-type a8-fxo
    voice
        companding-law {a-law | mu-law}
    no shutdown
```

Use the following CLI syntax to assign the type of companding law to be used on the FXS ports on a 6-port FXS Adapter card installed in a 7705 SAR-8 Shelf V2 or 7705 SAR-18 chassis.

CLI syntax:

```
config>card>mda#
    mda-type a6-fxs
    voice
        companding-law {a-law | mu-law}
    no shutdown
```

3.12.1.8 Configuring ring adapter card or module parameters

Use the following CLI syntax to configure the adapter card or module parameters on the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module.

CLI syntax:

```
config>card>mda#
    ring
        [no] disable-aging
        [no] disable-learning
        [no] discard-unknown-source
        fdb-table-high-wmark high-water-mark
```


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```
        no fdb-table-high-wmark
        fdb-table-size table-size
        no fdb-table-size
        [no] mac-pinning port port-id
        remote-age aging-timer
        no remote-age
        [no] static-mac mac ieee-address port port-id [create]
    [no] shutdown
```

After configuring the adapter card or module, you can use the **config>card>mda>ring>info detail** command to display the information for the ring adapter card or module.

```
*A:7705:Sar18>config>card>mda>ring# info detail
----------------------------------------------
                no disable-aging
                no disable-learning
                no discard-unknown-source
                no remote-age
                no fdb-table-size
                no fdb-table-high-wmark
                no mac-pinning port 1/11/1
                no mac-pinning port 1/11/2
----------------------------------------------
*A:7705:Sar18>config>card>mda>ring#
```

3.12.1.9 Configuring Auxiliary Alarm card, chassis, and Ethernet port external alarm parameters

Use the following CLI syntax to configure the external alarm parameters for the Auxiliary Alarm card, 7705 SAR Ethernet ports (supported on all platforms with Ethernet ports), and for the four alarm inputs on the fan module (for the 7705 SAR-8 Shelf V2), alarm connector (for the 7705 SAR-M, 7705 SAR-Wx, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-X), and alarm module (for the 7705 SAR-18).

The output commands apply to the Auxiliary Alarm card only. The **debounce** and **normally** commands do not apply to external alarm parameters configured on an Ethernet port.

CLI syntax:

```
config# external-alarms
    alarm alarm-id
        chassis-alarming
        description description-string
        log
        severity {critical | major | minor | warning}
        thresholds
            analog
                level {lt | gt} millivolts
            exit
        trigger [any | all] {alarm-input1 | alarm-input2... | alarm-
input8}
        exit
    input alarm-input
        debounce seconds
        debounce detect detect-seconds clear clear-seconds
        description description-string
        name name-string
        normally {open | closed}
        shutdown
    exit
    output alarm-output
```


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```
        description description-string
        name name-string
        shutdown
```

Example:

```
config# external-alarms input alarm.d-1
config# external-alarms input alarm.d-2
config# external-alarms input alarm.d-3
config# external-alarms input alarm.d-4
config# external-alarms input alarm-1/1.d-1 name dinput1
config# external-alarms input alarm-1/1.d-2 name dinput2
config# external-alarms input alarm-1/1.d-3 name dinput3
config# external-alarms input alarm-1/1.d-4 name dinput4
config# external-alarms input alarm-1/1.d-5 name dinput5
config# external-alarms input alarm-1/1.d-23 name dinput23
config# external-alarms input alarm-1/1.d-24 name dinput24
config# external-alarms output alarm-1/1.d-1 name dinput11
config# external-alarms output relay-1/1.d-2 name output2
config# external-alarms output relay-1/1.d-3 name output3
config# external-alarms output relay-1/1.d-4 name output4
config# external-alarms output relay-1/1.d-5 name output5
config# external-alarms output relay-1/1.d-2 name output2
config# external-alarms output relay-1/1.d-3 name output3
config# external-alarms output relay-1/1.d-4 name output4
config# external-alarms output relay-1/1.d-5 name output5
config>ext-alarms# alarm 1
config>ext-alarms>alarm# chassis-alarming
config>ext-alarms>alarm# log
config>ext-alarms>alarm# trigger all alarm-1/1.d-1 alarm-1/1.d-2 alarm-1/
1.d-3 alarm-1/1.d-4 alarm-1/1.d-5 alarm-1/1.a-1
config>ext-alarms>alarm# exit
config>ext-alarms# alarm 2
config>ext-alarms>alarm# chassis-alarming
config>ext-alarms>alarm# no log
config>ext-alarms>alarm# trigger all alarm-1/1.d-1 alarm-1/1.d-2 alarm-1/
1.d-3 alarm-1/1.d-4 alarm-1/1.d-23 alarm-1/1.d-24 alarm-1/1.a-1 alarm-1/
1.a-2
config>ext-alarms>alarm# exit
config>ext-alarms# alarm 3
config>ext-alarms>alarm# chassis-alarming
config>ext-alarms>alarm# log
config>ext-alarms>alarm# trigger any alarm-1/1.d-1 alarm-1/1.d-2 alarm-1/
1.d-3 alarm-1/1.d-4 alarm-1/1.d-5 alarm-1/1.a-1 alarm-1/1.a-2 alarm.d-1
 alarm.d-2
config>ext-alarms>alarm# exit
config>ext-alarms# alarm 4
config>ext-alarms>alarm# chassis-alarming
config>ext-alarms>alarm# log
config>ext-alarms>alarm# trigger any alarm-1/1.a-1 alarm-1/1.a-2 alarm.d-1
 alarm.d-2 alarm.d-3 alarm.d-4
config>ext-alarms>alarm# severity major
config>ext-alarms>alarm# thresholds
config>ext-alarms>alarm>thresholds# analog level lt 4
config>ext-alarms>alarm>thresholds# exit
config>ext-alarms>alarm# exit
config>ext-alarms# exit
```

The following CLI syntax shows an example of configuring custom alarms on Ethernet ports.

Example:

```
config# external-alarms input port-1/1/5
config>ext-alarms>in# name “CABINET-DOOR”
```


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```
config>ext-alarms>in# description “Front Panel Access Door Sensor”
config>ext-alarms>in# exit
config# external-alarms input port-1/1/6
config>ext-alarms>in# name “REAR-PANEL”
config>ext-alarms>in# description “Rear Maintenance Panel Sensor”
config>ext-alarms>in# exit
config# external-alarms alarm 1
config>ext-alarms>alarm# description “Local Security Breach”
config>ext-alarms>alarm# trigger “CABINET-DOOR” “REAR-PANEL”
config>ext-alarms>alarm# severity critical
config>ext-alarms>alarm# no shutdown
config>ext-alarms>alarm# exit
```

Use the **show external-alarms input** command to display Ethernet port alarm input information.

```
*NOK-A# show external-alarms input
===============================================================================
External Alarm Input Summary
===============================================================================
Input Id        Name            Type        Admin Value     Alarm State
-------------------------------------------------------------------------------
alarm.d-1                       Digital-In  Up     Open      Ok
alarm.d-2                       Digital-In  Up     Open      Ok
alarm.d-3                       Digital-In  Up     Open      Ok
alarm.d-4                       Digital-In  Up     Open      Ok
port-1/5/1      CABINET-DOOR    Oper-State  Up     Down      Alarm-Detected
port-1/6/1      REAR-PANEL      Oper-State  Up     Up        Ok
===============================================================================
```

3.12.1.10 Displaying adapter card information

After performing the adapter card configuration, you can use the **config>card 1** and the **info** commands to display the information on the 7705 SAR-8 Shelf V2 or 7705 SAR-18. The following example is for the 7705 SAR-8 Shelf V2.

```
NOK-1>config# card 1
NOK-1>config>card# info
#--------------------------------------------------
echo "Card Configuration"
#--------------------------------------------------
    card 1
        card-type iom-sar
        mda 1
            mda-type a6-em
        exit
        mda 2
            mda-type a4-oc3
        exit
        mda 3
            mda-type a16-chds1v2
        exit
        mda 4
            mda-type a4-chds3v2
        exit
        mda 5
            mda-type a8-1gb-sfp
        exit
        mda 6
            mda-type a2-choc3
```


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```
        exit
    exit
#---------------------------------------------------
.....
NOK-1> config#
```

Use the **config>card 1** and the **info detail** commands to display the adapter card detailed configuration information. The following example is for the 7705 SAR-8 Shelf V2.

```
NOK-1>config# card 1
NOK-1>config>card# info detail
#---------------------------------------------------
echo "Card Configuration"
#---------------------------------------------------
card 1
        card-type iom-sar
        mda 1
            mda-type a6-em
            voice
                companding-law a-law
                signaling-type type-v
            exit
            no shutdown
        exit
        mda 2
            mda-type a4-oc3
            no fabric-stats-enabled
            network
                ingress
                    fabric-policy 1
                    queue-policy "default"
                exit
            exit
            access
                ingress
                    fabric-policy 1
                exit
            exit
            no shutdown
        exit
        mda 3
            mda-type a16-chds1v2
            clock-mode adaptive
            no fabric-stats-enabled
            network
                ingress
                    fabric-policy 1
                    queue-policy "default"
                exit
            exit
            access
                ingress
                    fabric-policy 1
                exit
            exit
            no shutdown
        exit
        mda 4
            no shutdown
            mda-type a4-chds3v2
            no fabric-stats-enabled
            network
                ingress
```


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```
                    fabric-policy 1
                    queue-policy "default"
                exit
            exit
            access
                ingress
                    fabric-policy 1
                exit
            exit
        exit
        mda 5
            mda-type a8-1gb-sfp
            no fabric-stats-enabled
            network
                ingress
                    fabric-policy 1
                    queue-policy "default"
                exit
            exit
            access
                ingress
                    fabric-policy 1
                exit
            exit
            no shutdown
        exit
        mda 6
            mda-type a2-choc3
            clock-mode adaptive
            no fabric-stats-enabled
            network
                ingress
                    fabric-policy 1
                    queue-policy "default"
                exit
            exit
            access
                ingress
                    fabric-policy 1
                exit
            exit
            no shutdown
        exit
        no shutdown
    exit
#--------------------------------------------------
......
NOK-1> config#
```

3.12.2 Configuring ports

This section provides the CLI syntax and examples to configure the following:

- Configuring APS port parameters
- Configuring LCR parameters
- Configuring a microwave link
- Configuring Ethernet port parameters
- Configuring SONET/SDH port parameters

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- SONET/SDH channelized port configuration examples
- Configuring voice ports
- Configuring codirectional G.703 ports
- Configuring teleprotection ports
- Configuring TDM PPP
- Configuring channelized ports
- Configuring fractional T1/E1 ports for PPP encapsulation
- Configuring T1 line buildout
- Configuring DS1 or E1 SSM
- Configuring ATM interface parameters
- Configuring multilink PPP bundles
- Configuring MC-MLPPP
- Configuring LAG parameters
- Configuring multilink ATM IMA groups
- Configuring SDI ports for IPCP encapsulation
- Configuring TDM and SDI ports for frame relay encapsulation
- Configuring TDM and SDI ports for HDLC encapsulation
- Configuring TDM and SDI ports for Cisco HDLC encapsulation
- Configuring GNSS receiver port parameters
- Configuring serial ports for raw socket transport

3.12.2.1 Configuring APS port parameters

APS has the following configuration rules:

- A working port must be added first. A protection port can then be added or removed at any time.
- The protection port must be removed from the configuration before the working port is removed.
- A protection port or working port must be shut down in the **config>port** *port-id* context before being removed from an APS group.
- A path cannot be configured on a port before the port is added to an APS group.
- A working port cannot be removed from an APS group until the APS port path is removed.
- When ports are added to an APS group, all path-level configurations are available only at the APS port level and configuration on the physical member ports is blocked.
- When a port is a protection circuit of an APS group, the configuration options available in the **config>port** *port-id*>**sonet-sdh** context are not allowed for that port unless they are in the following exception list:
  - clock-source
  - [no] loopback
  - [no] report-alarm

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- section-trace
- [no] threshold

SC-APS is supported in unidirectional or bidirectional mode on:

- 2-port OC3/STM1 Channelized Adapter cards for TDM CES (Cpipes) and TDM CESoETH with MEF 8 with DS3/DS1/E1/DS0 channels
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards for MLPPP access ports or TDM CES (Cpipes) and TDM CESoETH (MEF 8) access ports with DS1/E1 channels, or on a network port configured for POS
- 4-port OC3/STM1 Clear Channel Adapter cards network side (configured for POS operation).

SC-APS with TDM access is supported on DS3, DS1, E1, and DS0 (64 kb/s) channels.

MC-APS is supported in bidirectional mode on:

- 2-port OC3/STM1 Channelized Adapter cards for TDM CES (Cpipes) and TDM CESoETH with MEF 8 with DS3/DS1/E1/DS0 channels
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards for MLPPP access ports or CES (Cpipes) and TDM CESoETH (MEF 8) access ports with DS1/E1 channels.

MC-APS with TDM access is supported on DS3, DS1, E1, and DS0 (64 kb/s) channels.

TDM SAP-to-SAP with MC-APS is supported on:

- 2-port OC3/STM1 Channelized Adapter cards for TDM CES (Cpipes)
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter cards for CES (Cpipes)

TDM SAP-to-SAP with MC-APS is not supported with MEF 8 service types.

APS can be configured in SC-APS mode with both working and protection circuits on the same node, or in MC-APS mode with the working and protection circuits configured on separate nodes.

For SC-APS and MC-APS with MEF 8 services where the remote device performs source MAC validation, the MAC address of the channel group in each of the redundant interfaces may be configured to the same MAC address using the **mac** CLI command.

Use the following CLI syntax to configure APS port parameters for an SC-APS group.

CLI syntax:

```
config# port aps-id
    aps
        hold-time-aps {[lsignal-fail sf-time] [lsignal-degrade sd-time]}
        protect-circuit port-id
        rdi-alarms {suppress | circuit}
        revert-time minutes
        switching-mode {bi-directional | uni-1plus1}
        working-circuit port-id
```

The following CLI syntax shows an example of configuring ports for SC-APS. The only mandatory configuration required to create an SC-APS group is to configure the working and protection circuit.

Example:

```
config# port aps-1
config>port# aps
config>port>aps# switching-mode uni-1plus1
config>port>aps# working-circuit 1/2/4
config>port>aps# rdi-alarms circuit
config>port>aps# revert-time 5
```


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```
config>port>aps# protect-circuit 1/3/4
```

Use the **config port info** command to display port configuration information.

```
ALU-B>config>port# info
             ----------------------------------------------
                      shutdown
                      aps
                      switching-mode uni-1plus1
                      revert-time 5
                      working-circuit 1/2/4
                      protect-circuit 1/3/4
                      exit
                      sonet-sdh
                      exit
             ----------------------------------------------
```

Use the following CLI syntax to configure APS port parameters for an MC-APS group.

CLI syntax:

```
config# port aps-id
    aps
        advertise-interval advertise-interval
        hold-time hold-time
        neighbor ip-address
        protect-circuit port-id
        rdi-alarms {suppress | circuit}
        revert-time minutes
        working-circuit port-id
```

The following CLI syntax shows an example of configuring an MC-APS working circuit on a node. The only mandatory configuration required to create an MC-APS group is to configure the working and protection circuit, and the neighbor address.

Example:

```
config# port aps-2
config>port# aps
config>port>aps# advertise-interval 25
config>port>aps# hold-time 75
config>port>aps# working-circuit 1/2/4
config>port>aps# neighbor 10.10.10.101
config>port>aps# rdi-alarms circuit
config>port>aps# revert-time 5
```

To complete the MC-APS configuration, log in to the protection node, configure an APS group with the same APS ID as the working group, and configure the protection circuit. The MC-APS signaling path is established automatically when APS groups with matching IDs are both configured.

The following CLI syntax shows an example of configuring an MC-APS protection circuit on a node.

Example:

```
config# port aps-2
config>port# aps
config>port>aps# protect-circuit 1/3/2
```

Use the **config port info** command to display port configuration information.

```
*A:7705:Dut-D# configure port aps-2
*A:7705:Dut-D>config>port# info
```


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```
-----------------------------------------------
        aps
            neighbor 10.10.10.2
            protect-circuit 1/3/2
        exit
        sonet-sdh
            path sts1-1
                payload vt15
                no shutdown
            exit
            path vt15-1.1.1
                no shutdown
            exit
        exit
        tdm
            ds1 1.1.1
                channel-group 1
                    encap-type cem
                    timeslots 1-24
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
-----------------------------------------------
```

SC-APS and MC-APS on the 2-port OC3/STM1 Channelized Adapter card (access side) normally support only TDM CES (Cpipes). SC-APS and MC-APS support Epipes with TDM SAPs when the MEF 8 service is used.

The following CLI syntax shows an example of TDM CESoETH with MEF 8 for APS.

```
*A:7705:Dut-D# configure service epipe 1
*A:7705:Dut-D>config>epipe# info
-----------------------------------------------
epipe 1 customer 1 vpn 1 create
            description "Default epipe description for service id 1"
            endpoint "X" create
            exit
            endpoint "Y" create
            exit
            sap aps-1.1.1.1.1 endpoint "X" create
                description "Default sap description for service id 1"
                cem
                    local-ecid 1
                    remote-ecid 2
                    remote-mac a4:8d:01:06:00:01
                exit
            exit
            spoke-sdp 2003:1 endpoint "Y" create
            exit
            spoke-sdp 2004:1001 endpoint "X" icb create
            exit
            spoke-sdp 2004:2001 endpoint "Y" icb create
            exit
            no shutdown
        exit
-----------------------------------------------
```

The following CLI syntax shows examples of typical configurations of SC-APS and MC-APS on MC-MLPPP access ports on a 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.

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SC-APS node:

```
==================
    port bpgrp-ppp-1
        multilink-bundle
            working-bundle bundle-ppp-1/5.1
            protect-bundle bundle-ppp-1/6.1
        exit
    exit

   port aps-1
        aps
            working-circuit 1/5/1
            protect-circuit 1/6/4
        exit
        sonet-sdh
            path sts1-1
                no shutdown
            exit
            path vt15-1.1.1
                no shutdown
            exit
            path vt15-1.1.2
                no shutdown
            exit
            path vt15-1.1.3
                no shutdown
            exit
            path vt15-1.1.4
                no shutdown
            exit
            path vt15-1.2.1
                no shutdown
            exit
            path vt15-1.2.2
                no shutdown
            exit
            path vt15-1.2.3
                no shutdown
            exit
            path vt15-1.2.4
                no shutdown
            exit
        tdm
            ds1 1.1.1
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.1.2
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.1.3
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
```


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```
            exit
            ds1 1.1.4
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.1
               channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.2
                channel-group 1
                    encap-type ipcp
                   no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.3
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.4
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit

     port bpgrp-ppp-1
        multilink-bundle
            mlppp
                endpoint-discriminator class ip-address discriminator-id 1.2.3.4
                multiclass 4
            exit
            member aps-1.1.1.1.1
            member aps-1.1.1.2.1
            member aps-1.1.1.3.1
            member aps-1.1.1.4.1
            member aps-1.1.2.1.1
            member aps-1.1.2.2.1
            member aps-1.1.2.3.1
            member aps-1.1.2.4.1
        exit
        no shutdown
    exit
    port bundle-ppp-1/5.1
        no shutdown
    exit
    port bundle-ppp-1/6.1
        no shutdown
    exit
    service
        customer 1 create
            description "Default customer"
        exit
```


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```
        ipipe 1 customer 1 vpn 1 create
            description "Default ipipe description for service id 1"
            sap 1/2/8:501 create
                description "Default sap description for service id 1"
                ce-address 172.16.0.1
            exit
            sap bpgrp-ppp-1 create
                description "Default sap description for service id 1"
                ce-address 172.16.0.0
                ipcp
                exit
            exit
            no shutdown
        exit
```

MC-APS working node:

```
============================
    port bpgrp-ppp-1
        multilink-bundle
            working-bundle bundle-ppp-1/9.1
        exit
    exit
     port aps-1
        aps
            neighbor 10.10.10.4
            working-circuit 1/9/2
        exit
        sonet-sdh
            path sts1-1
                no shutdown
            exit
            path vt15-1.1.1
                no shutdown
            exit
            path vt15-1.1.2
                no shutdown
            exit
            path vt15-1.1.3
                no shutdown
            exit
            path vt15-1.1.4
                no shutdown
            exit
            path vt15-1.2.1
                no shutdown
            exit
            path vt15-1.2.2
                no shutdown
            exit
            path vt15-1.2.3
                no shutdown
            exit
            path vt15-1.2.4
                no shutdown
            exit
        tdm
            ds1 1.1.1
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
```


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```
            exit
            ds1 1.1.2
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.1.3
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
           exit
            ds1 1.1.4
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.1
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.2
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.3
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.4
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
    port bpgrp-ppp-1
        multilink-bundle
            mlppp
                endpoint-discriminator class ip-address discriminator-id 1.2.3.4
                multiclass 4
            exit
            member aps-1.1.1.1.1
            member aps-1.1.1.2.1
            member aps-1.1.1.4.1
            member aps-1.1.1.3.1
            member aps-1.1.2.1.1
            member aps-1.1.2.2.1
            member aps-1.1.2.3.1
            member aps-1.1.2.4.1
```


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```
        exit
        no shutdown
    exit
    port bundle-ppp-1/9.1
        no shutdown
    exit
    service
        sdp 3001 create
            description "LDP_SdpToDut-A"
            far-end 10.10.10.1
            ldp
            keep-alive
                shutdown
            exit
            no shutdown
        exit
        sdp 3004 create
            description "LDP_SdpToDut-D"
            far-end 10.10.10.4
            ldp
            keep-alive
                shutdown
            exit
            no shutdown
        exit
        customer 1 create
            description "Default customer"
        exit
        ipipe 1 customer 1 vpn 1 create
            description "Default ipipe description for service id 1"
            endpoint "X" create
            exit
            endpoint "Y" create
            exit
            sap bpgrp-ppp-1 endpoint "X" create
                description "Default sap description for service id 1"
                ce-address 172.16.0.1
                ipcp
                exit
            exit
            spoke-sdp 3001:1 endpoint "Y" create
                ce-address 172.16.0.0
                no shutdown
            exit
            spoke-sdp 3004:1001 endpoint "X" icb create
                no shutdown
            exit
            spoke-sdp 3004:2001 endpoint "Y" icb create
                no shutdown
            exit
            no shutdown
        exit
```

MC-APS protection node:

```
============================
    port bpgrp-ppp-1
        multilink-bundle
            protect-bundle bundle-ppp-1/9.1
        exit
    exit
    port aps-1
        aps
```


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```
            neighbor 10.10.10.3
            protect-circuit 1/9/4
        exit
        sonet-sdh
            path sts1-1
                no shutdown
            exit
            path vt15-1.1.1
                no shutdown
            exit
            path vt15-1.1.2
                no shutdown
            exit
            path vt15-1.1.3
                no shutdown
            exit
            path vt15-1.1.4
                no shutdown
            exit
            path vt15-1.2.1
                no shutdown
            exit
            path vt15-1.2.2
                no shutdown
            exit
            path vt15-1.2.3
                no shutdown
            exit
            path vt15-1.2.4
                no shutdown
            exit
        tdm
            ds1 1.1.1
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.1.2
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.1.3
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.1.4
                channel-group 1
                    encap-type ipcp
                    no shutdown
                exit
                no shutdown
            exit
            ds1 1.2.1
                channel-group 1
                    encap-type ipcp
                    no shutdown
```


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```
            exit
            no shutdown
        exit
        ds1 1.2.2
            channel-group 1
                encap-type ipcp
                no shutdown
            exit
            no shutdown
        exit
        ds1 1.2.3
            channel-group 1
                encap-type ipcp
                no shutdown
            exit
            no shutdown
        exit
        ds1 1.2.4
            channel-group 1
                encap-type ipcp
                no shutdown
            exit
            no shutdown
        exit
port bpgrp-ppp-1
    multilink-bundle
        mlppp
            endpoint-discriminator class ip-address discriminator-id 1.2.3.4
            multiclass 4
        exit
        member aps-1.1.1.1.1
        member aps-1.1.1.2.1
        member aps-1.1.1.3.1
        member aps-1.1.1.4.1
        member aps-1.1.2.1.1
        member aps-1.1.2.2.1
        member aps-1.1.2.3.1
        member aps-1.1.2.4.1
    exit
    no shutdown
exit
port bundle-ppp-1/9.1
    no shutdown
exit
service
    sdp 4001 create
        description "LDP_SdpToDut-A"
        far-end 10.10.10.1
        ldp
        keep-alive
            shutdown
        exit
        no shutdown
    exit
    sdp 4003 create
        description "LDP_SdpToDut-C"
        far-end 10.10.10.3
        ldp
        keep-alive
            shutdown
        exit
        no shutdown
    exit
    customer 1 create
```


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```
            description "Default customer"
        exit
        ipipe 1 customer 1 vpn 1 create
            description "Default ipipe description for service id 1"
            endpoint "X" create
            exit
            endpoint "Y" create
            exit
            sap bpgrp-ppp-1 endpoint "X" create
                description "Default sap description for service id 1"
                ce-address 172.16.0.1
                ipcp
                exit
            exit
            spoke-sdp 4001:1 endpoint "Y" create
                ce-address 172.16.0.0
                no shutdown
            exit
            spoke-sdp 4003:1001 endpoint "Y" icb create
                no shutdown
            exit
            spoke-sdp 4003:2001 endpoint "X" icb create
                no shutdown
            exit
            no shutdown
        exit
```

Pseudowire redundancy node:

```
===================
    service
        sdp 1003 create
            description "LDP_SdpToDut-C"
            far-end 10.10.10.3
            ldp
            keep-alive
                shutdown
            exit
            no shutdown
        exit
        sdp 1004 create
            description "LDP_SdpToDut-D"
            far-end 10.10.10.4
            ldp
            keep-alive
                shutdown
            exit
            no shutdown
        exit
        customer 1 create
            description "Default customer"
        exit
        ipipe 1 customer 1 vpn 1 create
            description "Default ipipe description for service id 1"
            endpoint "Y" create
                revert-time 5
                standby-signaling-master
            exit
            sap 1/2/1:501 create
                description "Default sap description for service id 1"
                ce-address 172.16.1.1
            exit
            spoke-sdp 1003:1 endpoint "Y" create
```


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```
            ce-address 172.16.1.2
            precedence primary
            no shutdown
        exit
        spoke-sdp 1004:1 endpoint "Y" create
            ce-address 172.16.1.2
            precedence 1
            no shutdown
        exit
        no shutdown
    exit
```

3.12.2.2 Configuring LCR parameters

LCR has the following configuration rules:

- The working and protection adapter cards in an LCR group must be configured with the same setting for the **mda-mode** command. In addition, the **clock-mode** for each card must be set to **dcr-acr** before the adapter card can be added to an LCR group.
- In an SC-LCR group, both the working and protection adapter cards are configured with the same LCR group ID on the same node. The working and protection adapter cards must be the same type.
- In an MC-LCR group, the working and protection adapter cards are configured on separate nodes. Users must ensure that the working and protection adapter cards are the same type.
- A working adapter card must be created first in an LCR group. A protection adapter card can then be added to or removed from an LCR group at any time.
- The protection adapter card must be removed from the configuration before the working adapter card is removed.
- A protection adapter card or working adapter card must be shut down in the **config>card>mda** *mda-slot* context before being removed from an LCR group.
- A channel cannot be configured on a T1/E1 port before its associated adapter card is added to an LCR group.
- A working adapter card cannot be removed from an LCR group until the associated T1/E1 channel is removed.
- When adapter cards are added to an LCR group, all channel-level configurations are available only on the associated LCR ports and configuration on the physical member ports is blocked.

LCR is supported on the following cards on the 7705 SAR-8 Shelf V2 and the 7705 SAR-18:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card

To create an SC-LCR group, it is mandatory to configure a group ID and the working and protection adapter cards. Use the following CLI syntax to configure SC-LCR.

CLI syntax:

```
config# lcr lcr-id
    working-mda mda-id
    protect-mda mda-id
```


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The following CLI syntax shows an example of configuring SC-LCR.

Example:

```
config# lcr lcr-1
config>lcr# working-mda 1/1
config>lcr# protect-mda 1/2
config>lcr# revert-time 5
```

Use the **info** command to display SC-LCR configuration information.

```
*A:7705:DUT-A>config>lcr lcr-1
*A:7705:DUT-A>config>lcr# info
             ----------------------------------------------
                       revert-time 5
                       working-mda 1/1
                       protect-mda 1/2
             ----------------------------------------------
```

To create an MC-LCR group, it is mandatory to configure the LCR ID, the working adapter card and neighbor address, and protection adapter card and neighbor address. Use the following CLI syntax to configure LCR parameters for an MC-LCR group.

CLI syntax:

```
config# lcr lcr-id
        advertise-interval advertise-interval
        hold-time hold-time
        neighbor ip-address
        protect-mda mda-id
        revert-time minutes
        working-mda mda-id
```

The following CLI syntax shows an example of configuring a working adapter card on a node in an MC-LCR group.

Example:

```
config# lcr lcr-2
config>lcr# neighbor 25.25.25.25
config>lcr# working-mda 1/1
```

To complete the MC-LCR configuration, log in to the protection node, configure an LCR group with the same LCR ID as the working adapter card, and configure the protection adapter card and the neighbor address. An IP link establishes a multi-chassis protocol (MCP) link between the two nodes.

The following CLI syntax shows an example of configuring a protection adapter card on a node in an MC-LCR group.

Example:

```
config# lcr lcr-2
config>lcr# neighbor 14.14.14.14
config>lcr# protect-mda 1/1
config>lcr# revert-time 5
```

Use the **info** command to display MC-LCR configuration information.

```
*A:7705:Dut-D# configure lcr lcr-2
*A:7705:Dut-D>config>lcr# info
----------------------------------------------
        neighbor 14.14.14.14
```


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```
        revert-time 5
        protect-mda 1/1
-------------------------------------------
```

3.12.2.3 Configuring a microwave link

A microwave link can be configured on a 7705 SAR-8 Shelf V2 or 7705 SAR-18 to support a microwave connection from ports 1 through 4 on a Packet Microwave Adapter card to an MPR-e radio that may be configured in standalone mode or single network element (single NE) mode.

Use the following CLI syntax to configure a microwave link (in the example, the MPR-e radios are configured in standalone mode):

CLI syntax:

```
config# port mw-link-id
[no] shutdown
    mw
        [no] hold-time {up hold-time-up | down hold-time-down}
        [no] peer-discovery
        [no] protection
        radio port-id main create
            [no] database filename
            name name-string
            standalone
            [no] tx-mute
        radio port-id spare create
            [no] database filename
            name name-string
            standalone
            [no] tx-mute
        [no] revert rps eps
```

The following CLI syntax shows an example of configuring a microwave link on the 7705 SAR-8 Shelf V2; the MPR-e radios are in standalone mode.

Example:

```
config# port mw-link-24
config>port# no shutdown
config>port# mw
config>port>mw# hold-time up 0 down 0
config>port>mw# no peer-discovery
config>port>mw# protection
config>port>mw# radio 1/2/3 main create
config>port>mw>radio# database mwLink1.tar
config>port>mw>radio# name radiomain
config>port>mw>radio# standalone
config>port>mw>radio# tx-mute
config>port>mw>radio# exit
config>port>mw# radio 1/2/3 spare create
config>port>mw>radio# database mwLink1.tar
config>port>mw>radio# name radiospare
config>port>mw>radio# standalone
config>port>mw>radio# tx-mute
config>port>mw>radio# exit
config>port>mw# revert rps eps
config>port>mw# exit
config>port# exit
```


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3.12.2.4 Configuring Ethernet port parameters

Use the following CLI syntax to configure Ethernet network and access port parameters. For more information about the **dot1x** command, see Configuring 802.1x authentication port parameters . For more information about the **mac-auth** and mac-auth-wait commands, see Configuring MAC authentication port parameters.

When an Ethernet port is configured in WAN mode (**xgig wan** command), users can change specific SONET/SDH parameters to reflect the SONET/SDH requirements for the port. For more information, see Configuring SONET/SDH parameters on an Ethernet XGIG WAN port.

CLI syntax:

```
config# port port-id
ethernet
    access
        egress
            unshaped-sap-cir cir-rate
    autonegotiate limited
    cfm-loopback priority {low | high | dot1p} [match-vlan {vlan-range |
 none}]
    crc-monitor
        sd-threshold threshold [multiplier multiplier]
        no sd-threshold
        sf-threshold threshold [multiplier multiplier]
        no sf-threshold
        window-size seconds
        no window-size
    dot1q-etype 0x0600..0xffff
    dot1x
        [no] mac-auth
        mac-auth-wait seconds
        no mac-auth-wait
        [no] max-auth-req max-auth-request
        [no] port-control {auto | force-auth | force-unauth}
        [no] quiet-period seconds
        [no] radius-plcy name
        [no] re-auth-period seconds
        [no] re-authentication
        [no] server-timeout seconds
        [no] supplicant-timeout seconds
        [no] transmit-period seconds
    down-when-looped
        [no] keep-alive timer
        [no] retry-timeout timer
        [no] shutdown
        [no] use-broadcast-address
    duplex {full|half}
    efm-oam
        [no] accept-remote-loopback
        hold-time time-value
        [no] ignore-efm-state
        mode {active | passive}
        [no] shutdown
        transmit-interval interval [multiplier multiplier]
        [no]tunneling
    egress-rate sub-rate [include-fcs] [allow-eth-bn-rate-changes] [hold-
time hold-time]
    encap-type {dot1q|null|qinq}
    hold-time hold-time {[up hold-time-up | down hold-time-down] [seconds
 | centiseconds]}
    ingress-rate ingress-rate cbs {size [bytes | kilobytes] | default}
    no ingress-rate
```


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```
        src-pause
        no src-pause
    lacp-tunnel
    lldp
        dest-mac
    loopback {line | internal} {timer {0 | 30..86400} | persistent} [swap-
src-dst-mac]
    no loopback
    mac ieee-address
    mode {access | network | hybrid}
    mtu mtu-bytes
    network
        accounting-policy policy-id
        [no] collect-stats
        queue-policy name
        scheduler-mode {16-priority}
    phy-tx-clock {auto-pref-master | auto-pref-slave | slave | master}
    no phy-tx-clock
    poe {plus}
    no poe
    ptp-asymmetry nano-seconds
    no ptp-asymmetry
    qinq-etype 0x0600..0xffff
    report-alarm [signal-fail] [remote] [local] [no-frame-lock] [high-ber]
    speed {10|100|1000}
    ssm
        code-type {sonet | sdh}
        [no] shutdown
        [no] tx-dus
    util-stats-interval seconds
    vlan-filter filter-id
    no vlan-filter
    xgig {lan | wan}
    xor-mode {rj45 | sfp}
```

3.12.2.4.1 Configuring an Ethernet network port

A network port is network facing and participates in the service provider transport or infrastructure network processes.

Use the following basic CLI syntax to configure Ethernet network mode port parameters.

CLI syntax:

```
port port-id
ethernet
    mode {network}
    network
        accounting-policy policy-id
        [no] collect-stats
        queue-policy name
        scheduler-mode {16-priority}
```

The following CLI syntax shows an example of configuring an Ethernet port for network mode.

Example:

```
config# port 1/1/1
config>port# description "Ethernet network port"
config>port# ethernet
config>port>ethernet# mode network
config>port>ethernet# exit
```


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```
config>port># no shutdown
```

Use the **config port info** command to display port configuration information.

```
ALU-B>config>port# info
----------------------------------------------
        description "Ethernet network port"
        ethernet
        exit
        no shutdown
----------------------------------------------
```

3.12.2.4.2 Configuring an Ethernet access port

Services are configured on access ports used for customer-facing traffic. If a service access point (SAP) is to be configured on a port, it must be configured for access mode.

When a port is configured for access mode, the appropriate encapsulation type can be specified to distinguish the services on the port. When a port has been configured for access mode, multiple services may be configured on the port.

Use the following basic CLI syntax to configure Ethernet access mode port parameters.

CLI syntax:

```
port port-id
    mode {access}
    encap-type {dot1q | null | qinq}
```

The following CLI syntax shows an example of configuring an Ethernet port for access mode.

Example:

```
config# port 1/1/2
config>port# description "Ethernet access port"
config>port# ethernet
config>port>ethernet# mode access
config>port>ethernet# encap-type dot1q
config>port>ethernet# exit
config>port# no shutdown
```

Use the **config port info** command to display port configuration information.

```
ALU-A>config>port# info
----------------------------------------------
        description "Ethernet access port"
        ethernet
            mode access
            encap-type dot1q
        exit
        no shutdown
----------------------------------------------
ALU-A>config>port#
```


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3.12.2.4.3 Configuring a hybrid Ethernet port

A hybrid Ethernet port allows the combination of network and access modes of operation on a per-VLAN basis and must be configured for either dot1q or qinq encapsulation.

A hybrid mode port must use dot1q encapsulation to be configured as a network IP interface. Attempting to specify a qinq-encapsulated hybrid port as the port of a network interface is blocked.

When a port has been configured for hybrid mode, multiple services may be configured on the port.

Use the following basic CLI syntax to configure hybrid mode port parameters.

CLI syntax:

```
port port-id
    mode {hybrid}
    encap-type {dot1q | qinq}
```

The following CLI syntax shows an example of configuring a hybrid port for access mode.

Example:

```
config# port 1/1/5
config>port# description “hybrid Ethernet port”
config>port# ethernet
config>port>ethernet# mode hybrid
config>port>ethernet# encap-type dot1q
config>port>ethernet# exit
config>port# no shutdown
```

Use the **config port info** command to display port configuration information.

```
ALU-A>config>port# info
----------------------------------------------
        description “hybrid Ethernet port”
        ethernet
            mode hybrid
            encap-type dot1q
        exit
        no shutdown
----------------------------------------------
ALU-A>config>port#
```

3.12.2.4.4 Configuring 802.1x authentication port parameters

The 7705 SAR supports network access control of client devices (for example, PCs and STBs) on an Ethernet network using the IEEE 802.1x standard. 802.1x is a standard for authenticating customer devices before they can access the network. Authentication is performed using Extensible Authentication Protocol (EAP) over LAN (EAPOL).

802.1x provides protection against unauthorized access by forcing the device connected to the 7705 SAR to go through an authentication phase before it is able to send any non-EAP packets. Only EAPOL frames can be exchanged between the aggregation device (authenticator; for example, the 7705 SAR) and the customer device (supplicant) until authentication is successfully completed.

Use the following CLI syntax to configure an 802.1x Ethernet port.

CLI syntax:

```
port port-id ethernet
```


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```
    dot1x
        max-auth-req max-auth-request
        port-control {auto | force-auth | force-unauth}
        quiet-period seconds
        radius-plcy name
        re-authentication
        re-auth-period seconds
        server-timeout seconds
        supplicant-timeout seconds
        transmit-period seconds
```

The following CLI syntax shows an example of configuring an 802.1x Ethernet port.

Example:

```
config# port 1/5/2 ethernet dot1x
config>port>ethernet>dot1x# port-control auto
config>port>ethernet>dot1x# radius-plcy dot1xpolicy
config>port>ethernet>dot1x# re-auth-period 3500
config>port>ethernet>dot1x# transmit-period 30
config>port>ethernet>dot1x# quiet-period 50
config>port>ethernet>dot1x# supplicant-timeout 30
config>port>ethernet>dot1x# server-timeout 30
```

Use the **config port info** command to display port configuration information.

```
ALU-A>config>port>ethernet>dot1x# info detail
----------------------------------------------
            port-control auto
            radius-plcy dot1xpolicy
            re-authentication
            re-auth-period 3600
            max-auth-req 2
            transmit-period 30
            quiet-period 60
            supplicant-timeout 30
            server-timeout 30
            no mac-auth
            no mac-auth-wait
----------------------------------------------
ALU-A>config>port>ethernet>dot1x#
```

3.12.2.4.5 Configuring MAC authentication port parameters

The 7705 SAR supports a fallback MAC authentication mechanism for client devices (for example, PCs and STBs) on an Ethernet network that do not support 802.1x EAP.

MAC authentication provides protection against unauthorized access by forcing the device connected to the 7705 SAR to have its MAC address authenticated by a RADIUS server before it is able to transmit packets through the 7705 SAR.

Use the following CLI syntax to configure MAC authentication for an Ethernet port.

CLI syntax:

```
port port-id ethernet
    dot1x
        mac-auth
        mac-auth-wait seconds
        port-control auto
        quiet-period seconds
```


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```
        radius-plcy name
```

The following CLI syntax shows an example of configuring MAC authentication for an Ethernet port.

Example:

```
config# port 1/5/2 ethernet dot1x
config>port>ethernet>dot1x# mac-auth
config>port>ethernet>dot1x# mac-auth-wait 20
config>port>ethernet>dot1x# port-control auto
config>port>ethernet>dot1x# quiet-period 60
config>port>ethernet>dot1x# radius-plcy dot1xpolicy
```

Use the **info detail** command to display port configuration information.

```
ALU-A>config>port>ethernet>dot1x# info detail
----------------------------------------------
            port-control auto
            radius-plcy dot1xpolicy
            re-authentication
            re-auth-period 3600
            max-auth-req 2
            transmit-period 30
            quiet-period 60
            supplicant-timeout 30
            server-timeout 30
            mac-auth
            mac-auth-wait 20
----------------------------------------------
ALU-A>config>port>ethernet>dot1x#
```

3.12.2.5 Configuring SONET/SDH port parameters

When configuring a SONET/SDH port, users configure both SONET/SDH and TDM aspects of a channel. The CLI uses the *sonet-sdh-index* variable to identify a channel in order to match SONET/SDH parameters with TDM parameters for the channel. Configuring TDM on a SONET/SDH port is similar to configuring it on a TDM port. See Configuring channelized ports for more information.

This section shows the CLI syntax for the following adapter cards and provides examples for configuring SONET/SDH access and network ports:

- 4-port OC3/STM1 Clear Channel Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

4-port OC3/STM1 Clear Channel Adapter card

Use the following CLI syntax to configure SONET/SDH port parameters on a 4-port OC3/STM1 Clear Channel Adapter card. On the 4-port OC3/STM1 Clear Channel Adapter card, the *sonet-sdh-index* variable in the **path** command is optional and defaults to **sts3**, which cannot be changed.

CLI syntax:

```
port port-id
    sonet-sdh
        clock-source {loop-timed | node-timed}
        framing {sonet | sdh}
        hold-time {[up hold-time-up] [down hold-time-down]}
        loopback {line | internal}
```


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```
        path [sonet-sdh-index]
            atm
                cell-format cell-format
                min-vp-vpi value
            crc {16 | 32}
            description long-description-string
            encap-type {atm | ppp-auto}
            mode {access | network}
            mtu mtu
            network
                accounting-policy policy-id
                collect-stats
                queue-policy name
            payload
            ppp
                keepalive time-interval [dropcount drop-count]
            report-alarm [pais] [plop] [prdi] [pplm] [prei] [puneq]
            scramble
            [no] shutdown
            signal-label value
            trace-string [trace-string]
        report-alarm [loc] [lais] [lrdi] [lb2er-sd] [lb2er-sf] [slof]
[slos] [lrei]
        section-trace {increment-z0 | byte value | string string}
        speed {oc3}
        threshold {ber-sd | ber-sf} rate threshold
        tx-dus
```

2-port OC3/STM1 Channelized Adapter card and 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

Use the following CLI syntax to configure SONET/SDH port parameters on a 2-port OC3/STM1 Channelized Adapter card or a 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card. The *sonet-sdh-index* values are different for each of these adapter cards (see SONET/SDH for more information). The syntax includes the TDM port parameters.

CLI syntax:

```
port port-id
    sonet-sdh
        clock-source {loop-timed | node-timed}
        framing {sonet | sdh}
        group sonet-sdh-index payload {tu3 | vt2 | vt15}
        hold-time {[up hold-time-up] [down hold-time-down]}
        loopback {line | internal}
        path sonet-sdh-index
            atm description-string
                cell-format cell-format
                min-vp-vpi value
            crc {16|32}
            description long-description-string
            encap-type encap-type
            mode {access | network}
            mtu mtu
            network
                accounting-policy policy-id
                collect-stats mtu
                queue-policy name
            ppp
                keepalive time-interval [dropcount drop-count]
            report-alarm [pais] [plop] [prdi] [pplm] [prei] [puneq]
 [plcd]
            scramble
            [no] shutdown
```


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```
            signal-label value
            trace-string [trace-string]
        report-alarm [loc] [lais] [lrdi] [ss1f] [lb2er-sd] [lb2er-sf]
 [slof] [slos] [lrei]
        section-trace {increment-z0 | byte value | string string}
        speed {oc3 | oc12}
        tx-dus
```

CLI syntax:

```
    tdm
        ds1 [ds1-id]
            channel-group channel-group
                atm
                    cell-format cell-format
                    min-vp-vpi value
                cisco-hdlc
                    down-count down-count
                    keepalive time-interval
                    up-count up-count
                crc {16|32}
                description long-description-string
                encap-type {atm|bcp-null| bcp-dot1q|ipcp|ppp-auto| frame-
relay|wan-mirror| cisco-hdlc|cem|hdlc}
                frame-relay
                    lmi-type {ansi|itu|none|rev1}
                    mode {dce|dte|bidir}
                    n391dte intervals
                    n392dce threshold
                    n392dte threshold
                    n393dce count
                    n393dte count
                    t391dte keepalive
                    t392dce keepalive
                idle-cycle-flag {flags|ones}
                idle-payload-fill {all-ones| pattern}
                idle-signal-fill {all-ones| pattern}
                loopback {line|internal}
                mac ieee-address
                mode {access|network}
                mtu mtu-bytes
                network
                    accounting-policy policy-id
                    collect-stats
                    queue-policy name
                ppp
                    ber-sf-link-down
                    keepalive time-period [dropcount drop-count]
                scramble
                [no] shutdown
                signal-mode cas
                timeslots timeslots
            clock-source {loop-timed|node-timed| adaptive| differential}
            framing {esf|sf|ds1-unframed}
            hold-time {[up hold-time-up] [down hold-time-down]}
            loopback {line|internal| fdl-ansi|fdl-bellcore|payload-ansi}
            remote-loop-respond
            report-alarm [ais] [los] [oof] [rai] [looped] [ber-sd] [ber-
sf]
            [no] shutdown
            signal-mode cas
            threshold {ber-sd|ber-sf} rate {1|5|10|50|100}
        ds3 [sonet-sdh-index]
            atm
```


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```
                cell-format cell-format
                mapping mapping
                min-vp-vpi value
            channelized {ds1|e1}
            clock-source {loop-timed|node-timed| differential|free-run}
            crc {16|32}
            description long-description-string
            encap-type {atm|bcp-null|bcp-dot1q| ipcp|ppp-auto|frame-relay|
wan-mirror| cisco-hdlc|cem}
            feac-loop-respond
            frame-relay
                lmi-type {ansi|itu|none|rev1}
                mode {dce|dte|bidir}
                n391dte intervals
                n392dce threshold
                n392dte threshold
                n393dce count
                n393dte count
                t391dte keepalive
                t392dce keepalive
            framing {c-bit|m23|ds3-unframed}
            idle-cycle-flag {flags|ones}
            loopback {line|internal|remote}
            mac ieee-address
            mdl {eic|lic|fic|unit|pfi|port|gen} mdl-string
            mdl-transmit {path|idle-signal| test-signal}
            mode {access|network}
            mtu mtu-bytes
            network
                accounting-policy policy-id
                collect-stats
                queue-policy name
            ppp
                keepalive time-period [dropcount drop-count]
            report-alarm [ais] [los] [oof] [rai] [looped]
            scramble
            [no] shutdown
```

3.12.2.5.1 Configuring a SONET/SDH access port

This section provides examples of configuring a SONET/SDH access port on the following adapter cards:

- 4-port OC3/STM1 Clear Channel Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

4-port OC3/STM1 Clear Channel Adapter card

Use the following CLI syntax to configure a SONET/SDH access port on a 4-port OC3/STM1 Clear Channel Adapter card. The default setting for the **mode** command is access.

CLI syntax:

```
port port-id
    sonet-sdh
        path [sonet-sdh-index]
            encap-type atm
            [no] shutdown
```


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The following CLI syntax shows an example of configuring a SONET/SDH access port on a 4-port OC3/STM1 Clear Channel Adapter card.

Example:

```
config# port 1/2/1
config>port# sonet-sdh
config>port>sonet-sdh# path
config>port>sonet-sdh>path# encap-type atm
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# exit
```

Use the **config port info** command to display SONET/SDH port configuration information.

```
ALU-B>config>port# info
....
#------------------------------------------------
echo "Port Configuration"
#------------------------------------------------
....
    port 1/2/1
        shutdown
        sonet-sdh
            path
                encap-type atm
                atm
                no shutdown
            exit
        exit
    exit
....
```

2-port OC3/STM1 Channelized Adapter card

Use the following CLI syntax to configure a SONET/SDH access port on a 2-port OC3/STM1 Channelized Adapter card.

CLI syntax:

```
port port-id
    sonet-sdh
        path sonet-sdh-index
        path sonet-sdh-index
    tdm
        ds1 ds1-id
            channel-group channel-group
                encap-type atm
                mode access
                [no] shutdown
```

The following CLI syntax shows an example of configuring a SONET/SDH access port on a 2-port OC3/STM1 Channelized Adapter card.

Example:

```
config# port 1/2/2
config>port# sonet-sdh
config>port>sonet-sdh# path sts1-1
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.1
config>port>sonet-sdh>path# no shutdown
```


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```
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# tdm
config>port>tdm# ds1 1.1.1
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# encap-type atm
config>port>tdm>ds1>channel-group# mode access
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# exit
config>port>tdm># exit
config>port# exit
```

4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

Use the following CLI syntax to configure a SONET/SDH access port on a 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.

CLI syntax:

```
port port-id
    sonet-sdh
        path sonet-sdh-index
        path sonet-sdh-index
    tdm
        ds1 ds1-id
            channel-group channel-group
                encap-type cem
                mode access
                [no] shutdown
```

The following CLI syntax shows an example of configuring a SONET/SDH access port on a 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card (4-port mode).

Example:

```
config# port 1/2/3
config>port# sonet-sdh
config>port>sonet-sdh# path sts1-1
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.1
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# tdm
config>port>tdm# ds1 1.1.1
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# encap-type cem
config>port>tdm>ds1>channel-group# mode access
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# exit
config>port>tdm># exit
config>port# exit
```

The following display shows the configuration when the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card is in 4-port mode. Use the **config port info** command to display SONET/SDH port information.

```
ALU-B>config>port# info
....
#------------------------------------------------
```


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```
echo "Port Configuration"
#------------------------------------------------
....
sonet-sdh
            path sts1-1
                payload vt15
                no shutdown
            exit
            path vt15-1.1.1
                no shutdown
            exit
        exit
        tdm
            ds1 1.1.1
                channel-group 1
                    encap-type cem
                    no shutdown
                exit
                no shutdown
            exit
         exit
....
```

The following display shows the configuration when the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card is in 1-port mode. Use the **config port info** command to display SONET/SDH port information.

```
ALU-B>config>port# info
....
#------------------------------------------------
echo "Port Configuration"
#------------------------------------------------
....
sonet-sdh
            path sts1-1.1
                payload vt15
                no shutdown
            exit
            path vt15-1.1.1.1
                no shutdown
            exit
        exit
        tdm
            ds1 1.1.1.1
                channel-group 1
                    encap-type cem
                    no shutdown
                exit
                no shutdown
            exit
         exit
....
```

3.12.2.5.2 Configuring a SONET/SDH network port

This section provides examples of configuring a SONET/SDH network port on the following adapter cards:

- 4-port OC3/STM1 Clear Channel Adapter card
- 2-port OC3/STM1 Channelized Adapter card

4-port OC3/STM1 Clear Channel Adapter card

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Use the following CLI syntax to configure a SONET/SDH network port on a 4-port OC3/STM1 Clear Channel Adapter card.

CLI syntax:

```
port port-id
    sonet-sdh
        path [sonet-sdh-index]
            encap-type ppp-auto
            mode network
            network
                accounting-policy policy-id
                [no] collect-stats
                queue-policy name
            [no] shutdown
```

The following CLI syntax shows an example of configuring a SONET/SDH network port on a 4-port OC3/STM1 Clear Channel Adapter card.

Example:

```
config# port 1/2/2
config>port# sonet-sdh
config>port>sonet-sdh# path
config>port>sonet-sdh>path# mode network
config>port>sonet-sdh>path# encap-type ppp-auto
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# exit
config#
```

Use the **config port info** command to display SONET/SDH port information for the configured port.

```
ALU-B>config>port# info
....
#------------------------------------------------
echo "Port Configuration"
#------------------------------------------------
....
    port 1/2/2
        sonet-sdh
            path
                no shutdown
                mode network
                encap-type ppp-auto
                network
                    queue-policy "default"
                exit
            exit
        exit
        no shutdown
    exit
....
```

2-port OC3/STM1 Channelized Adapter card

Use the following CLI syntax to configure a SONET/SDH network port on a 2-port OC3/STM1 Channelized Adapter card.

CLI syntax:

```
port port-id
    sonet-sdh
```


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```
        path sonet-sdh-index
            payload ds3
            [no] shutdown
    tdm
        ds3 [sonet-sdh-index]
            channelized ds1
            [no] shutdown
        ds1 ds1-id
            channel-group channel-group
                encap-type ppp-auto
                mode network
            [no] shutdown
        [no] shutdown
```

The following CLI syntax shows an example of configuring a SONET/SDH DS1 network port on a 2-port OC3/STM1 Channelized Adapter card. Configuring a SONET/SDH DS3 port is similar but without a channel group.

Example:

```
config# port 1/2/2
config>port# sonet-sdh
config>port>sonet-sdh# path sts1-1
config>port>sonet-sdh>path# payload ds3
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh># exit
config>port# tdm
config>port>tdm# ds3 1
config>port>tdm>ds3# channelized ds1
config>port>tdm>ds3# no shutdown
config>port>tdm>ds3# exit
config>port>tdm# ds1 1.22
config>port>tdm>ds1# channel-group 5
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# exit
config>port>tdm># exit
config>port# exit
config#
```

Use the **config port info** command to display SONET/SDH port information for the configured port.

```
ALU-B>config>port# info
....
#------------------------------------------------
echo "Port Configuration"
#------------------------------------------------
....
    port 1/2/2
        shutdown
        sonet-sdh
            path sts1-1
                no shutdown
            exit
        exit
        tdm
            ds3 1
                channelized ds1
                no shutdown
            exit
```


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```
            ds1 1.22
                shutdown
                channel-group 5
                    mode network
                    encap-type ppp-auto
                    no shutdown
                exit
            exit
        exit
....
```

3.12.2.5.3 Configuring the SONET/SDH port group and path commands

The **group** and **path** commands in the **config>port>sonet-sdh** context both use the *sonet-sdh-index* variable. However, the *sonet-sdh-index* format for each command is different. The full commands are as follows:

- **group** *sonet-sdh-index* **payload** {**tu3** | **vt2** | **vt15**}
- **path** [*sonet-sdh-index*]

The **group** command is only available on SONET/SDH adapter cards that support STS-3 channelization (that is, **path sts3** or **path sts3-1** commands). The payload is **tug-***index* for the STS-3 path. The **group** command is available with SDH framing when an STS-3 path is configured with a payload of **tug3**. The payload of the group determines the next path layer.

The **path** [*sonet-sdh-index*] command is available on all SONET/SDH adapter cards. The *sonet-sdh-index* variable is optional for the 4-port OC3/STM1 Clear Channel Adapter card because the card defaults to **sts3** and no further channelization is possible.

The 7705 SAR SONET/SDH implementation has options for clear channel OC3 and OC12.

The 2-port OC3/STM1 Channelized Adapter card supports DS3/DS1/E1 channelization (not E3), as well as n × DS0 channelization.

The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card supports DS1/E1 channelization but not DS3/E3 and not n × DS0 channelization. In addition, DS1/E1 channels cannot be in DS3/E3 channels. To configure clear channel OC3 and clear channel OC12 on this adapter card, use the **config card 1 mda** *slot* **mda-mode** command to configure either 4-port OC3 mode (**mda-mode p4-oc3**) or 1-port OC12 mode (**mda-mode p1-oc12**).

Use the following CLI syntax to configure the basic channelized OC3/STM1 parameters:

CLI syntax:

```
config# port port-id
sonet-sdh
    framing {sonet|sdh}
    group sonet-sdh-index payload {tu3|vt2|vt15}
    path [sonet-sdh-index]
        payload {sts3|tug3|ds3|e3}
        trace-string [trace-string]
        no shutdown
```

The following CLI syntax shows an example of configuring the basic channelized OC3/STM1 parameters.

Example:

```
config# port 5/2/1
config>port# sonet-sdh
config>port>sonet-sdh# framing sdh
config>port>sonet-sdh# path sts3
```


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```
config>port>sonet-sdh>path# trace-string "HO-path"
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# group tug3-1 payload vt2
config>port>sonet-sdh# group tug3-3 payload vt2
config>port>sonet-sdh# path vt2-1.1.1
config>port>sonet-sdh>path# trace-string "LO-path 3.7.3"
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh#  exit
config>port# tdm
config>port>tdm# e1 1.1.1
config>port>tdm>e1# channel-group 1
config>port>tdm>e1>channel-group# timeslots 2-32
config>port>tdm>e1>channel-group# no shutdown
config>port>tdm>e1>channel-group# exit
config>port>tdm# e1 3.7.3
config>port>tdm>e1# channel-group 2
config>port>tdm>e1>channel-group# timeslots 2-32
config>port>tdm>e1>channel-group# no shutdown
config>port>tdm>e1>channel-group# exit
```

Use the **info** command to display configuration information.

```
A:ALA-49>config>port# info
----------------------------------------------------------------------------------
        sonet-sdh
            framing sdh
            path sts3
                trace-string "HO-path"
                no shutdown
            exit
            group tug3-1 payload vt2
            group tug3-3 payload vt2
            path vt2-1.1.1
                trace-string "LO-path 3.7.3"
                no shutdown
            exit
            path vt2-3.7.3
                no shutdown
            exit
        exit
        tdm
            e1 1.1.1
                channel-group 1
                    timeslots 2-32
                    no shutdown
                exit
                no shutdown
            exit
            e1 3.7.3
                channel-group 2
                    timeslots 2-32
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-49>config>port#
```


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3.12.2.5.4 Configuring SONET/SDH parameters on an Ethernet XGIG WAN port

When an Ethernet port is configured in WAN mode (**xgig wan** command), you can change certain SONET/SDH parameters to reflect the SONET/SDH requirements for the port.

The following CLI output shows an example of a SONET/SDH configuration for a WAN PHY Ethernet port.

```
*A:7705>config>port# info
----------------------------------------------
        shutdown
        ethernet
            xgig wan
        exit
        sonet-sdh
            tx-dus
            suppress-lo-alarm
            threshold ber-sd rate 4
            section-trace increment-z0
            path
                trace-string "hello"
                report-alarm pais
                signal-label 0x20
            exit
        exit
----------------------------------------------
```

3.12.2.6 SONET/SDH channelized port configuration examples

This section contains information about the following topics:

- OC3 channelization using SONET and SDH
- Configuring DS1/E1 on a channelized OC3 port with STS1 path
- Configuring DS1/E1 on a channelized OC3 port with STM path
- Configuring DS1/E1 on a channelized OC3 port with STS3 path
- Configuring a SONET/SDH port with multiple DS1s in an MLPPP bundle

Note: The following sections show examples of OC3 configurations. Similar examples for OC12 configurations would require an extra level in *sonet-sdh-index*. See Table 22: SONET/SDH channelized port syntax examples in SONET/SDH channelized port ID for port syntax examples.

3.12.2.6.1 OC3 channelization using SONET and SDH

In SONET, the base signal is referred to as synchronous transport signal–level 1 (STS-1), which operates at 51.84 Mb/s. Higher-level signals are integer multiples of STS-1, for example, STS-3/OC3 = 3 x STS-1 = 155.52 Mb/s. The SDH equivalent of the SONET STS-1 and STS-3 frames are STM-0 and STM-1, respectively.

In addition to the STS-1 base format, SONET also defines synchronous formats at sub-STS-1 levels. The STS-1 payload can be subdivided into virtual tributaries (VTs) for SONET or virtual containers (VCs) for SDH. VTs and VCs are synchronous signals used to transport lower-speed transmissions. Two VTs are VT1.5 and VT2, where:

- VT1.5 = 1.728 Mb/s (enough to carry a T1)

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- VT2 = 2.304 Mb/s (enough to carry an E1)

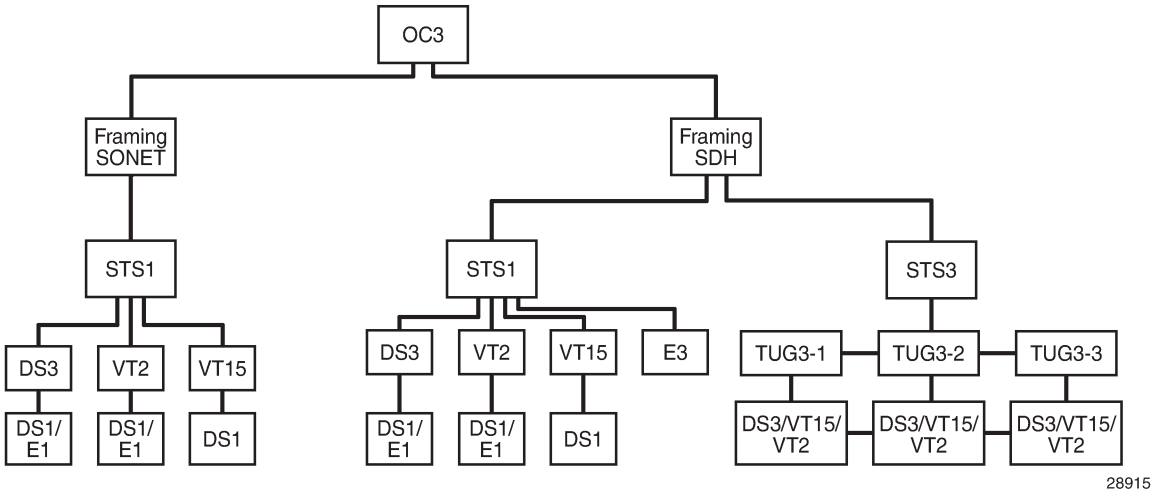
The SDH equivalents to VT1.5 and VT2 are VC11 and VC12, respectively.

Note: The 7705 SAR CLI always uses the SONET command syntax and nomenclature, even when configuring an SDH port. For example, the same SONET CLI syntax and nomenclature would be used to configure both a VT1.5 and a VC11. The **framing** {**sonet** | **sdh**} command determines whether VTs or VCs are being configured. Use the **show>port-tree** command to display SONET/SDH containers.

The following figure shows various possibilities for OC3 channelization using SONET and SDH framing. The VT1.5 and VT2 labels under the SDH STS1 path illustrate that SONET conventions are used for SDH configuration.

Note: The 7705 SAR does not allow a payload of VT1.5 for VT2 paths. The payload for a VT1.5 path is **ds1** and the payload for a VT2 path is **vt2**.

Figure 42: OC3 channelization using SONET and SDH



3.12.2.6.2 Configuring DS1/E1 on a channelized OC3 port with STS1 path

This section provides several examples of configuring DS1/E1 channels and the use of the *sonet-sdh-index* parameter:

- 1. DS1 (SONET framing, STS1)
- 2. E1 (SONET framing, STS1)

1. DS1 (SONET framing, STS1)

There are three STS1 paths per OC3. The following examples use sts1-1.

There are two ways to configure a DS1 channel on a SONET framed port (see Figure 42: OC3 channelization using SONET and SDH, SONET framing branch):

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- STS1 with channelized DS3 payload
- STS1 with VT1.5 payload

STS1 with channelized DS3 payload

To configure a DS1 on an STS1 with a channelized DS3 payload:

1. Create the STS1 path and set the payload to DS3.
2. Create the channelized DS3 on the STS1 path.
3. Create the DS1 on the DS3.

Use the **info** command to display configuration information.

```
        sonet-sdh
            path sts1-1
                payload ds3
                no shutdown
            exit
        exit
        tdm
            ds3 1
                channelized ds1
                no shutdown
            exit
            ds1 1.1
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the **path** command is **sts1-***stsNum*, where:
  - *stsNum* is the STS number, which can be 1, 2, or 3
- the CLI identifier for the TDM **ds3** command is *ds3Num*, where:
  - *ds3Num* is equal to *stsNum*

  In the example above, DS3 is configured on **sts1-1**, hence the numbering **ds3 1**. If **sts1-2** or **sts1-3** was configured instead of **sts1-1**, the corresponding DS3 configuration would be **ds3 2** or **ds3 3**, respectively.
- the CLI identifier for the TDM **ds1** command is *ds3Num.ds1Num*, where:
  - *ds1Num* is the DS1 number. Because a DS3 can carry 28 T1s, *ds1Num* can be between 1 and 28.

STS1 with VT1.5 payload

To configure a DS1 on an STS1 with a VT1.5 payload:

1. Create the STS1 path and set the payload to VT1.5.
2. Create the VT1.5 path on the STS1 path.
3. Create the DS1 on the VT1.5 path.

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Note: There is one DS1 per VT1.5 path.

Use the **info** command to display configuration information. The example below creates two VT1.5 paths, each with its own DS1.

```
        sonet-sdh
            path sts1-1
                payload vt15
                no shutdown
            exit
            path vt15-1.1.1
                payload ds1
                no shutdown
            exit
            path vt15-1.7.4
                payload ds1
                no shutdown
            exit
        exit
        tdm
            ds1 1.1.1
                no shutdown
            exit
            ds1 1.7.4
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the VT1.5 **path** command is **vt15-***stsNum.vtGroupNum.vtNum*, where:
  - **vt15-** is a keyword
  - *stsNum* is the STS1 number, which can be 1, 2, or 3
  - *vtGroupNum* is the VT group number. An STS1 frame contains seven VT groups, so *vtGroupNum* can be from 1 to 7
  - *vtNum* is the VT1.5 number. A VT group can hold four VT1.5 paths, so *vtNum* can be from 1 to 4
- the CLI identifier for the TDM **ds1** command is similar to the **path** command, namely, *stsNum.vtGroupNum.ds1Num*, where:
  - *ds1Num* is equal to *vtNum*

2. E1 (SONET framing, STS1)

A DS3 can be configured to carry an E1 payload (see Figure 42: OC3 channelization using SONET and SDH, SONET framing branch).

To configure an E1 on an STS1 with a DS3 payload:

1. Create the STS1 path and set the payload to DS3.
2. Create the TDM DS3 with channelized E1.
3. Create the TDM E1.

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Use the **info** command to display configuration information. In the example below, which applies only to the 2-port OC3/STM1 Channelized Adapter card, DS3 1 carries two E1 channels.

```
        sonet-sdh
            path sts1-1
                payload ds3
                no shutdown
            exit
        exit
        tdm
            ds3 1
                no shutdown
                channelized e1
            exit
            e1 1.1
                no shutdown
            exit
            e1 1.21
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the **path** command is **sts1-***stsNum*, where:
  - *stsNum* is between 1 and 3
- the CLI identifier for the TDM **ds3** command is *ds3Num*, where:
  - *ds3Num* is equal to *stsNum*

  In the example above, DS3 is configured on **sts1-1**, hence the command **ds3 1**. If **sts1-2** or **sts1-3** was configured instead of **sts1-1**, the corresponding **ds3** configuration would be **ds3 2** or **ds3 3**, respectively.
- the CLI identifier for the TDM **e1** command is *ds3Num.e1Num*, where:
  - *e1Num* is between 1 and 21 because a DS3 can carry 21 E1s

3.12.2.6.3 Configuring DS1/E1 on a channelized OC3 port with STM path

A SONET framed port—as well as an SDH framed port—can be divided into three STS1 paths. Each SONET port can be subdivided further into lower-speed virtual tributaries (VTs). Similarly, each SDH port can be subdivided into lower-speed virtual containers (VCs). As stated in OC3 channelization using SONET and SDH, the CLI uses SONET STS1/VT configuration conventions to configure SDH VC paths.

The following examples illustrate the use of SONET CLI terminology to configure SDH paths. See the STS1 branch under SDH framing in Figure 42: OC3 channelization using SONET and SDH.

- 1. DS1 (SDH framing, STS1)
- 2. E1 (SDH framing, STS1)

1. DS1 (SDH framing, STS1)

There are two ways to configure a DS1 channel on an SDH-framed port with STS1 paths:

- STS1 with channelized DS3 payload

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- STS1 with VT1.5 payload

STS1 with channelized DS3 payload

To configure a DS1 on an STS1 with a channelized DS3 payload:

1. Create the STS1 path and set the payload to DS3.
2. Create the TDM DS3 with channelized DS1.
3. Create the TDM DS1.

Use the **info** command to display configuration information.

```
        sonet-sdh
            framing sdh
            path sts1-1
                payload ds3
                no shutdown
            exit
        exit
        tdm
            ds3 1
                channelized ds1
                no shutdown
            exit
            ds1 1.1
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the **path** command is **sts1-***stsNum*:
  - where *stsNum* is between 1 and 3
- the CLI identifier for the TDM **ds3** command is *ds3Num*, where:
  - *ds3Num* is equal to *stsNum*

  In the example above, DS3 is configured on **sts1-1**, hence the command **ds3 1**. If **sts1-2** or **sts1-**3 was configured instead of **sts1-1**, the corresponding **ds3** configuration would be **ds3 2** or **ds3 3**, respectively.
- the CLI identifier for the TDM **ds1** command is *ds3Num.ds1Num*, where:
  - *ds1Num* is between 1 and 28 because a DS3 can carry 28 T1s

STS1 with VT1.5 payload

To configure a DS1 on an STS1 with a VT1.5 payload:

1. Create the STS1 path and set the payload to VT1.5.
2. Create the VT1.5 path and set the payload to DS1.
3. Create the corresponding TDM DS1.

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Note: There is one DS1 per VT1.5 path.

Use the **info** command to display configuration information. This example creates two VT1.5 payloads, each having a corresponding DS1 channel.

```
        sonet-sdh
            framing sdh
            path sts1-1
                payload vt15
                no shutdown
            exit
            path vt15-1.1.1
                payload ds1
                no shutdown
            exit
            path vt15-1.7.4
                payload ds1
                no shutdown
            exit
        exit
        tdm
            ds1 1.1.1
                no shutdown
            exit
            ds1 1.7.4
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the VT1.5 **path** command is **vt15-***stsNum.vtGroupNum.vtNum*
  - **vt15-** is a keyword
  - *stsNum* is the STS1 number, which can be 1, 2, or 3
  - *vtGroupNum* is the VT group number. An STS1 frame contains seven VT groups, so *vtGroupNum* can be from 1 to 7
  - *vtNum* is the VT1.5 number. A VT group can hold four VT1.5 paths, so *vtNum* can be from 1 to 4
- the CLI identifier for the TDM **ds1** command is similar to the **path** command, namely, *stsNum.vtGroupNum.ds1Num*, where:
  - *ds1Num* is equal to *vtNum*

2. E1 (SDH framing, STS1)

There are two ways to configure an E1 channel on an SDH-framed port with STS1 paths (see the STS1 branch under SDH framing in Figure 42: OC3 channelization using SONET and SDH):

- STS1 with channelized DS3 payload
- STS1 with VT2 payload

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STS1 with channelized DS3 payload

To configure an E1 on an STS1 with a DS3 payload:

1. Create the STS1 path with SDH framing and set the payload to DS3.
2. Create a TDM DS3 with a channelized E1.
3. Create the corresponding E1.

Use the **info** command to display configuration information. In the example below, DS3 1 carries two E1 channels.

```
        sonet-sdh
            framing sdh
            path sts1-1
                payload ds3
                no shutdown
            exit
        exit
        tdm
            ds3 1
                no shutdown
                channelized e1
            exit
            e1 1.1
                no shutdown
            exit
            e1 1.21
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the **path** command is **sts1-***stsNum*, where:
  - *stsNum* is between 1 and 3
- the CLI identifier for the TDM **ds3** command is *ds3Num*, where:
  - *ds3Num* is equal to *stsNum*

  In the example above, DS3 is configured on **sts1-1**, hence the command **ds3 1**. If **sts1-2** or **sts1-3** was configured instead of **sts1-1**, the corresponding **ds3** configuration would be **ds3 2** or **ds3 3**, respectively.
- the CLI identifier for the TDM **e1** command is *ds3Num*.*e1Num*, where:
  - *e1Num* is between 1 and 21 because a DS3 can carry 21 E1s

STS1 with VT2 payload

To configure an E1 on an STS1 with a VT2 payload:

1. Create the STS1 path and set the payload to VT2.
2. Create the VT2 path and set the payload to E1.
3. Create the corresponding TDM E1.

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Note: There is one E1 per VT2 path.

Use the **info** command to display configuration information.

```
        sonet-sdh
            framing sdh
            path sts1-1
                no shutdown
                payload vt2
            exit
            path vt2-1.6.3
                payload e1
                no shutdown
            exit
        exit
        tdm
            e1 1.6.3
                no shutdown
            exit
        exit
        no shutdown
```

Notes:

- the CLI identifier for the VT2 **path** command is *vt2-stsNum.vtGroupNum.vtNum*, where:
  - *vt2-* is a keyword
  - *stsNum* is the STS1 number, which can be 1, 2, or 3
  - *vtGroupNum* is the VT group number. An STS1 frame contains seven VT groups, so *vtGroupNum* can be from 1 to 7
  - *vtNum* is the VT2 number. A VT group can hold three VT2 paths, so *vtNum* can be from 1 to 3
- the CLI identifier for the TDM **e1** command is similar to the **path** command, namely, *stsNum.vtGroupNum.e1Num*, where:
  - *e1Num* is equal to *vtNum*

3.12.2.6.4 Configuring DS1/E1 on a channelized OC3 port with STS3 path

Unique to an SDH framed port is the ability to configure a single STS3 path instead of three STS1 paths. When as STS3 path is configured, the VTs are configured using tributary units (TUs). One or more TUs can be combined into a tributary unit group (TUG) (see the STS3 branch in Figure 42: OC3 channelization using SONET and SDH).

When an STS3 path is configured on an SDH port, the three TUGs in the following configuration are created by default. Each TUG can be considered the equivalent of an STS1 path.

```
port 1/1/1
  sonet-sdh
    framing sdh
      path sts3
    exit
  group tug3-1 payload tu3
  group tug3-2 payload tu3
  group tug3-3 payload tu3
```


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This section provides information about the following topics:

- 1. DS1 (SDH framing, STS3)
- 2. E1 (SDH framing, STS3)

1. DS1 (SDH framing, STS3)

There are two ways to configure a DS1 on an SDH framed port with an STS3 path:

- STS3 / TUG with VT1.5 payload
- STS3 / TUG with TU3 payload

STS3 / TUG with VT1.5 payload

To configure a DS1 on an STS3 / TUG with a VT1.5 payload:

1. Configure an STS3 path on the port.
2. Configure one of the three TUGs for a VT1.5 payload.
3. Create a VT1.5 path with a DS1 payload on the STS3 path / TUG.
4. Create a DS1 on the VT1.5 path.

Use the **info** command to display configuration information.

```
        sonet-sdh
            framing sdh
            path sts3
                no shutdown
            exit
            group tug3-1 payload vt15
            path vt15-1.2.3
                payload ds1
                no shutdown
            exit
        exit
        tdm
            ds1 1.2.3
                no shutdown
            exit
```

Notes:

- the CLI identifier for the VT1.5 path is **vt15**-*tugNum.vtGroupNum.vtNum*, where:
  - **vt15-** is a keyword
  - *tugNum* is the TUG number, which can be 1, 2, or 3
  - *vtGroupNum* is the VT group number. A TUG3 contains seven VT groups, so *vtGroupNum* can be from 1 to 7
  - *vtNum* is the VT1.5 number. A VT group can hold four VT1.5 paths, so *vtNum* can be from 1 to 4
- the CLI identifier for the TDM **ds1** command is similar to that of the **path** command, namely, *tugNum.vtGroupNum.ds1Num*, where:
  - *ds1Num* is equal to *vtNum*

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STS3 / TUG with TU3 payload

To configure a DS1 on an STS3 / TUG with a TU3 payload:

1. Configure an STS3 path on the port.
2. Create a TU3 path with the default payload.
3. Create the TDM DS3 with channelized DS1.
4. Create the TDM DS1.

Use the **info** command to display configuration information.

```
        sonet-sdh
            framing sdh
            path sts3
                no shutdown
            exit
            path tu3-1
               no shutdown
           exit
       exit
       tdm
           ds3 1
               channelized ds1
               no shutdown
           exit
           ds1 1.1
               no shutdown
           exit
       exit
```

Notes:

- The CLI identifier for the TDM **ds1** command is similar to that of the **path** command, namely, *tugNum.vtGroupNum.ds1Num*, where:
  - *ds1Num* is equal to *vtNum*

2. E1 (SDH framing, STS3)

To configure an E1 on an SDH framed port with an STS3 path:

1. Configure an STS3 path on the port.
2. Configure one of the three TUGs for a VT2 payload.
3. Create a VT2 path with an E1 payload on the STS3 path / TUG.
4. Create an E1 on the VT2 path.

Use the **info** command to display configuration information.

```
        sonet-sdh
            framing sdh
            path sts3
                no shutdown
            exit
            group tug3-1 payload vt2
            path vt2-1.2.3
                payload e1
```


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```
                no shutdown
            exit
        exit
        tdm
            e1 1.2.3
                no shutdown
            exit
        exit
```

Notes:

- the CLI identifier for the VT2 **path** command is **vt2**-*tugNum.vtGroupNum.vtNum*, where:
  - *tugNum* is the TUG number, which can be 1, 2, or 3
  - *vtGroupNum* is the VT group number. A TUG3 contains seven VT groups, so *vtGroupNum* can be from 1 to 7
  - *vtNum* is the VT2 number. A VT group can hold three VT2 paths, so *vtNum* can be from 1 to 3
- the CLI identifier for the TDM **e1** command is similar to the **path** command, namely, *tugNum.vtGroupNum.e1Num*, where:
  - *e1Num* is equal to *vtNum*

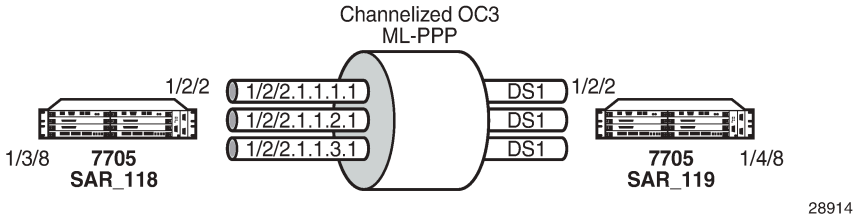
3.12.2.6.5 Configuring a SONET/SDH port with multiple DS1s in an MLPPP bundle

The following figure illustrates the setup to configure port 1/2/2 on 7705 SAR_118 as a SONET/SDH port with three DS1s on a channelized OC3/STM1 adapter card using SDH or SONET framing, and to configure the three DS1s for use in an MLPPP bundle on the network side.

This section provides information about the following topics:

- Configuring the network port
- Verifying the configured network ports
- Verifying the available channelization

Figure 43: Configuring SONET/SDH network port



3.12.2.6.5.1 Configuring the network port

1. Configure the DS1s.

   The following CLI syntax shows an example of configuring three DS1s on a channelized OC3/STM1 adapter card using SDH framing. The framing must match on both ends.

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If SONET framing is needed, use the CLI syntax after this SDH syntax.

CLI syntax:

```
configure port 1/2/2
config>port# description "to-SAR119"
config>port# sonet-sdh
config>port>sonet-sdh# framing sdh
config>port>sonet-sdh# path sts3 no shutdown
config>port>sonet-sdh# group tug3-1 payload vt15
config>port>sonet-sdh# path vt15-1.1.1
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.2
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.3
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# tdm
config>port>tdm# ds1 1.1.1
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# no shutdown
config>port>tdm>ds1# exit
config>port>tdm# ds1 1.1.2
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# no shutdown
config>port>tdm>ds1# exit
config>port>tdm# ds1 1.1.3
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# no shutdown
config>port>tdm>ds1# exit
config>port>tdm# exit
config>port# exit
*A:SAR118#
```

The following CLI syntax shows the configuration of the same example using SONET framing. The framing must match on both ends.

CLI syntax:

```
configure port 1/2/2
config>port# description "to-SAR119"
config>port# sonet-sdh
config>port>sonet-sdh# framing sonet
config>port>sonet-sdh# path sts1-1
config>port>sonet-sdh>path# payload vt15
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.1
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.2
```


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```
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# path vt15-1.1.3
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# tdm
config>port>tdm# ds1 1.1.1
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# no shutdown
config>port>tdm>ds1# exit
config>port>tdm# ds1 1.1.2
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# no shutdown
config>port>tdm>ds1# exit
config>port>tdm# ds1 1.1.3
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# mode network
config>port>tdm>ds1>channel-group# encap-type ppp-auto
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm>ds1# no shutdown
config>port>tdm>ds1# exit
config>port>tdm# exit
config>port# exit
```

2. Create an MLPPP bundle using the three DS1s.

CLI syntax:

```
configure port bundle-ppp-1/2.1
config>port# multilink-bundle
config>port>ml-bundle# member 1/2/2.1.1.1.1
config>port>ml-bundle# member 1/2/2.1.1.2.1
config>port>ml-bundle# member 1/2/2.1.1.3.1
config>port>ml-bundle# exit
config>port# no shutdown
config>port# exit
```

3. Repeat the same configurations on 7705 SAR_119 port 1/2/2.

3.12.2.6.5.2 Verifying the configured network ports

```
*A:SAR118# show port 1/2
===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
1/2/1       Down  No   Down
1/2/2       Up    Yes  Link Up                                 OC3-SR-MM
1/2/2.1.1.1.1
```


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```
            Up    Yes  Up      1572 1572    1 netw pppa tdm
1/2/2.1.1.2.1
            Up    Yes  Up      1572 1572    1 netw pppa tdm
1/2/2.1.1.3.1
            Up    Yes  Up      1572 1572    1 netw pppa tdm
===============================================================================
*A:SAR118#
```

3.12.2.6.5.3 Verifying the available channelization

Use the **port-tree** command to confirm the current channelization of the OC3 channel.

Until port 1/2/1 is configured, the default STS3 is subdivided into three STS1s, each having a payload type of DS3.

```
*A:SAR119# show port-tree 1/2/1
    ifIndex  type, sonet-sdh-index (* = provisioned)
===========  ======================================
   37781504  Port, N/A *
  574652417      STS3, none
  574652478          STS1, sts1-1
  574652481              DS3, 1
  574652484          STS1, sts1-2
  574652487              DS3, 2
  574652488          STS1, sts1-3
  574653222              DS3, 3
```

When port 1/2/1 path **sts1-1** has been provisioned (indicated in the following output by an "*" in line 574652478), all the available VT1.5 paths under **sts1-1** on port 1/2/1 are created and listed. In this case, all seven VT groups (VTGs) are listed, each containing four VT1.5 paths. The remaining two STS1s (**sts1-2** and **sts1-3**) still have DS3 payloads.

Note: The same **show port-tree** display is used for both SONET and SDH. The SONET nomenclature is used to show both SONET and SDH hierarchies.

The following command provisions **sts1-1** with VT1.5 paths, which appear in the **port-tree** command that follows.

```
*A:SAR119# configure port 1/2/1 sonet-sdh path sts1-1 payload vt15

*A:SAR119# show port-tree 1/2/1
    ifIndex  type, sonet-sdh-index (* = provisioned)
===========  ======================================
   37781504  Port, N/A *
  574652417      STS3, none
  574652478          STS1, sts1-1 *
  N/A                    VTG, 1.1
  574653223                  VT15, vt15-1.1.1
  574653224                      DS1, 1.1.1
  574653249                  VT15, vt15-1.1.2
  574653250                      DS1, 1.1.2
  574653275                  VT15, vt15-1.1.3
  574653276                      DS1, 1.1.3
  574653301                  VT15, vt15-1.1.4
  574653302                      DS1, 1.1.4
  N/A                    VTG, 1.2
  574653328                  VT15, vt15-1.2.1
  574653329                      DS1, 1.2.1
  574653354                  VT15, vt15-1.2.2
```


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```
  574653355                       DS1, 1.2.2
  574653380                   VT15, vt15-1.2.3
  574653381                       DS1, 1.2.3
  574653406                   VT15, vt15-1.2.4
  574653407                       DS1, 1.2.4
  N/A                     VTG, 1.3
  574653433                   VT15, vt15-1.3.1
  574653434                       DS1, 1.3.1
  574653459                   VT15, vt15-1.3.2
  574653460                       DS1, 1.3.2
  574653485                   VT15, vt15-1.3.3
  574653486                       DS1, 1.3.3
  574653511                   VT15, vt15-1.3.4
  574653512                       DS1, 1.3.4
  N/A                     VTG, 1.4
  574653538                   VT15, vt15-1.4.1
  574653539                       DS1, 1.4.1
  574653564                   VT15, vt15-1.4.2
  574653565                       DS1, 1.4.2
  574653590                   VT15, vt15-1.4.3
  574653591                       DS1, 1.4.3
  574653616                   VT15, vt15-1.4.4
  574653617                       DS1, 1.4.4
  N/A                     VTG, 1.5
  574653643                   VT15, vt15-1.5.1
  574653644                       DS1, 1.5.1
  574653669                   VT15, vt15-1.5.2
  574653670                       DS1, 1.5.2
  574653695                   VT15, vt15-1.5.3
  574653696                       DS1, 1.5.3
  574653721                   VT15, vt15-1.5.4
  574653722                       DS1, 1.5.4
  N/A                     VTG, 1.6
  574653748                   VT15, vt15-1.6.1
  574653749                       DS1, 1.6.1
  574653774                   VT15, vt15-1.6.2
  574653775                       DS1, 1.6.2
  574653800                   VT15, vt15-1.6.3
  574653801                       DS1, 1.6.3
  574653826                   VT15, vt15-1.6.4
  574653827                       DS1, 1.6.4
  N/A                     VTG, 1.7
  574653853                   VT15, vt15-1.7.1
  574653854                       DS1, 1.7.1
  574653879                   VT15, vt15-1.7.2
  574653880                       DS1, 1.7.2
  574653905                   VT15, vt15-1.7.3
  574653906                       DS1, 1.7.3
  574653931                   VT15, vt15-1.7.4
  574653932                       DS1, 1.7.4
  574652484             STS1, sts1-2
  574652487                 DS3, 2
  574652488             STS1, sts1-3
  574653222                 DS3, 3
*A:SAR119#
```

3.12.2.7 Configuring voice ports

Use the following CLI syntax to configure an analog voice port on a 6-port E&M Adapter card.

CLI syntax:

```
port port-id
```


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```
    voice
        audio-wires {four-wires | two-wires}
        [no] em
            [no] channel-group channel-group-id
                [no] description description-string
                [no] encap-type cem
                mode access
                [no] shutdown
            fault-signaling {idle | seized}
            [no] idle-code abcd-code
            [no] seized-code abcd-code
            [no] loopback {internal-analog | internal-digital}
            signaling-lead
                e {high | low | end-to-end}
                m {high | low | end-to-end}
            signaling-mode {em | transmission-only}
            [no] shutdown
        tlp-rx {-16.0 | -15.9 | ... | 6.9 | 7.0}
        tlp-tx {-16.0 | -15.9 | ... | 6.9 | 7.0}
```

The following CLI syntax shows an example of configuring an analog voice port on a 6-port E&M Adapter card. The default values are used for the commands that are not shown in the example.

Example:

```
config# port 1/1/1
config>port# voice
config>port>voice# em
config>port>voice# em# channel-group 1
config>port>voice# em# channel-group# mode access
config>port>voice# em# channel-group# encap-type cem
config>port>voice# em# channel-group# no shutdown
config>port>voice# em# channel-group# exit
config>port>voice# em# signaling-lead
config>port>voice# em# signaling-lead# e high
config>port>voice# em# signaling-lead# exit
config>port>voice# em# signaling-mode
config>port>voice# em# signaling-mode# em
config>port>voice# em# signaling-mode# exit
config>port>voice# em# no shutdown
config>port>voice# em# exit
config>port>voice# exit
config>port# no shutdown
config>port# exit
config#
```

Use the following CLI syntax to configure an analog voice port on an 8-port Voice & Teleprotection card.

CLI syntax:

```
port port-id
    voice
        fxo
            channel-group channel-group-id
                description description-string
                encap-type {cem}
                mode access
                no shutdown
            fault-signaling {idle | seized}
            loopback {internal-digital}
            no shutdown
        fxs
            channel-group channel-group-id
                description description-string
```


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```
                encap-type cem
                mode access
                no shutdown
            fault-signaling {idle | seized}
            loopback {internal-digital}
            ring-generation {16 | 20 | 25}
            no shutdown
        line-balance {nominal | 800 | short | long}
        signaling-type {3600plar | 1511plar | 3600ls | 1511profile1 |
 3600re | 1511sn137}
        tlp-rx decibels {-7.0 | -6.9 | ... | -0.1 | 0.0}
        tlp-tx decibels {-4.0 | -3.9 | ... | 2.9 | 3.0}
```

The following CLI syntax shows an example of configuring an analog voice port on an 8-port Voice & Teleprotection card. The default values are used for the commands that are not shown in the example.

Example:

```
config# port 1/1/6
config>port# voice
config>port>voice# fxo
config>port>voice>fxo# channel-group 1
config>port>voice>fxo>channel-group# mode access
config>port>voice>fxo>channel-group# encap-type cem
config>port>voice>fxo>channel-group# no shutdown
config>port>voice>fxo>channel-group# exit
config>port>voice>fxo# no shutdown
config>port>voice>fxo# exit
config>port>voice# exit
config>port# no shutdown
config>port# exit
config#
```

Use the following CLI syntax to configure an analog voice port on an 8-port FXO Adapter card.

CLI syntax:

```
port port-id
    voice
        fxo
            channel-group channel-group-id
                description description-string
                encap-type cem
                mode access
                no shutdown
            fault-signaling {idle | seized}
            loopback internal-digital
            no shutdown
        line-balance {nominal | 800}
        signaling-type {3600ls | 1511profile1 | 3600re | 1511sn137}
        tlp-rx decibels {-7.0 | -6.9 | ... | -0.1 | 0.0}
        tlp-tx decibels {-4.0 | -3.9 | ... | 2.9 | 3.0}
```

The following CLI syntax shows an example of configuring an analog voice port on an 8-port FXO Adapter card. The default values are used for the commands that are not shown in the example.

Example:

```
config# port 1/1/6
config>port# voice
config>port>voice# fxo
config>port>voice>fxo# channel-group 1
config>port>voice>fxo>channel-group# mode access
config>port>voice>fxo>channel-group# encap-type cem
```


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```
config>port>voice>fxo>channel-group# no shutdown
config>port>voice>fxo>channel-group# exit
config>port>voice>fxo# no shutdown
config>port>voice>fxo# exit
config>port>voice# exit
config>port# no shutdown
config>port# exit
config#
```

Use the following CLI syntax to configure an analog voice port on a 6-port FXS Adapter card.

CLI syntax:

```
port port-id
    voice
        fxs
            channel-group channel-group-id
                description description-string
                encap-type cem
                mode access
                no shutdown
            fault-signaling {idle | seized}
            loopback internal-digital
            no shutdown
        line-balance {nominal | 800}
        ring-generation {16 | 20 | 25}
        signaling-type {3600plar | 1511plar |3600ls |1511profile1 | 3600re
 | 1511sn137}
        tlp-rx {-7.0 | -6.9 | ... | -0.1 | 0.0}
        tlp-tx {-4.0 | -3.9 | ... | 2.9 | 3.0}
```

The following CLI syntax shows an example of configuring an analog voice port on a 6-port FXS Adapter card.

Example:

```
config# port 1/6/1
config>port# voice
config>port>voice# fxs
config>port>voice>fxs# channel-group 1
config>port>voice>fxs>channel-group# mode access
config>port>voice>fxs>channel-group# encap-type cem
config>port>voice>fxs>channel-group# no shutdown
config>port>voice>fxs>channel-group# exit
config>port>voice>fxs# no shutdown
config>port>voice>fxs# exit
config>port>voice# line-balance nominal
config>port>voice# ring-generation 16
config>port>voice# signaling-type 3600ls
config>port>voice# tlp-rx -7.0
config>port>voice# tlp-tx -4.0
config>port>voice# exit
config>port# exit
```

3.12.2.8 Configuring codirectional G.703 ports

Use the following CLI syntax to configure a codirectional G.703 port on an 8-port Voice & Teleprotection card.

CLI syntax:

```
port port-id
```


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```
    tdm
        codir
            channel-group channel-group-id
                description description-string
                encap-type cem
                mode access
                no shutdown
            loopback {internal | line}
            report-alarm {ais | los}
            no shutdown
```

The following CLI syntax shows an example of configuring a codirectional G.703 port on an 8-port Voice & Teleprotection card.

Example:

```
config# port 1/1/2
config>port# tdm
config>port>tdm>codir
config>port>tdm>codir# channel-group 1
config>port>tdm>codir>channel-group# description "CG 1"
config>port>tdm>codir>channel-group# encap-type cem
config>port>tdm>codir>channel-group# mode access
config>port>tdm>codir>channel-group# no shutdown
config>port>tdm>codir>channel-group# exit
config>port>tdm>codir# loopback line
config>port>tdm>codir# report-alarm ais
config>port>tdm>codir# no shutdown
config>port>tdm>codir# exit
config>port>tdm# exit
```

3.12.2.9 Configuring teleprotection ports

Use the following CLI syntax to configure a teleprotection port on an 8-port Voice & Teleprotection card or 8-port C37.94 Teleprotection card.

CLI syntax:

```
port port-id
    tdm
        tpif
            channel-group channel-group-id
                description description-string
                encap-type cem
                mode access
                no shutdown
                timeslots timeslots
            framing {framed | unframed}
            loopback {internal | line}
            report-alarm {los | rai}
            no shutdown
```

The following CLI syntax shows an example of configuring a teleprotection port on an 8-port Voice & Teleprotection card or an 8-port C37.94 Teleprotection card.

Example:

```
config# port 1/1/3
config>port# tdm
config>port>tdm>tpif
config>port>tdm>tpif# channel-group 1
config>port>tdm>tpif>channel-group# description "TPIF 1"
```


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```
config>port>tdm>tpif>channel-group# encap-type cem
config>port>tdm>tpif>channel-group# mode access
config>port>tdm>tpif>channel-group# timeslots 1
config>port>tdm>tpif>channel-group# no shutdown
config>port>tdm>tpif>channel-group# exit
config>port>tdm>tpif# framing framed
config>port>tdm>tpif# loopback internal
config>port>tdm>tpif# report-alarm los
config>port>tdm>tpif# no shutdown
config>port>tdm>tpif# exit
config>port>tdm# exit
```

3.12.2.10 Configuring TDM PPP

Use the following CLI syntax to configure PPP parameters for TDM DS3/E3 ports or DS3 channels.

CLI syntax:

```
port port-id
    tdm
        ds3
            encap-type ppp-auto
            mode network
            ppp
                keepalive time-interval [dropcount drop-count]
                no keepalive
        e3
            encap-type ppp-auto
            mode network
            ppp
                keepalive time-interval [dropcount drop-count]
                no keepalive
```

3.12.2.11 Configuring channelized ports

Channelized ports are supported on the following cards and modules:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 12-port Serial Data Interface card
- 6-port E&M Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 4-port DS3/E3 Adapter card
- 8-port Voice & Teleprotection card
- 8-port C37.94 Teleprotection card
- 4-port T1/E1 and RS-232 Combination module
- 8-port FXO Adapter card
- 6-port FXS Adapter card

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Note: Ethernet ports cannot be channelized.

When configuring channelized ports, the port ID is specified in different ways depending on the TDM type and level of channelization, as follows:

- N × DS0 in DS1 port.*channel-group*, where *channel-group* is 1 to 24
- N × DS0 in E1 port.*channel-group*, where *channel-group* is 1 to 32
- N × DS1 in DS3 port.DS1 port.*channel-group*, where *channel-group* is 1 to 24
- N × E1 in E3 port.E1 port.*channel-group*, where *channel-group* is 1 to 32
- 1 × DS0 in V.35, RS-232, or X.21 port.*channel-group*, where*channel-group* is 1
- 1 × DS0 in E&M, FXO, or FXS port.*channel-group*, where*channel-group* is 1
- 1 × DS0 in codirectional port.*channel-group*, where *channel-group* is 1
- N × DS0 in TPIF port.*channel-group*, where *channel-group* is 1

3.12.2.11.1 Verifying the adapter card type

To ensure that you have a channel-capable adapter card, verify the adapter card you are configuring by using the **show mda** command.

In the following example, mda 1, mda 3, mda 4, and mda 6 show channelized adapter cards on the 7705 SAR-8 Shelf V2.

```
*A:NOK-1# show mda
===============================================================================
MDA Summary
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)           State     State
-------------------------------------------------------------------------------
1     1     a12-sdiv2                                 up        up
      2     a4-oc3                                    up        up
      3     a16-chds1v2                               up        up
      4     a4-chds3v2                                up        up
      5     a8-1gb-sfp                                up        up
      6     a2-choc3                                  up        up
===============================================================================
*A:NOK-1
```

Use the **show mda detail** command to show detailed information for the channelized adapter cards shown in the previous example.

```
*A:NOK-1# show mda 1/1 detail
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)           State     State
-------------------------------------------------------------------------------
1     1     a12-sdiv2                                 up        provisioned

MDA Specific Data
    Maximum port count            : 12
    Number of ports equipped      : 12
```


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```
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : TRUE
    Capabilities                  : Serial, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : Serial RS-232
    Max number of channels        : 12
    Channels in use               : 2

CEM MDA Specific Data
    Clock Mode                    : n/a

Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : provisioned
    Software version              : N/A
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
    Base MAC address              :
===============================================================================
*A:NOK-1#


*A:NOK-1# show mda 1/3 detail
===============================================================================
MDA 1/3 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
                Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
1     3     a16-chds1v2                                   up        up

MDA Specific Data
    Maximum port count            : 16
    Number of ports equipped      : 16
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : TDM, PPP, ATM, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS1
    Max number of channels        : 256
    Channels in use               : 3

CEM MDA Specific Data
    Clock Mode                    : adaptive

Hardware Data
    Part number                   : Sim Part#
    CLEI code                     : Sim CLEI
    Serial number                 : mda-3
    Manufacture date              : 01012003
    Manufacturing string          : Sim MfgString mda-3
    Manufacturing deviations      : Sim MfgDeviation mda-3
    Administrative state          : up
    Operational state             : up
```


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```
    Software version              : N/A
    Time of last boot             : N/A
    Current alarm state           : alarm active
    Base MAC address              : a4:58:01:03:00:01
===============================================================================
*A:NOK-1#

*A:NOK-1# show mda 1/5 detail
===============================================================================
MDA 1/5 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
                Equipped Type (if different)             State     State
-------------------------------------------------------------------------------
1     5     a2-choc3                                     up        up

MDA Specific Data
    Maximum port count            : 2
    Number of ports equipped      : 2
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Sonet, TDM, PPP, ATM
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS3
    Max number of channels        : 512
    Channels in use               : 0

Hardware Data
    Part number                   : 3HE03127AAAB0102
    CLEI code                     : IPU3AFPEAA
    Serial number                 : NS092040281
    Manufacture date              : 05192009
    Manufacturing string          : ECO C03759
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 37C
    Temperature threshold         : 75C
    Software version              : N/A
    Time of last boot             : 2009/06/28 18:47:04
    Current alarm state           : alarm cleared
    Base MAC address              : a4:58:01:03:00:01
===============================================================================
*A:NOK-1#
```

On the 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, 2-port OC3/STM1 Channelized Adapter card, 4-port DS3/E3 Adapter card, and T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module, DS0 channel groups and their parameters are configured in the DS1 or E1 context. For a DS1 channel group, up to 24 timeslots can be assigned (numbered 1 to 24). For an E1 channel group, up to 31 timeslots can be assigned (numbered 2 to 32). For ATM, all timeslots are auto-configured when a channel group gets created. The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card supports channelization at the DS1/E1 level only.

On the 6-port E&M Adapter card, a single DS0 channel group and its parameters are configured in the E&M context.

On the 12-port Serial Data Interface card and RS-232 ports of the 4-port T1/E1 and RS-232 Combination module, DS0 channel groups and their parameters are configured in the V.35, RS-232, RS-530, or X.21 context. For RS-232, a single timeslot is auto-configured when a channel group is created. For V.35 and

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X.21, the number of timeslots auto-configured when a channel group is created depends on the interface speed.

On the 8-port Voice & Teleprotection card, a single DS0 channel group and its parameters are configured in the codirectional, FXO, FXS, or TPIF context and up to 12 timeslots can be assigned in the TPIF context.

On the 8-port C37.94 Teleprotection card, a single DS0 channel group and its parameters are configured in the TPIF context and up to 12 timeslots can be assigned in the TPIF context.

Note:

- Encapsulation type is configured at the DS1 or E1 level on the following:
  - 16-port T1/E1 ASAP Adapter card
  - 32-port T1/E1 ASAP Adapter card
  - 2-port OC3/STM1 Channelized Adapter card
  - 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
  - 4-port DS3/E3 Adapter card
  - T1/E1 ports of the 4-port T1/E1 and RS-232 Combination module
- The encapsulation type is configured at the RS-232, RS-530, V.35, or X.21 level for the following:
  - 12-port Serial Data Interface card
  - RS-232 ports of the 4-port T1/E1 and RS-232 Combination module
- A port can support only one encapsulation type. When the first channel group is configured for an encapsulation type, all other channel groups on the port are automatically configured with that encapsulation type. To change an encapsulation type, the channel group must be deleted, then recreated with the new encapsulation type.

The following is an example of an E1 channel group configuration.

```
NOK-A>config>port>tdm# e1
NOK-A>config>port>tdm>e1# channel-group 1
NOK-A>config>port>tdm>e1>channel-group# timeslots 2
NOK-A>config>port>tdm>e1>channel-group# no shutdown
NOK-A>config>port>tdm>e1>channel-group#
NOK-A>config>port>tdm>e1# no shutdown
NOK-A>config>port>tdm>e1# channel-group 2
NOK-A>config>port>tdm>e1>channel-group# timeslots 3,4
NOK-A>config>port>tdm>e1>channel-group# encap-type cem
NOK-A>config>port>tdm>e1>channel-group# no shutdown
NOK-A>config>port>tdm>e1>channel-group# exit
```

The following is an example of an RS-232 channel group configuration.

```
NOK-A>config>port 1/1/2
NOK-A>config>port# serial
NOK-A>config>port>serial# rs232
NOK-A>config>port>serial>rs232# channel-group 1
NOK-A>config>port>serial>rs232>channel-group# description "RS232GRP1"
NOK-A>config>port>serial>rs232>channel-group# encap-type cem
NOK-A>config>port>serial>rs232>channel-group# idle-payload-fill all-ones
NOK-A>config>port>serial>rs232>channel-group# no shutdown
NOK-A>config>port>serial>rs232>channel-group# exit
```


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The following is an example of an E&M channel group configuration.

```
NOK-A>config>port 1/1/1
NOK-A>config>port# voice
NOK-A>config>port>voice# em
NOK-A>config>port>voice>em# channel-group 1
NOK-A>config>port>voice>em>channel-group# description "DS0GRP"
NOK-A>config>port>voice>em>channel-group# encap-type cem
NOK-A>config>port>voice>em>channel-group# mode access
NOK-A>config>port>voice>em>channel-group# no shutdown
NOK-A>config>port>voice>em>channel-group# exit
```

The following is an example of an FXO channel group configuration:

```
NOK-A>config# port 1/1/6
NOK-A>config>port# voice
NOK-A>config>port>voice# fxo
NOK-A>config>port>voice>fxo# channel-group 1
NOK-A>config>port>voice>fxo>channel-group# mode access
NOK-A>config>port>voice>fxo>channel-group# encap-type cem
NOK-A>config>port>voice>fxo>channel-group# no shutdown
config>port>voice>fxo>channel-group# exit
config>port>voice>fxo# no shutdown
config>port>voice>fxo# exit
config>port>voice# exit
config>port# no shutdown
config>port# exit
config#
```

The following is an example of an FXS channel group configuration:

```
NOK-A>config# port 1/6/1
NOK-A>config>port# voice
NOK-A>config>port>voice# fxs
NOK-A>config>port>voice>fxs>channel-group 1
NOK-A>config>port>voice>fxs>channel-group# mode access
NOK-A>config>port>voice>fxs>channel-group# encap-type cem
NOK-A>config>port>voice>fxs>channel-group# no shutdown
config>port>voice>fxs>channel-group# exit
config>port>voice>fxs# no shutdown
config>port>voice>fxs# exit
config>port>voice# exit
config>port# no shutdown
config>port# exit
config#
```

Services can now be applied to the configured channelized ports.

3.12.2.12 Configuring fractional T1/E1 ports for PPP encapsulation

A T1 or E1 port can be configured to provide a subrate PPP service. That is, by using a channel group, the PPP service can be assigned to a subset of the timeslots that are available on the T1 or E1 port. Only one channel group can be configured per port for subrate PPP.

The following cards and platforms support fractional T1/E1 on a PPP channel group (encapsulation type ppp-auto), or all timeslots on T1/E1 ports, in network mode:

- 16-port T1/E1 ASAP Adapter card

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- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)
- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

You must then change the value of the timeslot configuration to specify the number of timeslots you want to use. Any timeslots not selected cannot be used.

Use the following CLI syntax to configure a T1/E1 port for fractional T1/E1.

First, configure the port:

CLI syntax:

```
port port-id
    tdm
        e1
            channel-group channel-group-id
            encap-type ppp-auto
            mode network
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
```

Use the **config port info** command to display port configuration information:

```
*A:ALU-A>config>port# info detail
----------------------------------------------
        description "DS1/E1"
        tdm
            e1
                shutdown
                framing g704
                no loopback
                clock-source node-timed
                no signal-mode
                report-alarm ais los
                no report-alarm oof rai looped ber-sd ber-sf
                no hold-time
                ssm
                   shutdown
                   ssm-bit 8
                   no tx-dus
                channel-group 1
                    shutdown
                    description "DS0GRP"
                    mode network
                    encap-type ppp-auto
                    no mtu
                    network
                        queue-policy "default"
                    exit
                    timeslots 2-32
                    crc 16
                    idle-cycle-flag flags
                    no scramble
                    ppp
```


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```
                    keepalive 10 dropcount 3
                exit
            exit
        exit
        line-impedance 120
    exit
    no shutdown
```

Next, change the value of the timeslots configuration (currently, all timeslots are allocated to this channel group):

CLI syntax:

```
port port-id
    tdm
        e1
            channel-group 1
                timeslots 11-20
```

Use the **config port info** command to display the new port configuration information:

```
*A:ALU-A>config>port# info detail
----------------------------------------------
        description "DS1/E1"
        tdm
            e1
                shutdown
                framing g704
                no loopback
                clock-source node-timed
                no signal-mode
                report-alarm ais los
                no report-alarm oof rai looped ber-sd ber-sf
                no hold-time
                ssm
                   shutdown
                   ssm-bit 8
                   no tx-dus
                channel-group 1
                    shutdown
                    description "DS0GRP"
                    mode network
                    encap-type ppp-auto
                    no mtu
                    network
                        queue-policy "default"
                    exit
                    timeslots 11-20
                    crc 16
                    idle-cycle-flag flags
                    no scramble
                    ppp
                        keepalive 10 dropcount 3
                    exit
                exit
            exit
            line-impedance 120
        exit
        no shutdown
----------------------------------------------
*A:ALU-A>config>port#
```


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3.12.2.13 Configuring T1 line buildout

Telcordia GR-499 requirements indicate that a T1/E1 transmitter will typically support an LBO adjustment in order to maintain an equivalent interconnect distance of approximately 655 ft over the full range of cable lengths up to 655 ft (200 m).

Use the following CLI syntax to configure LBO functions for T1 (DS1) ports. The LBO function is implemented using the length command. To change the length of the port, you must first shut down the port and then configure the length. This command applies to T1 ports only.

CLI syntax:

```
port port-id
    tdm
        length {133 | 266 | 399 | 533 | 655}
```

The following CLI syntax shows an example of configuring a length of 266 ft on a T1 port.

Example:

```
config# port 1/1/1
config>port# shutdown
config>port# tdm
config>port>tdm# length 266
config>port>tdm# exit
config>port# no shutdown
```

Use the **config port info** command to display port configuration information.

```
ALU-A>config>port# info
#--------------------------------------------------
    tdm
        length 266
        ds1
            channel-group 1
                encap-type cem
                timeslots 1-24
                no shutdown
            exit
            no shutdown
        exit
    exit
#--------------------------------------------------
```

3.12.2.14 Configuring DS1 or E1 SSM

Use the following CLI syntax to configure Synchronization Status Messaging (SSM) for DS1 or E1 TDM ports.

Note:

- Only **g704** framing mode should be used with E1 SSM. The **no-crc-g704** and **e1-unframed** framing modes are not compatible with E1 SSM.
- **ssm-bit** applies only to E1 SSM.

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- Only **esf** framing mode should be used with DS1 SSM.

CLI syntax:

```
port port-id
    tdm
        ds1 | e1
            ssm
                [no] shutdown
                [no] ssm-bit sa-bit
                [no] tx-dus
```

The following CLI syntax shows an example of configuring SSM on an E1 port.

Example:

```
config# port 1/3/1
config>port# tdm
config>port>tdm# e1
config>port>tdm>e1# ssm
config>port>tdm>e1>ssm# ssm-bit 4
config>port>tdm>e1>ssm# tx-dus
```

Use the **config port info** command to display port configuration information.

```
ALU-A>config>port# info
#------------------------------------------------
    tdm
        e1
            ssm
                ssm-bit 4
                tx-dus
                no shutdown
            exit
            no shutdown
        exit
    exit
#------------------------------------------------
```

3.12.2.15 Configuring ATM interface parameters

ATM interface parameters can be configured for SONET/SDH ports in access mode, TDM ports or channels supporting ATM encapsulation, and IMA multilink bundles. The parameters allow users to configure characteristics of an ATM interface. The 7705 SAR-8 Shelf V2 and 7705 SAR-18 support configuration of the following ATM interface parameters:

- cell-format – allows the user to select the ATM cell format to be used on an interface: UNI or NNI (NNI is not supported on SONET/SDH interfaces)
- min-vp-vpi – allows the user to set the minimum allowable virtual path identifier (VPI) value that can be used on the ATM interface for a VPC
- mapping – allows the user to configure ATM cell mapping for DS3 clear channels. Because E3 ports only support G.751 framing with direct cell mapping, ATM mapping is hard-coded for direct mapping for an E3 port (you will get an error message if you try to change the value).

Use the following CLI syntax to configure basic ATM interface parameters for SONET/SDH ports.

CLI syntax:

```
port port-id
```


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```
    sonet-sdh
        path [sonet-sdh-index]
            atm
                cell-format cell-format
                min-vp-vpi value
```

Use the following CLI syntax to configure basic ATM interface parameters for TDM DS3/E3 ports.

CLI syntax:

```
port port-id
    tdm
        ds3
            atm
                cell-format cell-format
                mapping direct
                min-vp-vpi value
        e3
            atm
                cell-format cell-format
                min-vp-vpi value
```

Use the following CLI syntax to configure basic ATM interface parameters for TDM DS1/E1 channels.

CLI syntax:

```
port port-id
    tdm
        ds1
            channel-group 1
                atm
                    cell-format cell-format
                    min-vp-vpi value
        e1
            channel-group 1
                atm
                    cell-format cell-format
                    min-vp-vpi value
```

Use the following CLI syntax to configure basic ATM interface parameters for IMA multilink bundles.

CLI syntax:

```
port>multilink-bundle
    ima
        atm
            cell-format cell-format
            min-vp-vpi value
```

3.12.2.16 Configuring multilink PPP bundles

The following cards, modules, and platforms support multilink bundles:

- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

  The following must have all member links of an MLPPP bundle configured on the same card or module:

  – 16-port T1/E1 ASAP Adapter card

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– 32-port T1/E1 ASAP Adapter card

– T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)

The following must have all member links of an MLPPP bundle configured on the same card or module, and on the same port:

– 2-port OC3/STM1 Channelized Adapter card

– 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

Multilink bundling is based on a link control protocol (LCP) option negotiation that allows a system to indicate to its peer that it is capable of combining multiple physical links into a bundle. Each bundle represents a single connection between two routers. The bundles aggregate channelized ports to define the bandwidth between the routers over the DS1 links.

Multilink bundling operations are modeled after a virtual PPP link-layer entity where packets received over different physical link-layer entities are identified as belonging to a separate PPP network protocol (the Multilink Protocol, or MP) and recombined and sequenced according to information present in a multilink fragmentation header. All packets received over links identified as belonging to the multilink arrangement are presented to the same network-layer protocol processing machine, whether they have multilink headers or not.

When you configure multilink bundles, consider the following guidelines:

- A multilink bundle configuration should include at least 2 ports.
- Multilink bundles can only be aggregated on a single adapter card.
- All member links of an MLPPP group must be of the same type (either E1 or Ds1).
- When you configure a channel group on the network side with ppp-auto encapsulation, the system automatically allocates all timeslots to the channel group.
- When you configure a channel group on the access side with IPCP encapsulation, the system does not automatically allocate all timeslots to the channel group. To use the port or channel group as a member in an MLPPP or MC-MLPPP, you must manually allocate all the timeslots to the channel group before adding it to the bundle.

3.12.2.17 Configuring MC-MLPPP

When you configure MC-MLPPP on a port, consider the following guidelines:

- MC-MLPPP can be enabled on every MLPPP bundle
- MC-MLPPP must be enabled before links are added
- links inside an MC-MLPPP bundle must be configured for access mode and IPCP encapsulation type. All links must be from the same adapter card and all timeslots must be allocated to a single channel group.
- a single fragment size for all classes is supported
- prefix elision is not supported, as per RFC 2686. The prefix elision (compressing common header bytes) option advises the router that, in each of the specific classes, the implementation expects to receive only packets with a particular prefix; this prefix is not to be sent as part of the information in the fragments of this class.

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Use the following CLI syntax to configure MC-MLPPP.

CLI syntax:

```
config port {bundle-id}
    multilink-bundle
        mlppp
            multiclass count
```

The following CLI syntax shows an example of configuring MC-MLPPP.

Example:

```
config# port bundle-ppp-1/6.1
config>port# multilink-bundle
config>port>multilink-bundle# mlppp
config>port>multilink-bundle>mlppp# multiclass 4
config>port>multilink-bundle>mlppp# exit
config>port>multilink-bundle# exit
config>port# exit
config#
```

Use the **config port info** command to display port configuration information.

```
NOK-B>config>port# info
....
#------------------------------------------------
echo "Port Configuration"
#------------------------------------------------
....
   port bundle-ppp-1/6.1
        shutdown
        multilink-bundle
            mlppp
                multiclass 4
            exit
```

3.12.2.18 Configuring LAG parameters

Observe the following general rules and conditions when configuring LAGs:

- All ports (links) in a LAG must share the same characteristics (speed, duplex, hold-timer, and so on). The port characteristics are inherited from the primary port.
- Autonegotiation must be disabled or set to limited mode for ports in a LAG in order to guarantee a specific port speed.
- Ports in a LAG must be configured as full duplex.
- Ports in a LAG must be configured with the same encapsulation value.
- LAG is supported on Ethernet access, network, and hybrid ports.
- On access ports, the links must be distributed over two different adapter cards or different MDAs on the 7705 SAR-X, in order to minimize the effect of an adapter card failure on the LAG.
- On network ports, the links can be on the same platform or adapter card/module or distributed over multiple components.
- A LAG can be in active/active mode or in active/standby mode for access, network, or hybrid mode. Active/standby mode is a subset of active/active mode if subgroups are enabled.

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- By default, LACP is disabled. LACP operates in two modes: passive and active. If the mode on the CE end is passive, the LACP mode on the 7705 SAR end must be active.

  Note: LACP cannot be configured for static LAG. For more information about static LAG, see Static LAG (active/standby LAG operation without LACP).

- Each link in a LAG must be a member of a subgroup. On access, network or hybrid ports, a LAG can have a maximum of four subgroups and a subgroup can have links up to the maximum number supported on the LAG. LAG is active/active if there is only one sub-group. LAG is active/standby if there is more than one subgroup.
- The port with the highest priority is the primary port. If multiple ports have the same priority, the port with the lowest port ID becomes the primary port.
- A port on standby can be replaced while the active port in the LAG is operational.
- When one port is on a Gen-2 Ethernet adapter card and the other port is on a Gen-3 Ethernet adapter card, mix-and-match traffic management occurs. The LAG SAP uses a generic QoS configuration where **scheduler-mode**, *agg-rate*, and *cir-rate* are configured for the SAP, but only those applicable parameters needed by the active adapter card are used to set the QoS values of the active port. See LAG support on mixed-generation hardware for details. See Table 2: Ethernet adapter card, module, and platform generations for a list of adapter card generations.
- The primary port configuration settings are applied to both the primary and secondary LAG ports. Therefore, in order to support unshaped SAPs when the primary port is a Gen-3-based port and the secondary port is a Gen-2-based port, configuring the **unshaped-sap-cir** on the Gen-3-based port is allowed, even though it does not apply to the Gen-3-based port. This is because **unshaped-sap-cir** is needed by the (secondary) Gen-2-based port when it becomes the active port. The full command is **config>port>ethernet>access> egress>unshaped-sap-cir** *cir-rate*.

Additional general rules for LAG configuration are as follows:

- Most port features (port commands) can only be configured on the primary member port. The configuration, or any change to the configuration, is automatically propagated to any remaining ports within the same LAG. Operators cannot modify the configurations on non-primary ports.
- When adding the first port member to a LAG group, its port configuration becomes the configuration of the LAG group.
- After a LAG group has been created, new ports can be added to the LAG group only if their port configurations match with the LAG group configurations inherited from the group's existing primary port. A newly added port may become the primary port or a non-primary port, depending on the setting of the LAG selection criteria, priorities, and so on.
- Not all configurations follow the conventions above. Some exceptions include the commands **loopback** (internal or line), **cfm-loopback**, **mac**, **lldp**, **dot1x**, and **efm-oam**.
- At boot-up, port configuration is applied before LAG configuration is applied. Therefore, configuration values are allowed or prohibited for both a standalone port and a port attached to a LAG group; otherwise, a database **restore** or **exec** command will fail. For example, if the scheduler mode **profile** command option is supported on a Gen-2 port that is the primary member of a LAG, operators are allowed to change **scheduler-mode** on other member links, including Gen-3 ports. If the scheduler mode **profile** command option is blocked for a standalone Gen-2 port, then after issuing an **admin>save** command followed by a **reboot** command, the node will fail to reload the database file.

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The following CLI syntax shows an example of configuring LAG parameters:

Example:

```
config# lag 2
config>lag# description LAG2
config>lag# port 1/4/3 priority 200 sub-group 1
config>lag# port 1/5/3 priority 100 sub-group 2
config>lag# lacp active administrative-key 32768
```

The following example displays a LAG configuration:

```
NOK-B>config>lag# info detail
----------------------------------------------
        shutdown
        description "LAG2"
        port 1/4/3 priority 200 sub-group 1
        port 1/5/3 priority 100 sub-group 2
        lacp active administrative-key 32768
        no mac
        mode access
        encap-type null
        port-threshold 0
        lacp-xmit-interval fast
        lacp-xmit-stdby
        no selection-criteria
        no hold-time
        standby-signaling lacp
----------------------------------------------
NOK-B>config>lag#
```

3.12.2.19 Configuring multilink ATM IMA groups

IMA groups are supported on channelized 16-port T1/E1 ASAP Adapter cards, 32-port T1/E1 ASAP Adapter cards, 2-port OC3/STM1 Channelized Adapter cards, and T1/E1 ports on the 7705 SAR-M. The groups aggregate E1 or DS1 ATM channels into a single logical ATM interface.

Use the following CLI syntax to configure IMA group parameters.

CLI syntax:

```
configure# port bundle-ima-slot/port.bundle-num
description description-string
multilink-bundle
    ima
        atm
            cell-format {uni|nni}
            min-vp-vpi vp-vpi-value
        exit
        link-delay {activate | deactivate} milliseconds
        version IMA-version
    member port-id
    minimum-links minimum-links
    red-differential-delay red-diff-delay [down]
```


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3.12.2.19.1 Configuration notes for IMA groups

An IMA group has common interface characteristics (for example, configuration that applies to a logical ATM interface either configured via the IMA group context or taken from the primary link). The following list details the common IMA group interface characteristics:

- ATM interface characteristics (under the ATM menu context)
- interface mode type (only access is supported)

Member links inherit these common characteristics from the IMA group that they are part of and as long as they are part of the IMA group.

The primary link is the member that has the lowest ifindex. When a member is added or deleted, the primary member may be changed based on the ifindexes of all member links.

When a path becomes part of an IMA group logical link, the path ceases to exist as a physical ATM path interface. This means that:

- ATM interface characteristics enforced over the link are those of a group. When a link is removed from an IMA group, the link's ATM characteristics are reset to ATM interface defaults.
- no services can be configured on the member link

After the primary member has been added, each additional member added to the group will only be accepted if it matches the configuration of the IMA group.

ATM interface characteristics are not part of this verification as they are overwritten or reset to defaults when a link is added to or removed from an IMA group.

When a member is assigned to an IMA group, the member is automatically assigned an IMA link ID. IMA link IDs range from 0 to 16 and stay constant as long as the router does not reboot.

When configuring IMA groups, consider the following guidelines:

- All IMA links in an IMA group must belong to the same T1/E1 adapter card or the same physical OC3 port.
- IMA bundles can only be aggregated on a single adapter card.
- On the 2-port OC3/STM1 Channelized Adapter card, the red differential delay is configurable from 2 to 50 ms and is accurate within 1 ms. On the 16-port T1/E1 ASAP Adapter card and 32-port T1/E1 ASAP Adapter card, the red differential delay is configurable from 2 to 75 ms and is accurate within 1 ms.
- If no member links are configured on an IMA group, the speed of an E1 channel will be used to compute the maximum IMA group bandwidth that may be allocated to shaped services.
- When adding member links to an IMA group, the clock-source of the E1 or DS1 link must be set to node-timed.

The following example illustrates creation of an IMA group with three group members residing on a channelized 16-port T1/E1 ASAP Adapter card in slot 1/3/1:

```
NOK-A>config# port bundle-ima-1/3.1
NOK-A>config>port# multilink-bundle
NOK-A>config>port>ml-bundle# member 1/3/1.1
NOK-A>config>port>ml-bundle# member 1/3/2.1
NOK-A>config>port>ml-bundle# member 1/3/3.1
```


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3.12.2.19.2 IMA test procedure

Use the following CLI syntax to perform an IMA test pattern procedure on a member link of an IMA group.

CLI syntax:

```
configure# port bundle-ima-slot/port.bundle-num
multilink-bundle
    ima
    test-pattern-procedure
        test-link port-id
        test-pattern [pattern]
        no shutdown
```

An operator can deploy IMA test procedures to verify operations of an IMA group and its member links. The following is a list of key points about the test pattern procedure.

1. The test procedure is performed as defined by the IMA specification version 1.1. That is, a test pattern is sent over the specified link and is expected to be looped back over all the links in the group. ICP cells are used to perform the test.
2. The test procedure is not traffic-affecting; that is, data traffic is not affected by the ongoing test.
3. There can only be a single test executed per IMA group at any one time.
4. The IMA member link must exist in the specified group for the command to be accepted.
5. The test pattern procedure must be shut down before a new test-link value or test pattern is accepted.
6. The current IMA group test pattern configuration and result of a specific IMA test can be seen by executing a show command for the IMA group. A test-link result can have three values:
   - Disabled: the test-link is currently not running
   - Operating: the test pattern procedure is **no shutdown** and there are currently no failed links for this running test-pattern procedure
   - Link-Failed: one or more links have failed the test-pattern procedure. Execute a **show port** *slot/mda/port* **ima-link** command to see the failed link and received pattern value.
7. Deleting a member link that is the same as the specified test-link, to stay in compliance with key point 4, results in the test-link value being reset to default.

   IMA test procedure configurations are not saved when the admin **save** command is executed.

3.12.2.20 Configuring SDI ports for IPCP encapsulation

V.35 and X.21 ports on the 12-port Serial Data Interface card can be configured for IPCP encapsulation to support PPP SAPs for Ipipes. See the 7705 SAR Services Guide for more information about IP interworking VLL (Ipipe) services.

Use the following CLI syntax to configure IPCP parameters for V.35 serial ports. X.21 ports that are configured for super-rate speeds are also supported. The **encap-type** must be set to **ipcp**.

CLI syntax:

```
port port-id
    serial
        v35
            channel-group channel-group-id
                encap-type {cem | frame-relay | ipcp | hdlc | cisco-hdlc}
                mode access
```


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```
                ppp
                    keepalive time-interval [dropcount drop count]
                exit
              exit
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
```

Use the **config port info detail** command to display port configuration information:

```
*A:NOK-A>config>port# info detail
----------------------------------------------
        description "RS-232/V.35/X.21/RS-530"
        serial
            v35
                shutdown
                no loopback
                control-lead
                    input
                        dtr-dsr high
                        rts-dcd high
                        alb-cts high
                    exit
                    output
                        dsr-dtr high
                        dcd-rts high
                        cts-alb high
                    exit
                exit
                speed 64k
                device-mode synchronous
                device-gender dce
                clock-source slave
                duplex full
                no report-alarm hcmOof hcmRai
                channel-group 1
                    shutdown
                    description "DS0GRP"
                    mode access
                    encap-type ipcp
                    mtu 2000
                    crc 32
                    idle-cycle-flag ones
                    ppp
                        keepalive 20 dropcount 100
                    exit
                exit
            exit
        exit
----------------------------------------------
*A:NOK-A>config>port#
```

3.12.2.21 Configuring TDM and SDI ports for frame relay encapsulation

Frame relay service can be configured on the following ports:

- 16-port T1/E1 ASAP Adapter card on DS1 or E1 ports

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- 32-port T1/E1 ASAP Adapter card on DS1 or E1 ports
- 4-port DS3/E3 Adapter card on clear channel DS3 or E3 ports, or on DS3 ports channelized to DS1 or E1 down to DS0
- 12-port Serial Data Interface card on V.35 or X.21 serial ports

Frame relay ports can be configured in access mode to support:

- Fpipes on:
  - 16-port T1/E1 ASAP Adapter card on DS1 or E1 ports
  - 32-port T1/E1 ASAP Adapter card on DS1 or E1 ports
  - 4-port DS3/E3 Adapter card on clear channel DS3 or E3 ports, or on DS3 ports channelized to DS1 or E1 down to DS0
  - 12-port Serial Data Interface card on V.35 or X.21 serial ports
- Ipipes on:
  - 16-port T1/E1 ASAP Adapter card on DS1 or E1 ports
  - 32-port T1/E1 ASAP Adapter card on DS1 or E1 ports
  - 4-port DS3/E3 Adapter card on clear channel DS3 or E3 ports only
  - 12-port Serial Data Interface card on V.35 or X.21 serial ports

The **encap-type** must be set to **frame-relay**. The settings for the frame relay port can be modified by using the parameters under the **frame-relay** command hierarchy as shown in the following examples. The settings apply to frame relay ports used for Fpipe SAPs and interworking Ipipe SAPs. See the 7705 SAR Services Guide for more information about frame relay VLL (Fpipe) services and IP interworking VLL (Ipipe) services.

Use the following CLI syntax to configure a frame relay access port on a 16-port T1/E1 ASAP Adapter card or a 32-port T1/E1 ASAP Adapter card.

CLI syntax:

```
port port-id
    tdm
        e1
            channel-group channel-group-id
                encap-type {atm|bcp-null|bcp-dot1q|ipcp| ppp-auto|frame-
relay|wan-mirror|cisco-hdlc|cem|hdlc}
                frame-relay
                    lmi-type {ansi | itu | none | rev1}
                    mode {dce | dte | bidir}
                    n393dce count
                    n393dte count
                    n391dte intervals
                    n392dce threshold
                    n392dte threshold
                    t391dte keepalive
                    t392dce keepalive
                mode access
                no shutdown
            exit
            no shutdown
        exit
    exit
    no shutdown
```


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Use the **config port info detail** command to display port configuration information:

```
*A:NOK-A>config>port# info detail
----------------------------------------------
        description "DS1/E1"
        tdm
            e1
                shutdown
                framing g704
                no loopback
                clock-source node-timed
                no signal-mode
                report-alarm ais los
                no report-alarm oof rai looped ber-sd ber-sf
                no hold-time
                ssm
                   shutdown
                   ssm-bit 8
                   no tx-dus
                channel-group 1
                    shutdown
                    description "E1"
                    mode access
                    encap-type frame-relay
                    no mtu
                    network
                        queue-policy "default"
                    exit
                    timeslots 2-32
                    crc 16
                    frame-relay
                        lmi-type ansi
                        mode dte
                        n393dce 4
                        n393dte 4
                        n391dte 6
                        n392dce 3
                        n392dte 3
                        t391dte 10
                        t392dce 15
                    exit
                exit
            exit
            line-impedance 120
        exit
        no shutdown
----------------------------------------------
*A:NOK-A>config>port#
```

Use the following CLI syntax to configure frame relay parameters for TDM DS3/E3 ports.

CLI syntax:

```
port port-id
    tdm
        ds3
            encap-type {atm |bcp-null | bcp-dot1q | ipcp | ppp-auto |
 frame-relay | wan-mirror | cem}
            mode {access | network}
            frame-relay
                lmi-type {ansi | itu | none | rev1}
                mode {dce | dte | bidir}
                n393dce count
                n393dte count
```


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```
                n391dte intervals
                n392dce threshold
                n392dte threshold
                t391dte keepalive
                t392dce keepalive
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
        e3
            encap-type {atm | bcp-null | bcp-dot1q | ipcp | ppp-auto |
 frame-relay | wan-mirror | cem}
            mode {access | network}
            frame-relay
                lmi-type {ansi | itu | none | rev1}
                mode {dce | dte | bidir}
                n393dce count
                n393dte count
                n391dte intervals
                n392dce threshold
                n392dte threshold
                t391dte keepalive
                t392dce keepalive
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
```

Use the following CLI syntax to configure frame relay parameters for V.35 serial ports. X.21 ports at super-rate speeds are also supported.

CLI syntax:

```
port port-id
    serial
        v35
            channel-group channel-group-id
            encap-type {cem | frame-relay | ipcp | hdlc | cisco-hdlc}
            mode access
            frame-relay
                lmi-type {ansi | itu | none | rev1}
                mode {dce | dte | bidir}
                n393dce count
                n393dte count
                n391dte intervals
                n392dce threshold
                n392dte threshold
                t391dte keepalive
                t392dce keepalive
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
```


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3.12.2.22 Configuring TDM and SDI ports for HDLC encapsulation

HDLC service can be configured on the following ports:

- 16-port T1/E1 ASAP Adapter card on clear channel or fractional DS1 or E1 ports
- 32-port T1/E1 ASAP Adapter card on clear channel or fractional DS1 or E1 ports
- 12-port Serial Data Interface card on V.35 or X.21 serial ports (at super-rate speeds only)

HDLC ports can be configured in access mode to support Hpipes on the above cards. The **encap-type** must be set to **hdlc**.

Note: HDLC encapsulation can be used on a port to transmit cHDLC frames into an Hpipe.

Use the following CLI syntax to configure a T1/E1 port for HDLC.

HDLC ports cannot be configured if the mode is set to network.

CLI syntax:

```
port port-id
    tdm
        e1
            channel-group channel-group-id
                encap-type {atm | cem | ipcp | ppp-auto | frame-relay |
 hdlc | cisco-hdlc}
            timeslots timeslots
            mode {access}
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
```

Use the **config port info** command to display the new port configuration information:

```
*A:NOK-A>config>port# info detail
----------------------------------------------
        description "DS1/E1"
        tdm
            e1
                shutdown
                framing g704
                no loopback
                clock-source node-timed
                no signal-mode
                report-alarm ais los
                no report-alarm oof rai looped ber-sd ber-sf
                no hold-time
                ssm
                   shutdown
                   ssm-bit 8
                   no tx-dus
                channel-group 1
                    description "DS0GRP"
                    mode access
                    encap-type hdlc
                    no mtu
                    timeslots 2-32
```


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```
                    crc 16
                    idle-cycle-flag flags
                    no scramble
                    no shutdown
                exit
                no shutdown
            exit
            line-impedance 120
        exit
        no shutdown
-------------------------------------------
*A:NOK-A>config>port#
```

Use the following CLI syntax to configure an X.21 serial port (super-rate speed) on a 12-port Serial Data Interface card for HDLC. The syntax for a V.35 serial port is similar.

CLI syntax:

```
port port-id
    serial
        x21
            channel-group channel-group-id
                encap-type {cem | ipcp | frame-relay | hdlc | cisco-hdlc}
                mode access
            no shutdown
            speed {1200|2400|4800|9600|19200|38400|56000|64k|128k|256k|
384k|512k|640k|768k|89k|1024k|1152k|1280k|1408k|1536k|1664k |1792k|1920k|
2048k}
        exit
        no shutdown
    exit
exit
no shutdown
```

Use the **config port info** command to display the new port configuration information:

```
*A:NOK-A>config>port# info
-------------------------------------------
        description "RS-232/V.35/X.21/RS-530"
        serial
            x21
                speed 1024k
                channel-group 1
                    shutdown
                    encap-type hdlc
                    mode access
                exit
                no shutdown
            exit
        exit
        no shutdown
-------------------------------------------
*A:NOK-A>config>port#
```

3.12.2.23 Configuring TDM and SDI ports for Cisco HDLC encapsulation

Cisco HDLC (cHDLC) service can be configured on the following ports:

- 16-port T1/E1 ASAP Adapter card on clear channel or fractional DS1 or E1 ports
- 32-port T1/E1 ASAP Adapter card on clear channel or fractional DS1 or E1 ports

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- 12-port Serial Data Interface card on V.35 or X.21 serial ports (at super-rate speeds)
- 7705 SAR-X on clear channel or fractional DS1 or E1 ports

Cisco HDLC ports can be configured in access mode to support Ipipes on the above cards. The **encap-type** must be set to **cisco-hdlc**.

Note: Cisco HDLC encapsulation cannot be used to transmit HDLC frames into an Ipipe.

Use the following CLI syntax to configure a T1/E1 port for cHDLC.

Cisco HDLC ports cannot be configured if the mode is set to network.

CLI syntax:

```
port port-id
    tdm
        e1
            channel-group channel-group-id
                encap-type {atm | cem | ipcp | ppp-auto | frame-relay |
 hdlc | cisco-hdlc}
                cisco-hdlc
                    down-count down-count
                    keep-alive time-interval
                    up-count up-count
                timeslots timeslots
                mode {access | network}
                no shutdown
            exit
            no shutdown
        exit
    exit
    no shutdown
```

Use the **config port info** command to display the new port configuration information:

```
*A:NOK-A>config>port# info detail
----------------------------------------------
        description "DS1/E1"
        tdm
            e1
                shutdown
                framing g704
                no loopback
                clock-source node-timed
                no signal-mode
                report-alarm ais los
                no report-alarm oof rai looped ber-sd ber-sf
                no hold-time
                ssm
                   shutdown
                   ssm-bit 8
                   no tx-dus
                channel-group 1
                    description "DS0GRP"
                    mode access
                    encap-type cisco-hdlc
                    no mtu
                    timeslots 2-32
                    crc 16
                    idle-cycle-flag flags
                    no scramble
                    cisco-hdlc
```


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```
                        keepalive 0
                        upcount 1
                        downcount 3
                    exit
                    no shutdown
                exit
                no shutdown
            exit
            line-impedance 120
        exit
        no shutdown
-----------------------------------------------
*A:NOK-A>config>port#
```

The example below shows cHDLC encapsulation configured on an unframed E1 interface.

```
*A:NOK-A>cconfig>port# info
-----------------------------------------------
        tdm
            e1
                framing e1-unframed
                channel-group 1
                    encap-type cisco-hdlc
                    cisco-hdlc
                    exit
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
-----------------------------------------------
```

Use the following CLI syntax to configure an X.21 serial port (at super-rate speeds) on a 12-port Serial Data Interface card for cHDLC. The syntax for a V.35 serial port is similar.

CLI syntax:

```
port port-id
    serial
        x21
            channel-group channel-group-id
                encap-type {cem | ipcp | frame-relay | hdlc | cisco-hdlc}
                mode access
            no shutdown
            speed {1200|2400|4800|9600|19200|38400|56000|64k|128k|256k|
384k|512k|640k|768k|89k|1024k|1152k|1280k|1408k|1536k|1664k |1792k|1920k}
            no shutdown
        exit
        no shutdown
    exit
exit
no shutdown
```

Use the **config port info** command to display the new port configuration information:

```
*A:NOK-A>config>port# info
-----------------------------------------------
        description "RS-232/V.35/X.21"
        serial
            x21
                speed 1024k
```


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```
                channel-group 1
                    shutdown
                    description "DS0GRP"
                    mode access
                    encap-type cisco-hdlc
                    cisco-hdlc
                        keepalive 10
                        up-count 1
                        down-count 3
                    exit
                exit
                no shutdown
            exit
        exit
        no shutdown
-------------------------------------------
*A:NOK-A>config>port#
```

3.12.2.24 Configuring GNSS receiver port parameters

Use the following CLI syntax to configure GNSS receiver port parameters.

CLI syntax:

```
config# port port-id
    gnss
        antenna-cable-delay 0..32767
        no antenna-cable-delay
        elevation-mask-angle 0..89
        no elevation-mask-angle
        [no] type [gps] [glonass]
```

3.12.2.25 Configuring serial ports for raw socket transport

Use the following CLI syntax to configure raw socket parameters on an RS-232 serial port.

Note: Raw sockets are only supported on RS-232 serial ports.

CLI syntax:

```
port port-id
    serial
        rs232
            socket socket-id
            description description-string
            encap-type raw
                rx
                    eop
                        idle-timeout milliseconds
                        length bytes
                        special-char value
                        exit
                    unsquelch-delay seconds
                    squelch-reset
                    exit
                tx
                    inter-session-delay milliseconds
                    exit
            no shutdown
```


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```
        exit
    exit
exit
```

3.12.3 Configuring SCADA bridge parameters

Use the following CLI commands to configure SCADA bridge parameters on an Integrated Services card.

CLI syntax:

```
scada bridge-id
    branch branch-id
        description description-string
        gain
            input decibels
            output decibels
        squelch
        exit
    description description-string
    exit
    mddb
        force-active master branch-id
        redundant-mode redundant-mode
        report-alarm [hcmOof] [hcmRai]
        speed {600 | 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 56000}
        squelch timeout timeout
        squelch reset
        squelch-recovery [mode] [time time]
        exit
    pcm
        force-active master branch-id
        redundant-mode redundant-mode
        squelch reset
        squelch timeout timeout
        squelch-recovery [mode] [time time]
        exit
    vcb
        idle-code abcd-code
        seized-code abcd-code
        exit
    exit
```

The following CLI syntax shows an example of configuring SCADA bridge parameters on an Integrated Services card.

CLI syntax:

```
scada 1/8/1 type mddb
    description “scada bridge1”
    no shutdown
    branch 1
        no shutdown
        exit
    branch 2
        no shutdown
        exit
    branch 3
        no shutdown
        exit
    branch 4
        no shutdown
        exit
```


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```
    branch 5
        no shutdown
        exit
    branch 6
        no shutdown
        exit
    branch 7
        no shutdown
        exit
    branch 8
        no shutdown
        exit
    branch 9
        no shutdown
        exit
    branch 10
        no shutdown
        exit
    branch 11
        no shutdown
        exit
    branch 12
        no shutdown
        exit
    exit
    mddb
        report-alarm hcmOof hcmRai
        squelch timeout 60
        exit
    exit
exit
```

Use the **config scada info** command to display the new SCADA bridge configuration information:

```
NOK-1>config>scada# info
#--------------------------------------------------
echo "MDDB Configuration"
#--------------------------------------------------
  .....
    scada 1/8/1
        description "scada bridge1"
        mddb
            squelch timeout 60
        exit
        branch 1
            no shutdown
        exit
        branch 2
            no shutdown
        exit
        branch 3
            no shutdown
        exit
        branch 4
            no shutdown
        exit
        branch 5
            no shutdown
        exit
        branch 6
            no shutdown
        exit
        branch 7
```


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```
            no shutdown
        exit
        branch 8
            no shutdown
        exit
        branch 9
            no shutdown
        exit
        branch 10
            no shutdown
        exit
        branch 11
            no shutdown
        exit
        branch 12
            no shutdown
        exit
    exit
.....
```

3.13 Service management tasks

This section describes the following service management tasks:

- Changing a provisioned adapter card type
- Deleting an adapter card

3.13.1 Changing a provisioned adapter card type

To change an adapter card type already provisioned for a specific slot, you must shut down any existing port configurations on the card, delete the adapter card configuration, and provision the new adapter card.

Use the following CLI syntax to change an adapter card type:

CLI syntax:

```
port port-id
    shutdown
    exit
card slot-number  //always 1
    mda mda-number
        shutdown
        exit
    no mda mda-number //deletes the adapter card
    mda mda-number
        mda-type mda-type //provisions new adapter card
        no shutdown
```

The following CLI syntax shows an example of modifying an adapter card.

Example:

```
config# port 1/1/1
config>port# shutdown
config>port# exit
config# port 1/1/2
config>port# shutdown
config>port# exit
config# card 1
```


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```
config>card# mda 1
config>card>mda# shutdown
config>card>mda# exit
config>card# no mda 1
config>card# mda 1
config>card>mda# mda-type a16-chds1v2
config>card>mda# no shutdown
```

3.13.2 Deleting an adapter card

To delete an adapter card provisioned for a specific slot, you must shut down any existing port configurations on the card and delete the adapter card configuration.

Use the following CLI syntax to delete an adapter card provisioned for a specific slot.

CLI syntax:

```
port port-id
    shutdown
    exit
card slot-number  //always 1
    mda mda-number
        shutdown
        exit
    no mda mda-number //deletes the adapter card
    exit
```

The following CLI syntax shows an example of deleting an adapter card.

Example:

```
config# port 1/1/1
config>port# shutdown
config>port# exit
config# port 1/1/2
config>port# shutdown
config>port# exit
config# card 1
config>card# mda 1
config>card>mda# shutdown
config>card>mda# exit
config>card# no mda 1
config>card# exit
```


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3.14 Configuration command reference

3.14.1 Command hierarchies

- Card commands
- Adapter card commands
- External alarm commands
- APS port commands
- T1/E1 LCR commands
- Microwave link commands
- Port configuration commands
- Ethernet commands
- GNSS commands
- IEEE 802.1x Ethernet port commands
- LLDP Ethernet port commands
- MACsec commands
- Ring virtual port Ethernet commands
- Ring MAC operations commands
- Multilink bundle and IMA group commands
- Serial commands
- SONET/SDH commands
- TDM commands
- DS1 commands
- DS3 commands
- E1 commands
- E3 commands
- Voice commands
- LAG commands
- SCADA commands

3.14.1.1 Card commands

```
config
    - [no] card slot-number
        - card-type card-type
        - no card-type
        - [no] shutdown
```


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3.14.1.2 Adapter card commands

```
config
    - [no] card slot-number
        - [no] mda mda-slot
            - access
                - ingress
                    - fabric-policy fabric-policy-id
                    - no fabric-policy
                    - security-queue-policy policy-id
                    - no security-queue-policy
                    - shaper-policy policy-name
                    - no shaper-policy policy-name
            - ais-propagation {enable | disable}
            - clock-mode adaptive
            - clock-mode {dcr-acr | differential} [timestamp-freq {19440 | 25000 | 77760 |
 103680}]
            - [no] fabric-stats-enabled
            - mda-mode  mda-mode
            - no mda-mode
            - mda-type mda-type
            - no mda-type
            - network
                - ingress
                    - fabric-policy fabric-policy-id
                    - no fabric-policy
                    - queue-policy name
                    - no queue-policy
                    - security-queue-policy policy-id
                    - no security-queue-policy
                - ring
                    - add-drop-port-queue-policy name
                    - no add-drop-port-queue-policy
                    - qos-policy network-policy-id
                    - no qos-policy
            - poe-power-source {internal | external | none}
            - no poe-power-source
            - ring    (see Ring MAC operations commands)
            - [no] shutdown
            - spt
                - security-aggregate-rate   agg-rate
                - no security-aggregate-rate
            - vcb
                - application {broadcast | teleprotection | vcb | vcb-branch-initiate}
            - voice
                - companding-law {a-law | mu-law}
                - signaling-type {type-i | type-ii | type-v}
```

3.14.1.3 External alarm commands

```
config
    - external-alarms
        - [no] alarm alarm-id
            - [no] chassis-alarming
            - description description-string
            - no description
            - [no] log
            - severity {critical | major | minor | warning}
            - [no] shutdown
```


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```
            - thresholds
                - analog
                    - [no] level {lt | gt} millivolts
            - trigger [any | all] {alarm-input1 | alarm-input2... | alarm-input8}
            - no trigger
        - input alarm-input
            - debounce seconds
            - debounce detect-seconds clear clear-seconds
            - no debounce
            - description description-string
            - no description
            - name name-string
            - no name
            - normally {open | closed|
            - [no] shutdown
        - output alarm-output
            - description description-string
            - no description
            - name name-string
            - no name
            - [no] shutdown
```

3.14.1.4 APS port commands

```
config
    - [no] port {aps-id}
        - aps
            - advertise-interval advertise-interval
            - no advertise-interval
            - hold-time hold-time
            - no hold-time
            - hold-time-aps ([lsignal-fail sf-time] [lsignal-degrade sd-time]}
            - no hold-time-aps
            - neighbor ip-address
            - no neighbor
            - protect-circuit port-id
            - no protect-circuit
            - [no] rdi-alarms {suppress | circuit}
            - revert-time minutes
            - no revert-time
            - switching-mode {bi-directional | uni-1plus1}
            - working-circuit port-id
            - no working-circuit
```

Note: Queue policies for APS are under the APS port hierarchy (port aps-id/sonet-sdh/path/network/queue-policy name), instead of under the physical port, similar to the configuration of regular SONET/SDH ports. See the SONET/SDH commands hierarchy for more information.

3.14.1.5 T1/E1 LCR commands

```
config
    - [no] lcr lcr-id
        - advertise-interval advertise-interval
        - no advertise-interval
        - description description
        - no description
        - hold-time hold-time
```


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```
        - no hold-time
        - neighbor ip-address
        - no neighbor
        - protect-mda mda-id
        - no protect-mda
        - revert-time minutes
        - no revert-time
        - working-mda mda-id
        - no working-mda
```

3.14.1.6 Microwave link commands

```
config
    - [no] port  mw-link-id
        - [no] shutdown
        - mw
            - [no] hold-time {[up hold-time-up] [down hold-time-down]}
            - [no] peer-discovery
            - [no] protection
            - radio port-id [create] [main | spare]
            - no radio port-id
                - database filename
                - no database
                - name name-string
                - no name
                - perfmon [g826] [power] [acm]
                - no perfmon
                - rsl-history file-url
                - no rsl-history
                - [no] standalone
                - suppress-faults  [hber] [rsl-threshold] [rdi] [all]
                - [no] suppress-faults
                - [no] tx-mute
            - [no] revert [eps] [rps]
```

3.14.1.7 Port configuration commands

```
config
    - port {port-id | bundle-id}
    - no port {port-id | bundle-id}
        - aps
        - [no] ddm-events
        - description description-string
        - no description
        - dwdm
            - channel channel
        - ethernet
        - gnss
        - multilink-bundle
        - mw
        - serial
        - [no] shutdown
        - sonet-sdh
        - tdm
        - voice
```


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3.14.1.8 Ethernet commands

```
config
    - [no] port port-id
        - ethernet
            - access
                - egress
                    - shaper-policy name
                    - no shaper-policy
                    - unshaped-sap-cir cir-rate
                    - no unshaped-sap-cir
            - autonegotiate [limited]
            - no autonegotiate
            - cfm-loopback priority {low | high | dot1p} [match-vlan {vlan-range | none}]
            - no cfm-loopback
            - crc-monitor
                - sd-threshold threshold [multiplier multiplier]
                - no sd-threshold
                - sf-threshold threshold [multiplier multiplier]
                - no sf-threshold
                - window-size seconds
                - no window-size
            - dot1q-etype 0x0600 to 0xffff
            - no dot1q-etype
            - dot1x
            - down-when-looped
                - keep-alive timer
                - no keep-alive
                - retry-timeout timer
                - no retry-timeout
                - [no] shutdown
                - [no] use-broadcast-address
            - duplex {full | half}
            - efm-oam
                - [no] accept-remote-loopback
                - hold-time time-value
                - no hold-time
                - [no] ignore-efm-state
                - mode {active | passive}
                - [no] shutdown
                - [no] transmit-interval interval [multiplier multiplier]
                - [no] tunneling
            - egress-rate sub-rate [include-fcs] [allow-eth-bn-rate-changes] [hold-time hold-
time]
            - no egress-rate
            - encap-type {dot1q | null | qinq}
            - no encap-type
            - [no] group-encryption
                - encryption-keygroup keygroup-id direction {inbound | outbound}
                - no encryption-keygroup direction {inbound | outbound}
            - hold-time {[up hold-time-up] [down hold-time-down] [seconds | centiseconds]}
            - no hold-time
            - ingress-rate ingress-rate cbs {size [bytes | kilobytes] | default}
            - no ingress-rate
                - src-pause
                - no src-pause
            - lacp-tunnel
            - no lacp-tunnel
            - lldp
            - loopback {line | internal} {timer {0 | 30 .. 86400} | persistent} [swap-src-dst-
mac]
            - no loopback
```


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```
            - mac ieee-address
            - no mac
            - mode {access | network | hybrid}
            - no mode
            - mtu mtu-bytes
            - no mtu
            - network
                - accounting-policy policy-id
                - [no] accounting-policy
                - [no] collect-stats
                - egress
                    - shaper-policy name
                    - no shaper-policy
                    - unshaped-if-cir cir-rate
                    - no unshaped-if-cir
                - queue-policy name
                - no queue-policy
                - scheduler-mode {16-priority}    (See Note below)
            - phy-tx-clock  {auto-pref-master | auto-pref-slave | slave | master}
            - no phy-tx-clock
            - poe [plus]
            - no poe
            - ptp-asymmetry ptp-asymmetry
            - no ptp-asymmetry
            - qinq-etype 0x0600 to 0xffff
            - report-alarm [signal-fail] [remote] [local] [no-frame-lock] [high-ber]
            - no report-alarm
            - speed {10 | 100 | 1000 | 10000}
            - ssm
                - code-type {sonet | sdh}
                - [no] shutdown
                - [no] tx-dus
            - util-stats-interval seconds
            - [no] vlan-filter filter-id
            - xgig {lan | wan}
            - xor-mode {rj45 | rjp5 | sfp}
```

Note: For more information about how to configure the scheduler mode on Ethernet ports, see the 7705 SAR Quality of Service Guide.

3.14.1.9 GNSS commands

```
config
    - port port-id
        - gnss
            - antenna-cable-delay 0 .. 32767
            - no antenna-cable-delay
            - elevation-mask-angle 0 .. 89
            - no elevation-mask-angle
            - [no] type [gps] [glonass]
```

3.14.1.10 IEEE 802.1x Ethernet port commands

```
config
    - port port-id
        - ethernet
            - dot1x
```


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```
                - [no] mac-auth
                - mac-auth-wait seconds
                - no mac-auth-wait
                - macsec
                    - exclude-mac-policy mac-policy-id
                    - no exclude-mac-policy
                    - [no] exclude-protocol [lacp] [lldp] [cdp] [eapol-start] [efm-oam] [eth-
cfm] [ptp] [ubfd]
                    - [no] rx-must-be-encrypted
                    - sub-port port-id [create]
                    - no sub-port port-id
                        - ca-name ca-name
                        - no ca-name
                        - eapol-destination-address address
                        - no eapol-destination-address
                        - encap-match {all-encap | double-tag encap-value | single-tag encap-
value | untagged}
                        - no encap-match
                        - max-peer num-peers
                        - no max-peer
                        - [no] shutdown
                - max-auth-req max-auth-request
                - no max-auth-req
                - port-control {auto | force-auth | force-unauth}
                - no port-control
                - quiet-period seconds
                - no quiet-period
                - radius-plcy name
                - no radius-plcy
                - re-auth-period seconds
                - no re-auth-period
                - [no] re-authentication
                - server-timeout seconds
                - no server-timeout
                - supplicant-timeout seconds
                - no supplicant-timeout
                - transmit-period seconds
                - no transmit-period
                - [no] tunneling
```

3.14.1.11 LLDP Ethernet port commands

```
config
    - port port-id
        - ethernet
            - lldp
                - dest-mac {nearest-bridge | nearest-non-tpmr | nearest-customer}
                    - admin-status {rx | tx | tx-rx | disabled}
                    - [no] notification
                    - port-id-subtype {tx-if-alias | tx-if-name | tx-local}
                    - tx-mgmt-address [system]
                    - no tx-mgmt-address
                    - tx-tlvs [port-desc] [sys-name] [sys-desc] [sys-cap]
                    - no tx-tlvs
```

3.14.1.12 MACsec commands

```
config
```


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```
    - macsec
        - connectivity-association ca-name [create]
        - no connectivity-association ca-name
            - [no] anysec
            - cipher-suite cipher-suite
            - no cipher-suite
            - clear-tag-mode clear-tag-mode
            - no clear-tag-mode
            - description description-string
            - no description
            - encryption-offset encryption-offset
            - no encryption-offset
            - [no] macsec-encrypt
            - [no] replay-protection
            - replay-window-size number-of-packets
            - [no] replay-window-size
            - [no] shutdown
            - [no] static-cak
                - active-psk active-pre-shared-key
                - no active-psk
                - mka-hello-interval mka-hello-interval
                - no mka-hello-interval
                - mka-key-server-priority key-server-priority
                - no mka-key-server-priority
                - pre-shared-key pre-shared-key-index [encryption-type encryption-type]
[create]
                - no pre-shared-key pre-shared-key-index
                    - cak hex-string [hash | hash2]
                    - no cak
                    - ckn hex-string
                    - no ckn
                - primary-keychain keychain-name
                - no primary-keychain
        - mac-policy mac-policy-id [create]
        - no mac-policy mac-policy-id
            - dest-mac-address mac-address [create]
            - no dest-mac-address mac-address
```

3.14.1.13 Ring virtual port Ethernet commands

```
config
    - [no] port port-id
        - ethernet
            - cfm-loopback priority {low | high | dot1p} [match-vlan {vlan-range | none}]
            - no cfm-loopback
            - dot1q-etype 0x0600 to 0xffff
            - no dot1q-etype
            - down-when-looped
                - keep-alive timer
                - no keep-alive
                - retry-timeout timer
                - no retry-timeout
                - [no] shutdown
                - [no] use-broadcast-address
            - duplex full
            - egress-rate sub-rate
            - no egress-rate
            - encap-type {dot1q | null}
            - no encap-type
            - mac ieee-address
            - no mac
```


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```
            - mode network
            - no mode
            - mtu mtu-bytes
            - no mtu
            - network
                - queue-policy name
                - no queue-policy
                - scheduler-mode 16-priority
            - speed 2500
```

3.14.1.14 Ring MAC operations commands

```
config
    - card
        - mda mda-id
            - ring
                - [no] disable-aging
                - [no] disable-learning
                - [no] discard-unknown-source
                - fdb-table-high-wmark high-water-mark
                - no fdb-table-high-wmark
                - fdb-table-size table-size
                - no fdb-table-size
                - [no] mac-pinning [port port-id]
                - remote-age aging-timer
                - no remote-age
                - [no] static-mac mac ieee-address port port-id [create]
```

3.14.1.15 Multilink bundle and IMA group commands

```
config
    - [no] port {bundle-id}
        - multilink-bundle
            - fragment-threshold fragment-threshold
            - no fragment-threshold
            - ima
                - atm
                    - cell-format cell-format
                    - min-vp-vpi value
                - link-delay {activate | deactivate} milliseconds
                - no link-delay {activate | deactivate}
                - test-pattern-procedure
                    - [no] shutdown
                    - test-link port-id
                    - no test-link
                    - test-pattern pattern
                    - no test-pattern
                - version IMA-version
                - no version
            - [no] member port-id
            - minimum-links minimum-links
            - no minimum-links
            - mlppp
                - endpoint-discriminator class {ip-address | global-mac-address | null}
 [discriminator-id discriminator-id]
                - no endpoint-discriminator
                - [no] magic-number
                - multiclass count
```


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```
                - no multiclass
            - mrru mrru
            - no mrru
            - red-differential-delay red-diff-delay [down]
            - no red-differential-delay
            - [no] short-sequence
            - yellow-differential-delay yellow-diff-delay
            - no yellow-differential-delay
```

3.14.1.16 Serial commands

```
config
    - [no] port {port-id}
        - serial
            - [no] rs232
                - [no] channel-group channel-group-id
                    - crc {16 | 32}
                    - description description-string
                    - no description
                    - encap-type cem
                    - no encap-type
                    - idle-payload-fill all-ones
                    - no idle-payload-fill
                    - mode access
                    - [no] shutdown
                - character-length  {6 | 7 | 8}
                - clock-source  {external | slave | dcr-serial}
                - control-lead  {input | monitor | output}
                    - input
                        - alb-cts  {high | low | end-to-end}
                        - dtr-dsr  {high | low}
                        - rdl-ri  {high | low}
                        - rts-dcd  {high | low | end-to-end}
                    - monitor
                        - alb-cts  {on | off | high | low}
                        - dtr-dsr  {on | off | high | low}
                        - rdl-ri  {on | off | high | low}
                        - rts-dcd  {on | off | high | low}
                    - output
                        - cts-rl  {high | low | end-to-end}
                        - dcd-rts  {high | low | end-to-end}
                        - dsr-dtr  {high | low}
                        - ri-rdl  {high | low}
                - data-position {F0-B5 | F0-B6}
                - device-gender  {dte | dce}
                - device-mode  {synchronous | asynchronous}
                - duplex  {half | full}
                - hold-time {[up hold-time-up] [down hold-time-down]}
                - no hold-time
                - [no] invert-clock
                - no invert-clock
                - loopback {bidir-b | bidir-e}
                - no loopback
                - mon-clock-deviation {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-clock-deviation
                - mon-data-inactivity {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-data-inactivity
                - multi-drop {disabled | slave | master}
                - parity  {odd | even | mark | space}
                - no parity
```


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```
                - [no] report-alarm  [hcmOof | hcmRai] [ctrlLeadMon] [monClockDev] [monData
Inac]
                - s-bit-signaling {on | off}
                - [no] shutdown
                - socket socket-id
                    - description description-string
                    - no description
                    - encap-type encap-type
                    - rx
                        - eop
                            - idle-timeout milliseconds
                            - length bytes
                            - special-char  value
                            - no special-char
                        - squelch-delay  seconds
                        - no squelch-delay
                        - squelch-reset
                        - unsquelch-delay  seconds
                        - no unsquelch-delay
                - [no] shutdown
                    - tx
                        - inter-session-delay  milliseconds
                - speed {600 | 1200 | 2400 | 4800 | 8000 | 9600 | 14400 | 16000 | 19200 | 24000
 | 32000 | 38400 | 56000 | 57600 | 64k | 115200}
                - stop-bits {1 | 2}
            - [no] rs530
                - [no] channel-group channel-group-id
                    - description description-string
                    - no description
                    - encap-type cem
                    - no encap-type
                    - idle-payload-fill {all-ones | pattern}
                    - no idle-payload-fill
                    - mode {access | network}
                    - [no] shutdown
                - character-length  {6 | 7 | 8}
                - clock-source  {external | slave | dcr-serial}
                - control-lead  {input | monitor | output}
                    - input
                        - dtr-dsr  {high | low}
                        - ll-tm  {high | low}
                        - rl-cts {high | low | end-to-end}
                        - rts-dcd  {high | low | end-to-end}
                    - monitor
                        - dtr-dsr  {on | off | high | low}
                        - ll-tm  {on | off | high | low}
                        - rl-cts  {on | off | high | low}
                        - rts-dcd  {on | off | high | low}
                    - output
                        - cts-rl  {high | low | end-to-end}
                        - dcd-rts  {high | low | end-to-end}
                        - dsr-dtr  {high | low}
                        - tm-ll  {high | low}
                - data-position {F0-B5 | F0-B6}
                - device-gender  {dte | dce}
                - device-mode  {synchronous | asynchronous}
                - duplex  {half | full}
                - hold-time {[up hold-time-up] [down hold-time-down]}
                - no hold-time
                - [no] invert-clock
                - loopback {bidir-e | bidir-e-signalling}
                - no loopback
                - mon-clock-deviation {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-clock-deviation
```


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```
                - mon-data-inactivity {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-data-inactivity
                - multi-drop {disabled | slave | master}
                - parity  {odd | even | mark | space}
                - no parity
                - [no] report-alarm  [hcmOof | hcmRai] [ctrlLeadMon] [monClockDev] [monData
Inac]
                - s-bit-signaling {on | off}
                - [no] shutdown
                - speed {600 | 1200 | 2400 | 4800 | 8000 | 9600 | 14400 | 16000 |19200 | 32000
 | 38400 | 56000 | 64k | 128k | 192k | 256k | 288k | 336k | 384k | 512k | 640k | 704k | 768k |
 896k | 1024k | 1152k| 1280k | 1344k | 1408k | 1536k | 1664k | 1792k | 1920k | 2048k | 3072k |
 4096k | 5120k | 6144k | 7168k | 8192k | 9216k | 10240k | 11264k | 12288k | 13312k | 14336k |
 15360k | 16384k}
                - stop-bits {1 | 2}
            - [no] v35
                - [no] channel-group channel-group-id
                    - cisco-hdlc
                        - down-count down-count
                        - no down-count
                        - keepalive time-interval
                        - no keepalive
                        - up-count up-count
                        - no up-count
                    - crc {16 | 32}
                    - description description-string
                    - no description
                    - encap-type {cem | ipcp | frame-relay | hdlc | cisco-hdlc}
                    - no encap-type
                    - frame-relay
                        - lmi-type {ansi | itu | none | rev1}
                        - mode {dce | dte | bidir}
                        - n391dte intervals
                        - no n391dte
                        - n392dce threshold
                        - no n392dce
                        - n392dte threshold
                        - no n392dte
                        - n393dce count
                        - no n393dce
                        - n393dte count
                        - no n393dte
                        - t391dte keepalive
                        - no t391dte
                        - t392dce keepalive
                        - no t392dce
                    - idle-cycle-flag {flags | ones}
                    - no idle-cycle-flag
                    - idle-payload-fill all-ones
                    - no idle-payload-fill
                    - mode access
                    - mtu mtu-bytes
                    - no mtu
                    - [no] ppp
                        - keepalive time-interval [dropcount drop-count]
                    - [no] shutdown
                - clock-source  slave
                - control-lead  {input | output}
                    - input
                        - alb-cts  {high | low | end-to-end}
                        - dtr-dsr  {high | low}
                        - rts-dcd  {high | low | end-to-end}
                    - monitor
                        - alb-cts  {on | off | high | low}
```


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```
                        - dtr-dsr  {on | off | high | low}
                        - rts-dcd  {on | off | high | low}
                    - output
                        - cts-alb  {high | low | end-to-end}
                        - dcd-rts  {high | low | end-to-end}
                        - dsr-dtr  {high | low}
                - device-gender  {dte | dce}
                - device-mode  {synchronous}
                - duplex  {half | full}
                - hold-time {[up hold-time-up] [down hold-time-down]}
                - no hold-time
                - [no] invert-clock
                - loopback {bidir-b | bidir-e}
                - no loopback
                - multi-drop {disabled | slave | master}
                - mon-clock-deviation {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-clock-deviation
                - mon-data-inactivity {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-data-inactivity
                - [no] report-alarm  [hcmOof | hcmRai] [ctrlLeadMon] [monClockDev] [monData
Inac]
                - [no] shutdown
                - speed {56k | 64k | 128k | 192k | 256k | 384k | 512k | 640k | 768k | 896k |
 1024k | 1152k | 1280k | 1344k | 1408k | 1536k | 1664k | 1792k | 1920k | 2048k | 4096k | 5120k
 | 7168k}
            - [no] x21
                - [no] channel-group channel-group-id
                    - cisco-hdlc
                        - down-count down-count
                        - no down-count
                        - keepalive time-interval
                        - no keepalive
                        - up-count up-count
                        - no up-count
                    - crc {16 | 32}
                    - description description-string
                    - no description
                    - encap-type {cem | ipcp | frame-relay | hdlc | cisco-hdlc}
                    - no encap-type
                    - frame-relay
                        - lmi-type {ansi | itu | none | rev1}
                        - mode {dce | dte | bidir}
                        - n391dte intervals
                        - no n391dte
                        - n392dce threshold
                        - no n392dce
                        - n392dte threshold
                        - no n392dte
                        - n393dce count
                        - no n393dce
                        - n393dte count
                        - no n393dte
                        - t391dte keepalive
                        - no t391dte
                        - t392dce keepalive
                        - no t392dce
                    - idle-cycle-flag {flags | ones}
                    - no idle-cycle-flag
                    - idle-payload-fill all-ones
                    - no idle-payload-fill
                    - invert-clock
                    - no invert-clock
                    - mode access
                    - mtu mtu-bytes
```


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```
                    - no mtu
                    - [no] ppp
                        - keepalive time-interval [dropcount drop-count]
                    - [no] shutdown
                - character-length  {6 | 7 | 8}
                - clock-source  slave
                - control-lead  {input | output}
                    - input
                        - c-i  {high | low | end-to-end}
                    - monitor
                        - c-i  {on | off | high | low}
                    - output
                        - i-c  {high | low | end-to-end}
                - data-position {F0-B5 | F0-B6}
                - device-gender  {dte | dce}
                - device-mode  {synchronous | asynchronous}
                - duplex  {half | full}
                - hold-time {[up hold-time-up] [down hold-time-down]}
                - no hold-time
                - invert-clock
                - no invert-clock
                - loopback {bidir-b | bidir-e}
                - no loopback
                - mon-clock-deviation {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-clock-deviation
                - mon-data-inactivity {[raise debounce-time-r] [clear debounce-time-c]}
                - no mon-data-inactivity
                - parity  {odd | even | mark | space}
                - no parity
                - [no] report-alarm  [hcmOof | hcmRai] [ctrlLeadMon] [monClockDev] [monData
Inac]
                - s-bit-signaling {on | off}
                - [no] shutdown
                - speed {1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 56000 | 64k | 128k | 256k
 | 384k | 512k | 640k | 768k | 896k | 1024k | 1152k | 1280k | 1408k | 1536k | 1664k | 1792k |
 1920k| 2048k}
```

3.14.1.17 SONET/SDH commands

```
config
    - [no] port {port-id}
        - sonet-sdh
            - clock-source {loop-timed | node-timed}
            - framing {sonet | sdh}
            - group sonet-sdh-index payload {tu3 | vt2 | vt15}
            - hold-time {[up hold-time-up] [down hold-time-down]}
            - no hold-time
            - loopback {line | internal}
            - no loopback
            - [no] path [sonet-sdh-index]
                - atm
                    - cell-format cell-format
                    - min-vp-vpi value
                - crc {16 | 32}
                - description description-string
                - no description
                - encap-type {atm | ppp-auto}
                - no encap-type
                - mode {access | network}
                - mtu mtu
                - no mtu
```


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```
                - network
                    - accounting-policy policy-id
                    - [no] accounting-policy
                    - [no] collect-stats
                    - queue-policy name
                    - no queue-policy
                - payload {sts12 | sts3 | tug3 | ds3 | e3 | vt2 | vt15 | ds1 | e1}
                - ppp
                    - keepalive time-interval [dropcount drop-count]
                    - no keepalive
                - [no] report-alarm [pais] [plop] [prdi] [pplm] [prei] [puneq] [plcd]
                - [no] scramble
                - [no] shutdown
                - signal-label value
                - no signal-label
                - trace-string [trace-string]
                - no trace-string
            - [no] report-alarm [loc] [lais] [lrdi] [ss1f] [lb2er-sd] [lb2er-sf] [slof] [slos]
[lrei]
            - section-trace {increment-z0 | byte value | string string}
            - speed {oc3 | oc12}
            - threshold {ber-sd | ber-sf} rate threshold-rate
            - no threshold {ber-sd | ber-sf}
            - [no] tx-dus
```

3.14.1.18 TDM commands

```
config
    - [no] port port-id
        - tdm
            - buildout {long | short}
            - [no] codir
                - [no] channel-group channel-group-id
                    - description description-string
                    - no description
                    - encap-type cem
                    - mode access
                    - [no] shutdown
                - loopback {internal | line}
                - no loopback
                - report-alarm {ais | los}
                - no report-alarm
                - [no] shutdown
                - [no] timing-8k
            - [no] ds1 ds1-id
            - [no] ds3 [sonet-sdh-index]
            - [no] e1 e1-id
            - [no] e3 [sonet-sdh-index]
            - encoding {b8zs | ami}
            - length {133 | 266 | 399 | 533 | 655}
            - line-impedance {75 | 100 | 120}
            - [no] tpif
                - [no] channel-group channel-group-id
                    - description description-string
                    - no description
                    - encap-type cem
                    - mode access
                    - [no] shutdown
                    - timeslots timeslots
                - framing {framed | unframed}
                - no framing
```


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```
                - loopback {internal | line}
                - no loopback
                - report-alarm {los | rai}
                - no report-alarm
                - [no] shutdown
```

3.14.1.19 DS1 commands

```
config
    - [no] port {port-id | aps-id | lcr-port-id}
        - tdm
            - [no] ds1 ds1-id
                - bert chngrp-id chngrp-id
                - no bert
                    - direction {line | internal}
                    - length {64k | 56k}
                    - pattern pattern
                    - [no] shutdown
                - [no] channel-group channel-group-id
                    - atm
                        - cell-format cell-format
                        - min-vp-vpi value
                    - cisco-hdlc
                        - down-count down-count
                        - no down-count
                        - keepalive time-interval
                        - no keepalive
                        - up-count up-count
                        - no up-count
                    - crc {16 | 32}
                    - description description-string
                    - no description
                    - encap-type {atm | cem | ipcp | ppp-auto | frame-relay | hdlc | cisco-
hdlc}
                    - no encap-type
                    - frame-relay
                        - lmi-type {ansi | itu | none | rev1}
                        - mode {dce | dte | bidir}
                        - n391dte intervals
                        - no n391dte
                        - n392dce threshold
                        - no n392dce
                        - n392dte threshold
                        - no n392dte
                        - n393dce count
                        - no n393dce
                        - n393dte count
                        - no n393dte
                        - t391dte keepalive
                        - no t391dte
                        - t392dce keepalive
                        - no t392dce
                    - idle-cycle-flag {flags | ones}
                    - no idle-cycle-flag
                    - idle-payload-fill {all-ones | pattern pattern}
                    - no idle-payload-fill
                    - idle-signal-fill {all-ones | pattern pattern}
                    - no idle-signal-fill
                    - loopback {line | internal}
                    - no loopback
                    - mac ieee-address
```


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```
                    - no mac
                    - mode {access | network}
                    - no mode
                    - mtu mtu-bytes
                    - no mtu
                    - network
                        - accounting-policy policy-id
                        - [no] accounting-policy
                        - [no] collect-stats
                        - queue-policy name
                        - no queue-policy
                    - [no] ppp
                        - ber-sf-link-down
                        - no ber-sf-link-down
                        - keepalive time-interval [dropcount drop-count]
                        - no keepalive
                    - [no] scramble
                    - [no] shutdown
                    - signal-mode cas
                    - no signal-mode
                    - timeslots timeslots
                    - no timeslots
                - clock-source {loop-timed | node-timed | adaptive | differential}
                - framing (DS1) {esf | sf | ds1-unframed}
                - hold-time {[up hold-time-up] [down hold-time-down]}
                - no hold-time
                - loopback (DS1) {line | internal | fdl-ansi | fdl-bellcore | payload-ansi}
                - no loopback (DS1)
                - [no] remote-loop-respond
                - [no] report-alarm {ais | los | oof | rai | looped | ber-sd | ber-sf}
                - [no] shutdown
                - signal-mode cas
                - no signal-mode
                - signaling-insertion chngrp-id channel-group
                - no signaling-insertion
                    - direction {line | internal}
                    - pattern pattern
                    - [no] shutdown
                - ssm
                    - [no] shutdown
                    - [no] tx-dus
                - threshold {ber-sd | ber-sf} rate threshold-rate
                - no threshold {ber-sd | ber-sf}
```

3.14.1.20 DS3 commands

```
config
    - [no] port {port-id | aps-id}
        - tdm
            - [no] ds3 [sonet-sdh-index]
                - atm
                    - cell-format cell-format
                    - no cell-format
                    - mapping direct
                    - no mapping
                    - min-vp-vpi value
                    - no min-vp-vpi
                - channelized {ds1 | e1}
                - no channelized
                - clock-source {loop-timed | node-timed | differential | free-run}
                - crc {16 | 32}
```


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```
                - description description-string
                - no description
                - encap-type  {atm | ppp-auto | frame-relay}
                - no encap-type
                - [no] feac-loop-respond
                - frame-relay
                    - lmi-type {ansi | itu | none | rev1}
                    - mode {dce | dte | bidir}
                    - n391dte intervals
                    - no n391dte
                    - n392dce threshold
                    - no n392dce
                    - n392dte threshold
                    - no n392dte
                    - n393dce count
                    - no n393dce
                    - n393dte count
                    - no n393dte
                    - t391dte keepalive
                    - no t391dte
                    - t392dce keepalive
                    - no t392dce
                - framing (DS3) {c-bit | m23}
                - idle-cycle-flag {flags | ones}
                - no idle-cycle-flag
                - loopback {line | internal | remote}
                - no loopback
                - mac ieee-address
                - no mac
                - mdl {eic | lic | fic | unit | pfi | port | gen} mdl-string
                - [no] mdl
                - [no] mdl-transmit {path | idle-signal | test-signal}
                - mode {access | network}
                - mtu mtu-bytes
                - no mtu
                - network
                    - accounting-policy policy-id
                    - [no] accounting-policy
                    - [no] collect-stats
                    - queue-policy name
                    - no queue-policy
                - ppp
                    - keepalive time-interval [dropcount drop-count]
                    - no keepalive
                - [no] report-alarm {ais | los | oof | rai | looped}
                - [no] shutdown
```

3.14.1.21 E1 commands

```
config
    - [no] port {port-id | aps-id | lcr-port-id}
        - tdm
            - [no] e1 e1-id
                - bert chngrp-id chngrp-id
                - no bert
                    - direction {line | internal}
                    - length {64k | 56k}
                    - pattern pattern
                    - [no] shutdown
                - [no] channel-group channel-group-id
                    - atm
```


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```
                        - cell-format cell-format
                        - min-vp-vpi value
                    - cisco-hdlc
                        - down-count down-count
                        - no down-count
                        - keepalive time-interval
                        - no keepalive
                        - up-count up-count
                        - no up-count
                    - crc {16 | 32}
                    - description description-string
                    - no description
                    - encap-type {atm | cem | ipcp | ppp-auto | frame-relay | hdlc | cisco-
hdlc}
                    - no encap-type
                    - frame-relay
                        - lmi-type {ansi | itu | none | rev1}
                        - mode {dce | dte | bidir}
                        - n391dte intervals
                        - no n391dte
                        - n392dce threshold
                        - no n392dce
                        - n392dte threshold
                        - no n392dte
                        - n393dce count
                        - no n393dce
                        - n393dte count
                        - no n393dte
                        - t391dte keepalive
                        - no t391dte
                        - t392dce keepalive
                        - no t392dce
                    - idle-cycle-flag {flags | ones}
                    - no idle-cycle-flag
                    - idle-payload-fill {all-ones | pattern pattern}
                    - no idle-payload-fill
                    - idle-signal-fill {all-ones | pattern pattern}
                    - no idle-signal-fill
                    - loopback {line | internal}
                    - no loopback
                    - mac ieee-address
                    - no mac
                    - mode {access | network}
                    - no mode
                    - mtu mtu-bytes
                    - no mtu
                    - network
                        - accounting-policy policy-id
                        - [no] accounting-policy
                        - [no] collect-stats
                        - queue-policy name
                        - no queue-policy
                    - [no] ppp
                        - ber-sf-link-down
                        - no ber-sf-link-down
                        - keepalive time-interval [dropcount drop-count]
                        - no keepalive
                    - [no] scramble
                    - [no] shutdown
                    - signal-mode cas
                    - no signal-mode
                    - timeslots timeslots
                    - no timeslots
                - clock-source {loop-timed | node-timed | adaptive | differential}
```


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```
                - framing (E1) {no-crc-g704 | g704 | e1-unframed}
                - hold-time {[up hold-time-up] [down hold-time-down]}
                - no hold-time
                - loopback (E1) {line | internal}
                - no loopback (E1)
                - [no] report-alarm {ais | los | oof | rai | looped | ber-sd | ber-sf}
                - [no] shutdown
                - signal-mode cas
                - no signal-mode
                - signaling-insertion chngrp-id channel-group
                - no signaling-insertion
                    - direction {line | internal}
                    - pattern pattern
                    - [no] shutdown
                - ssm
                    - [no] shutdown
                    - ssm-bit sa-bit
                    - no ssm-bit
                    - [no] tx-dus
                - threshold {ber-sd | ber-sf} rate threshold-rate
                - no threshold {ber-sd | ber-sf}
```

3.14.1.22 E3 commands

```
config
    - [no] port {port-id}
        - tdm
            - [no] e3 [sonet-sdh-index]
                - atm
                    - cell-format cell-format
                    - no cell-format
                    - min-vp-vpi value
                    - no min-vp-vpi
                - clock-source {loop-timed | node-timed | differential | free-run}
                - crc {16 | 32}
                - description description-string
                - no description
                - encap-type  {atm | cem | ppp-auto | frame-relay}|
                - no encap-type
                - [no] feac-loop-respond
                - frame-relay
                    - lmi-type {ansi | itu | none | rev1}
                    - mode {dce | dte | bidir}
                    - n391dte intervals
                    - no n391dte
                    - n392dce threshold
                    - no n392dce
                    - n392dte threshold
                    - no n392dte
                    - n393dce count
                    - no n393dce
                    - n393dte count
                    - no n393dte
                    - t391dte keepalive
                    - no t391dte
                    - t392dce keepalive
                    - no t392dce
                - framing (E3) g751
                - idle-cycle-flag {flags | ones}
                - no idle-cycle-flag
                - loopback {line | internal | remote}
```


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```
                - no loopback
                - mode {network}
                - mtu mtu-bytes
                - no mtu
                - network
                    - accounting-policy policy-id
                    - [no] accounting-policy
                    - [no] collect-stats
                    - queue-policy name
                    - no queue-policy
                - ppp
                    - keepalive time-interval [dropcount drop-count]
                    - no keepalive
                - [no] report-alarm {ais | los | oof | rai | looped}
                - [no] shutdown
```

3.14.1.23 Voice commands

```
config
    - [no] port port-id
        - voice
            - audio-wires {two-wires | four-wires}
            - [no] em
                - [no] channel-group channel-group-id
                    - description description-string
                    - no description
                    - encap-type cem
                    - no encap-type
                    - mode access
                    - [no] shutdown
                - fault-signaling {idle | seized}
                - idle-code abcd-code
                - no idle-code
                - loopback {internal-analog | internal-digital}
                - no loopback
                - seized-code abcd-code
                - signaling-lead
                    - e {high | low | end-to-end}
                    - m {high | low | end-to-end}
                - signaling-mode {em | transmission-only}
                - [no] shutdown
            - [no] fxo
                - [no] channel-group channel-group-id
                    - description description-string
                    - no description
                    - encap-type cem
                    - no encap-type
                    - mode access
                    - [no] shutdown
                - fault-signaling {idle | seized}
                - loopback internal-digital
                - no loopback
                - [no] shutdown
            - [no] fxs
                - [no] channel-group channel-group-id
                    - description description-string
                    - no description
                    - encap-type cem
                    - no encap-type
                    - mode access
                    - [no] shutdown
```


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```
                - fault-signaling {idle | seized}
                - loopback internal-digital
                - no loopback
                - [no] shutdown
            - line-balance {nominal | 800}
            - ring-generation {16 | 20 | 25}
            - no ring-generation
            - signaling-type {3600plar | 1511plar | 3600ls | 1511profile1 | 3600re | 1511sn137}
            - tlp-rx  decibels
            - tlp-tx decibels
```

3.14.1.24 LAG commands

```
config
    - [no] lag [lag-id]
        - access
            - adapt-qos {link | distribute}
        - bfd
            - family ipv4
                - [no] bfd-on-distributing-only
                - local-ip-address ip-address
                - no local-ip-address
                - max-admin-down-time [[down-interval] | infinite]
                - no max-admin-down-time
                - max-setup-time [[up-interval] | infinite]
                - no max-setup-time
                - multiplier multiplier
                - no multiplier
                - receive-interval receive-interval
                - no receive-interval
                - remote-ip-address ip-address
                - no remote-ip-address
                - [no] shutdown
                - transmit-interval transmit-interval
                - no transmit-interval
        - description description-string
        - no description
        - [no] dynamic-cost
        - encap-type {dot1q | null | qinq}
        - no encap-type
        - hold-time down hold-down-time
        - no hold-time
        - lacp [mode] [administrative-key admin-key] [system-id system-id] [system-
priority priority]
        - no lacp
        - lacp-xmit-interval {slow | fast}
        - no lacp-xmit-interval
        - [no] lacp-xmit-stdby
        - mac ieee-address
        - no mac
        - mode {access | network | hybrid}
        - no mode
        - port port-id [port-id] [priority priority] [sub-group sub-group-id]
        - no port port-id
        - port-threshold value [action {dynamic-cost | down}]
        - no port-threshold
        - selection-criteria [best-port | highest-count | highest-weight] [slave-to-partner]
 [subgroup-hold-time hold-time]
        - no selection-criteria
        - [no] shutdown
        - standby-signaling [lacp | power-off]
```


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```
        - no standby-signaling
```

3.14.1.25 SCADA commands

```
config
    - scada bridge-id
        - [no] branch branch-id
            - description description-string
            - no description
            - gain
                - input decibels
                - output decibels
                - [no] sidetone  (see the Note below)
            - [no] shutdown
            - [no] squelch
        - description description-string
        - no description
        - mddb
            - force-active master branch-id
            - redundant-mode redundant-mode
            - [no] report-alarm [hcmOof] [hcmRai]
            - speed {600 | 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 56000}
            - squelch timeout timeout
            - squelch reset
            - no squelch
            - squelch-recovery [mode] [time time]
        - pcm
            - force-active master branch-id
            - redundant-mode redundant-mode
            - squelch timeout timeout
            - squelch reset
            - no squelch
            - squelch-recovery [mode] [time time]
        - [no] shutdown
        - vcb
            - idle-code abcd-code
            - no idle-code
            - seized-code abcd-code
            - no seized-code
```

Note: The **sidetone** command is not supported in this release.

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3.14.2 Command descriptions

- Generic commands
- Card commands
- Adapter card commands
- Interface QoS commands
- External alarm commands
- APS port commands
- T1/E1 LCR commands
- Microwave link commands
- General port commands
- Ethernet commands
- GNSS commands
- IEEE 802.1x Ethernet port commands
- LLDP Ethernet port commands
- Ring MAC operations commands
- Serial commands
- RS-232, RS-530, V.35, and X.21 channel group commands
- SONET/SDH port commands
- SONET/SDH path commands
- Network port commands
- Multilink bundle and IMA group commands
- ATM interface commands
- TDM commands
- DS1 and E1 commands
- DS1 and E1 channel group commands
- DS3 and E3 commands
- Voice commands
- Voice channel group commands
- LAG commands
- Frame relay commands
- Cisco HDLC commands
- SCADA commands

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3.14.2.1 Generic commands

description

Syntax

description *description-string*

no description

Context

config>external-alarms>alarm

config>external-alarms>input

config>external-alarms>output

config>lcr

config>macsec>connectivity-association

config>port

config>port>tdm>ds1>channel-group

config>port>tdm>ds3

config>port>tdm>e1>channel-group

config>port>tdm>e3

config>port>tdm>codir>channel-group

config>port>tdm>tpif>channel-group

config>port>voice>fxo>channel-group

config>port>voice>fxs>channel-group

config>port>sonet-sdh>path

config>port>serial>rs232>channel-group

config>port>serial>rs232>socket

config>port>serial>rs530>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

config>port>voice>em>channel-group

config>lag

config>scada

config>scada>branch

Description

This command creates a text description for a configuration context to help identify the content in the configuration file.

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The **no** form of this command removes any description string from the context. For the serial context, the **no** form of this command restores the default value.

Default

"DS0GRP" (for the serial context and the voice context)

"Discrete Digital Input" for digital input (for Auxiliary Alarm card or chassis alarm inputs), "Analog Input" for analog input, and "Digital Output Relay" for output (for Auxiliary Alarm card)

n/a for others

Parameters

description-string

description character string. Allowed values are any string up to 80 or 160 characters long (depending on the command) composed of printable, 7-bit ASCII characters. If the string contains special characters (such as #, $, or spaces), the entire string must be enclosed within double quotes.

shutdown

Syntax

[**no**] **shutdown**

Context

config>card

config>card>mda

config>external-alarms>alarm

config>external-alarms>input

config>external-alarms>output

config>port

config>port>ethernet>down-when-looped

config>port>ethernet>efm-oam

config>port>ethernet>ssm

config>port>mw-link

config>port>serial>rs232

config>port>serial>v35

config>port>serial>x21

config>port>serial>rs232>channel-group

config>port>serial>rs232>socket

config>port>serial>rs530>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

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config>port>sonet-sdh>path

config>port>tdm>ds1

config>port>tdm>ds1>bert

config>port>tdm>ds1>channel-group

config>port>tdm>ds1>signaling-insertion

config>port>tdm>ds1>ssm

config>port>tdm>ds3

config>port>tdm>e1

config>port>tdm>e1>bert

config>port>tdm>e1>channel-group

config>port>tdm>e1>signaling-insertion

config>port>tdm>e1>ssm

config>port>tdm>e3

config>port>tdm>codir

config>port>tdm>codir>channel-group

config>port>tdm>tpif

config>port>tdm>tpif>channel-group

config>port>voice>fxo

config>port>voice>fxs

config>port>voice>fxo>channel-group

config>port>voice>fxs>channel-group

config>port>voice>em

config>port>voice>em>channel-group

config>lag

config>scada

config>scada>branch

Description

This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics.

The operational state of the entity is disabled as well as the operational state of any entities contained within. Many objects must be shut down before they can be deleted.

When used with the **ethernet>efm-oam** command, **shutdown** enables tunneling on the port (see tunneling), and **no shutdown** enables Ethernet EFM OAM 802.3ah.

The **no** form of this command administratively enables an entity.

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Note: The **config>port>shutdown** command does not remove power on ports that are Power over Ethernet (PoE/PoE+) capable. You must use the **config>port>ethernet>no poe**command to turn the power off; see poe for more information.

Default

card – no shutdown

mda – no shutdown

port – shutdown

scada – shutdown

scada>branch – no shutdown

input – no shutdown (for Auxiliary Alarm card and chassis alarm inputs)

alarm – shutdown (for Auxiliary Alarm card)

output – shutdown (for Auxiliary Alarm card)

lag – shutdown

3.14.2.2 Card commands

card

Syntax

[**no**] **card** *slot-number*

Context

config

Description

This mandatory command is the first step in activating the IOM software: designating it a slot position in the chassis. On the 7705 SAR, the slot number is always **1**. The IOM software must be activated before the adapter cards and ports can be configured. The **no** form of this command removes the card from the configuration. All associated ports, services, and adapter cards must be shut down.

Default

n/a

Parameters

slot-number

the slot number of the card in the chassis

Values 1

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card-type

Syntax

card-type *card-type*

no card-type

Context

config>card

Description

This mandatory command is the second step in activating the IOM software: designating the card type. The card type can be preprovisioned, meaning that the card does not need to be installed in the chassis. On the 7705 SAR, the card type is always **iom-sar**.

A card must be provisioned (configured) before an adapter card or port can be configured.

A card can only be provisioned in a slot that is vacant, which means that no other card can be provisioned for that particular slot. To reconfigure a slot position, use the **no** form of this command to remove the current information. Port and adapter card information must be shut down.

A card can only be provisioned in a slot if the card type is allowed in the slot. An error message is generated if an attempt is made to provision a card type that is not allowed.

The **no** form of this command removes the card from the configuration. This operation requires that the card be administratively shut down. All dependencies to ports on this card must be shut down and removed from the configuration before issuing the **no card-type** command.

Default

n/a

Parameters

card-type

the type of card to be configured and installed in the slot

Values iom-sar

3.14.2.3 Adapter card commands

mda

Syntax

[**no**] **mda** *mda-slot*

Context

config>card

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Description

This mandatory command enables access to a card's MDA CLI context to configure adapter cards.

Default

n/a

Parameters

mda-slot

the adapter card or module slot number to be configured

ais-propagation

Syntax

ais-propagation {**enable** | **disable**}

Context

config>card>mda

Description

This command enables the 7705 SAR to interoperate with SDH networks that use subnetwork connection protection (SNCP). When **ais-propagation** is enabled, the 7705 SAR can use SDH signaling to make pseudowire switching decisions on Cpipes configured for redundancy.

For more information about 7705 SAR interoperation with SDH SNCP, see the 7705 SAR Services Guide, "AIS Fault Propagation".

Default

n/a

clock-mode

Syntax

clock-mode adaptive

clock-mode {**dcr-acr** | **differential**}[**timestamp-freq** {**19440** | **25000** | **77760** | **103680**}]

Context

config>card>mda

Description

This command defines the clocking mode and the associated timestamp frequency (if **differential** or **dcr-acr** clocking mode is configured).

All clock modes are supported on the following:

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- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 7705 SAR-A (variant with T1/E1 ports)
- 7705 SAR-M (variants with T1/E1 ports)
- 7705 SAR-X
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (the clock frequency value configured for **dcr-acr** clock mode or **differential** clock mode on one module takes effect on both modules installed in the 7705 SAR-H)

Only **differential** mode is supported on the following cards:

- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card (DS1/E1 channels)
- 4-port DS3/E3 Adapter card (clear channel DS3/E3 ports and DS1/E1 channels on channelized DS3 ports (E3 ports cannot be channelized)); differential mode on DS1/E1 channels is supported only on the first three ports of the card

Default

adaptive (if no clocking mode is configured)

differential (for 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card and 4-port DS3/E3 Adapter card)

If **differential** or **dcr-acr** clocking mode is configured on the 7705 SAR-M, 7705 SAR-A, 7705 SAR-X, or 4-port T1/E1 and RS-232 Combination module, the default timestamp frequency is **103680**.

If **differential** or **dcr-acr** clocking mode is configured on the 16-port T1/E1 ASAP Adapter card or the 32-port T1/E1 ASAP Adapter card, the default timestamp frequency is **77760**.

For the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card and the 4-port DS3/E3 Adapter card, the default timestamp frequency is **77760**.

Parameters

adaptive

enables adaptive clock recovery

dcr-acr

enables DCR and ACR on different ports of the same card

differential

enables differential clock recovery

timestamp-freq

sets the optional timestamp frequency

19440

sets the timestamp frequency to 19440 Hz (19.44 MHz) for Y.1413 compliance

25000

sets the timestamp frequency to 25000 Hz (25 MHz) for Ethernet-based systems

77760

sets the timestamp frequency to 77760 Hz (77.76 MHz) for interoperation with SONET/SDN-based systems such as TSS-5

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103680

sets the timestamp frequency to 103680 Hz (103.68 MHz), recommended for any operation over 100 MHz

Note: The 25000 and 103680 options are not supported on the 16-port T1/E1 ASAP Adapter card or the 32-port T1/E1 ASAP Adapter card. The 19440, 25000, and 103680 options are not supported on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card or the 4-port DS3/E3 Adapter card.

fabric-stats-enabled

Syntax

[**no**] **fabric-stats-enabled**

Context

config>card>mda

Description

This command enables the fabric port statistics counter to count egress traffic toward a specified adapter card. The CSM allows the collection of fabric statistics from only one fabric port at any specific time. To change the port statistics counter to a different adapter card, turn off statistics collection on the assigned adapter card by using **no fabric-stats-enabled** and then enabling statistics collection on another adapter card.

mda-mode

Syntax

mda-mode *mda-mode*

no mda-mode

Context

config>card>mda

Description

This command configures the set of software services that are enabled for a specific adapter card.

The **cem-atm-ppp** and **cem-fr-hdlc-ppp** parameter values are used to configure the appropriate encapsulation methods that are required to support pseudowire services. These values apply to the following adapter cards:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 4-port DS3/E3 Adapter card

The card-level encapsulation capabilities must be configured before the **encap-type** parameter is configured at the port level.

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The**x10-1gb-sfp** and **x1-10gb-sf+** parameter values are used for the 10-port 1GigE/1-port 10GigE X-Adapter card to define whether the card operates in 10-port 1GigE mode or 1-port 10GigE mode.

The **p4-oc3** and **p1-oc12** parameter values are used for the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card to define whether the card operates in 4-port OC3/STM1 mode or 1-port OC12/STM4 mode.

The **mddb**, **pcm**, and **vcb** parameter values are used for the Integrated Services card to define which SCADA application is active on the card.

The **no** form of this command sets the **mda-mode** back to the card's default mode. All service and port/channel configurations associated with the adapter card must be removed before the mda-mode can be changed. On the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, changing the mode causes the adapter card to reset.

Default

x1-10gb-sf+ (for the 10-port 1GigE/1-port 10GigE X-Adapter card)

cem-atm-ppp (for the T1/E1 ASAP adapter cards and 4-port DS3/E3 Adapter card)

p4-oc3 (for the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card)

mddb (for the Integrated Services card)

Parameters

mda-mode

the encapsulation mode for the adapter card to be provisioned

Values cem-atm-ppp, cem-fr-hdlc-ppp, x10-1gb-sfp, x1-10gb-sf+, p4-oc3, p1-oc12, mddb, pcm, vcb

mda-type

Syntax

mda-type *mda-type*

no mda-type

Context

config>card>mda

Description

This mandatory command provisions a specific adapter card or module type to the device configuration for the slot. The adapter card or module can be preprovisioned, but it must be provisioned before ports can be configured. Ports can be configured after the adapter card or module is properly provisioned.

A maximum of 6 adapter cards can be installed in a 7705 SAR-8 Shelf V2 chassis, and a maximum of 12 adapter cards and 4 XMDA adapter cards can be installed in a 7705 SAR-18 chassis. One module can be installed in a 7705 SAR-M chassis. A maximum of two modules can be installed in a 7705 SAR-H chassis. Only one adapter card or module can be provisioned per MDA or module slot. To modify an MDA or module slot, shut down all port associations.

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A medium severity alarm is generated if an adapter card or module is inserted that does not match the adapter card or module type configured for the slot. This alarm is cleared when the correct adapter card or module is inserted or the configuration is modified. A high severity alarm is raised if an administratively enabled adapter card or module is removed from the chassis. This alarm is cleared if either the correct adapter card or module type is inserted or the configuration is modified. A low severity trap is issued if an administratively disabled adapter card or module is removed.

An alarm is raised if partial or complete adapter card or module failure is detected. The alarm is cleared when the error condition ceases.

The **no** form of this command deletes the adapter card or module from the configuration. The adapter card or module must be administratively shut down before it can be deleted from the configuration. Before an adapter card or module can be shut down, all port associations with this adapter card or module, for example SAPs and IP interfaces, must be shut down first.

Default

n/a

Parameters

mda-type

the type of adapter card to be provisioned

Values

For the 7705 SAR-8 Shelf V2

a16-chds1v2	16-port T1/E1 ASAP Adapter card
a32-chds1v2	32-port T1/E1 ASAP Adapter card
a12-sdiv2	12-port Serial Data Interface card, version 2
a12-sdiv3	12-port Serial Data Interface card, version 3
a6-eth-10G	6-port Ethernet 10Gbps Adapter card, version 1
a6-eth-10G-v2	6-port Ethernet 10Gbps Adapter card, version 2
a6-eth-10G-e	6-port Ethernet 10Gbps Adapter card-E
a8-1gb-sfp	8-port Gigabit Ethernet Adapter card, version 1
a8-1gb-v2-sfp	8-port Gigabit Ethernet Adapter card, version 2
a8-1gb-v3-sfp	8-port Gigabit Ethernet Adapter card, version 3
a6-em	6-port E&M Adapter card
a4-oc3	4-port OC3/STM1 Clear Channel Adapter card
a4-chds3	4-port DS3/E3 Adapter card, version 1
a4-chds3v2	4-port DS3/E3 Adapter card, version 2
a2-choc3	2-port OC3/STM1 Channelized Adapter card
a4-choc3/12	4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

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a2-10gb-xfp	2-port 10GigE (Ethernet) Adapter card
aux-alarm	Auxiliary Alarm card
mw-pic-2	Power Injector card
a8-pmc	Packet Microwave Adapter card
a8-vt	8-port Voice & Teleprotection card
a8-c3794	8-port C37.94 Teleprotection card
a8-fxo	8-port FXO Adapter card
a6-fxs	6-port FXS Adapter card
oadm-cwdm-1ch	CWDM OADM Adapter card (1-channel)
oadm-cwdm-2ch	CWDM OADM Adapter card (2-channel)
oadm-cwdm-4ch	CWDM OADM Adapter card (4-channel)
oadm-cwdm-8ch	CWDM OADM Adapter card (8-channel)
isc	Integrated Services card
a1-gnss	GNSS Receiver card

For the 7705 SAR-18

a16-chds1v2	16-port T1/E1 ASAP Adapter card
a32-chds1v2	32-port T1/E1 ASAP Adapter card
a12-sdiv2	12-port Serial Data Interface card, version 2
a12-sdiv3	12-port Serial Data Interface card, version 3
a6-eth-10G	6-port Ethernet 10Gbps Adapter card, version 1
a6-eth-10G-v2	6-port Ethernet 10Gbps Adapter card, version 2
a6-eth-10G-e	6-port Ethernet 10Gbps Adapter card-E
a8-1gb-sfp	8-port Gigabit Ethernet Adapter card, version 1
a8-1gb-v2-sfp	8-port Gigabit Ethernet Adapter card, version 2
a8-1gb-v3-sfp	8-port Gigabit Ethernet Adapter card, version 3
x-10GigE	10-port 1GigE/1-port 10GigE X-Adapter card, version 1
x-10GigE-v2	10-port 1GigE/1-port 10GigE X-Adapter card, version 2
a6-em	6-port E&M Adapter card
a4-chds3	4-port DS3/E3 Adapter card, version 1

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a4-chds3v2	4-port DS3/E3 Adapter card, version 2
a4-oc3	4-port OC3/STM1 Clear Channel Adapter card
a2-choc3	2-port OC3/STM1 Channelized Adapter card
a4-choc3/12	4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
a2-10gb-xfp	2-port 10GigE (Ethernet) Adapter card
aux-alarm	Auxiliary Alarm card
mw-pic-2	Power Injector card
a8-pmc	Packet Microwave Adapter card
a8-vt	8-port Voice & Teleprotection card
a8-c3794	8-port C37.94 Teleprotection card
a8-fxo	8-port FXO Adapter card
a6-fxs	6-port FXS Adapter card
oadm-cwdm-1ch	CWDM OADM Adapter card (1-channel)
oadm-cwdm-2ch	CWDM OADM Adapter card (2-channel)
oadm-cwdm-4ch	CWDM OADM Adapter card (4-channel)
oadm-cwdm-8ch	CWDM OADM Adapter card (8-channel)
isc	Integrated Services card
a1-gnss	GNSS Receiver card

For the 7705 SAR-M

oadm-cwdm-1ch	CWDM OADM module (1-channel)
p2-10gb-xfp	2-port 10GigE (Ethernet) module
p6-eth	6-port SAR-M Ethernet module

For the 7705 SAR-H

p4-combo	4-port T1/E1 and RS-232 Combination module
p1-gps	GPS Receiver module
p4-eth	4-port SAR-H Fast Ethernet module

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poe-power-source

Syntax

poe-power-source {**internal** | **external** | **none**}

no poe-power-source

Context

config>card>mda

Description

This command specifies whether the internal system-level PoE power supply or an external PoE power supply is used to power the PoE-capable ports on a 7705 SAR chassis.

When the 7705 SAR-H is configured for the internal power supply, standard 15 W PoE can be enabled only on ports 5 and 6. Port 5 can also support 34 W PoE+, but in that case, port 6 cannot support PoE. When configured for the external PoE power supply, all four PoE-capable ports support a combination of standard 15 W PoE and 34 W PoE+, with a maximum power delivery of 83 W among all PoE-enabled ports. See the 7705 SAR-H Chassis Installation Guide, "Ethernet Ports", for information about supported combinations and restrictions.

The following chassis types only support the internal system-level PoE power supply:

- 7705 SAR-Hc
- 7705 SAR-Wx

The **no** form of this command disables the PoE power supply on the node.

Default

internal

Parameters

internal

specifies that the internal PoE power source be used for the PoE-capable ports

external

specifies that an external PoE power source be used for the PoE-capable ports

none

specifies that no internal or external PoE power source is used

vcb

Syntax

vcb

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Context

config>card>mda

Description

This command enables the context to configure voice conference bridge (VCB) parameters on the Integrated Services card.

Default

n/a

application

Syntax

application {**broadcast** | **teleprotection** | **vcb** | **vcb-branch-initiate**}

Context

config>card>mda>vcb

Description

This command specifies the operating mode for the VCB application. The mode is set at the card level and applies to all bridges configured on the card.

Default

vcb

Parameters

broadcast

only one branch on the bridge (fixed as branch 1) has control of the bridge to transmit, and all other branches are in listen-only mode

teleprotection

each teleprotection relay transmits state information on discrete frequencies so that each relay can both hear what the other relays are transmitting as well as transmit its own information to the other relays

vcb

one branch talks and all other branches on the bridge can hear

vcb-branch-initiate

branches on the bridge are only enabled (unmuted) when the attached base station signals its presence by grounding the M-lead on the interface connected to the bridge. Upon receiving the grounded M-lead via T1/E1 ABCD bits or TDM PW signaling, the bridge unmutes the associated branch. When the ground is removed, the branch is muted again.

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voice

Syntax

voice

Context

config>card>mda

Description

This command enables the context to configure voice parameters on the 6-port E&M Adapter card, 8-port Voice & Teleprotection card, 8-port FXO Adapter card, 6-port FXS Adapter card, and Integrated Services card (when it is configured for VCB with the mda-mode command).

Default

n/a

companding-law

Syntax

companding-law {**a-law** | **mu-law**}

Context

config>card>mda>voice

Description

This command specifies the companding law to be used on the 6-port E&M Adapter card, 8-port Voice & Teleprotection card, 8-port FXO Adapter card, 6-port FXS Adapter card, and Integrated Services card (for VCB).

To change this parameter, all ports associated with the card must be in shutdown mode and no channels can be defined on the card. A change in the companding law results in a corresponding change to the signaling-type default. The signaling-type applies only to the 6-port E&M Adapter card.

Default

mu-law

Parameters

a-law

A-Law companding

mu-law

Mu-Law companding

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signaling-type

Syntax

signaling-type {**type-i** | **type-ii** | **type-v**}

Context

config>card>mda>voice

Description

This command specifies the signaling type to be used on the 6-port E&M Adapter card.

To change the signaling type, all ports associated with the 6-port E&M Adapter card must be in shutdown mode and no channels can be defined on the card.

The signaling type is selectable on a per-card basis. When either A-Law or Mu-Law companding is configured, Type I, Type II, or Type V signaling can be selected. However, the only supported configurations are both ends of the connection operating in the same mode (for example, Type I to Type I) or one end operating in Type I mode and the other in Type V mode.

Default

type-i (for Mu-Law companding)

type-v (for A-Law companding)

Parameters

type-i

Type I signaling

type-ii

Type II signaling

type-v

Type V signaling

3.14.2.4 Interface QoS commands

access

Syntax

access

Context

config>card>mda

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Description

This command enables the access context to configure QoS policy parameters for the specified adapter card.

network

Syntax

network

Context

config>card>mda

Description

This command enables the network context to configure QoS policy parameters for the specified adapter card.

ingress

Syntax

ingress

Context

config>card>mda>access

config>card>mda>network

Description

This command enables the context to configure the QoS policy parameters for ingress traffic, in either an access or network context, for the specified adapter card.

fabric-policy

Syntax

fabric-policy *fabric-policy-id*

no fabric-policy

Context

config>card>mda>access>ingress

config>card>mda>network>ingress

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Description

This command configures (applies) the ingress fabric policy, in either an access or network context, for the specified adapter card.

Fabric profiles do not apply to the Auxiliary Alarm card.

The **no** form of this command resets the *fabric-policy-id* to the default value.

Default

1

Parameters

fabric-policy-id

an existing fabric policy ID

Values 1 to 256

queue-policy

Syntax

queue-policy *name*

no queue-policy

Context

config>card>mda>network>ingress

Description

This command specifies the network ingress queue policy that defines queue parameters such as CBS, high-priority-only burst size, MBS, CIR, and PIR rates, as well as forwarding class-to-queue mappings. The network queue policy is defined in the **config>qos>network-queue** context. See the 7705 SAR Quality of Service Guide, "Network Queue QoS Policies", for more information.

The **no** form of this command reverts to the default.

Default

"default"

Parameters

name

specifies an existing network queue policy name

security-queue-policy

Syntax

security-queue-policy *policy-id*

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no security-queue-policy

Context

config>card>mda>access>ingress

config>card>mda>network>ingress

Description

This command applies an existing security queue policy, in either an access or network context, to the specified adapter card.

The **no** form of this command sets the *policy-id* back to the default.

Default

1

Parameters

policy-id

specifies an existing security queue policy ID

Values 1 to 65535

shaper-policy

Syntax

shaper-policy *policy-name*

no shaper-policy *policy-name*

Context

config>card>mda>access>ingress

Description

This command enables the context to assign a shaper policy to an Ethernet MDA.

For access ingress per-customer aggregate shaping, the shaper policy is assigned to an Ethernet MDA and SAPs on that Ethernet MDA must be bound to a shaper group within the shaper policy bound to that Ethernet MDA.

The default shaper policy cannot be deleted. The following table displays the default shaper policy parameters.

Table 36: Shaper policy defaults

Field	Default
description	"Default Shaper QoS policy."
shaper-group	"default"

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Field	Default
description	"Default Shaper Group."
pir-rate	max
cir-rate	0

The **no** form of this command removes the configured **shaper-policy**.

Default

shaper-policy "default"

Parameters

policy-name

the name of the shaper policy. To access the default shaper policy, enter "default".

Values Valid names consist of any string up to 32 characters long composed of printable, 7-bit ASCII characters.

If the string contains special characters (such as #, $, or spaces), the entire string must be enclosed within double quotes.

create

keyword used to create a shaper policy

ring

Syntax

ring

Context

config>card>mda>network

Description

This command specifies the QoS policy parameters for ring traffic in a network, for the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module.

add-drop-port-queue-policy

Syntax

add-drop-port-queue-policy *name*

no add-drop-port-queue-policy

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Context

config>card>mda>network>ring

Description

This command specifies the network queue policy to be applied to the add/drop port on the bridging domain side of a ring adapter card. The network queue policy is defined in the **config>qos>network-queue** context. See the 7705 SAR Quality of Service Guide, "Network Queue QoS Policies", for more information.

The ring ports and the add/drop port cannot use the same non-default network queue policy that is being used by the v-port and any other port on other cards.

Default

no add-drop-port-queue-policy

Parameters

name

specifies an existing network queue policy

qos-policy

Syntax

qos-policy *network-policy-id*

no qos-policy

Context

config>card>mda>network>ring

Description

This command specifies the network QoS policy for the ring. Only a ring type network QoS policy can be assigned to a port on the bridging domain side of a ring adapter card.

Default

no qos-policy

Parameters

network-policy-id

specifies the network QoS policy for the ring ports and the add/drop port on a ring adapter card

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spt

Syntax

spt

Context

config>card>mda

config>system

Description

This command enables the context for configuring SPT (self-processed traffic) parameters. The **config>card>mda** context is used for the 7705 SAR-8 Shelf V2, 7705 SAR-18, and 7705 SAR-X. The **config>system** context is used for the 7705 SAR-Hc, 7705 SAR-H, and 7705 SAR-Wx.

Default

n/a

security-aggregate-rate

Syntax

security-aggregate-rate *agg-rate*

no security-aggregate-rate

Context

config>card>mda>spt

config>system>spt

Description

This command configures the fabric aggregate rate for security queues on the datapath. The command is configured in the **config>card>mda>spt** context for the 7705 SAR-8 Shelf V2, 7705 SAR-18, and 7705 SAR-X, and in the **config>system>spt** context for the 7705 SAR-Hc, 7705 SAR-H, and 7705 SAR-Wx.

Parameters

agg-rate

specifies the aggregate rate for security queues, in kilobits per second

Values 1 to 10000000 | maximum

Default 50000

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3.14.2.5 External alarm commands

external-alarms

Syntax

external-alarms

Context

config

Description

This command enables access to the context to configure external alarm attributes on 7705 SAR Ethernet ports (supported on all platforms with Ethernet ports), on the Auxiliary Alarm card, and on the four alarm inputs on the fan module (for the 7705 SAR-8 Shelf V2), alarm connector (for the 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Wx, and 7705 SAR-X), and alarm module (for the 7705 SAR-18).

When configuring custom alarms for an Ethernet port, the port must be configured for 100Base-Tx operation with autonegotiation disabled.

alarm

Syntax

[**no**] **alarm** *alarm-id*

Context

config>external-alarms

Description

This command creates or removes alarms.

The **no** form of this command disables the alarm attributes for the specified alarm. The alarm must be in the shutdown state before the **no** form of the command can be performed.

Default

n/a

Parameters

alarm-id

specifies the alarm identifier

Values 1 to 2147483647

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chassis-alarming

Syntax

[**no**] **chassis-alarming**

Context

config>external-alarms>alarm

Description

This command generates output to chassis alarm relays and LEDs for the specified alarm.

The **no** form of this command disables the generation of output to chassis alarm relays and LEDs.

Default

chassis-alarming

log

Syntax

[**no**] **log**

Context

config>external-alarms>alarm

Description

This command generates raise/clear log events for the specified alarm and controls SNMP trap generation for the raise/clear log events.

The **no** form of this command disables the generation of raise/clear log events.

Default

log

severity

Syntax

severity {**critical** | **major** | **minor** | **warning**}

Context

config>external-alarms>alarm

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Description

This command configures the severity level for the specified alarm.

The alarm must be disabled before the severity level can be modified.

If the alarm generates raise/clear log events and SNMP traps (enabled by the log command), the severity of the raise log events and SNMP traps is controlled by this configuration. The severity level of the clear log events and SNMP traps is warning.

If the alarm generates output to chassis alarm relays and LEDs (enabled by the chassis-alarming command), the severity level of the alarm output is controlled by this configuration. For chassis relay alarms, only the critical, major and minor levels of severity apply. (There are three LEDs that represent each of them.)

Default

major

Parameters

critical

specifies a critical alarm

major

specifies a major alarm

minor

specifies a minor alarm

warning

specifies a warning (not applicable for chassis relay alarms)

thresholds

Syntax

thresholds

Context

config>external-alarms>alarm

Description

This command enables the context to configure the thresholds for the specified alarm.

Default

n/a

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analog

Syntax

analog

Context

config>external-alarms>alarm>thresholds

Description

This command enables the context to configure analog trigger thresholds for the specified alarm.

Default

n/a

level

Syntax

[**no**] **level** {**lt** | **gt**} *millivolts*

Context

config>external-alarms>alarm>thresholds>analog

Description

This command configures the analog voltage level thresholds for the specified alarm.

The analog input level threshold cannot be changed from **no level** when there are no analog inputs configured as triggers. When all analog inputs are removed from the trigger list, the level is automatically changed to **no level**. The analog input level threshold cannot be changed to **no level** when there is analog input in the trigger list. When the first analog input is added to the alarm trigger, the level is automatically changed to **gt** 0.

The **no** form of this command removes the analog voltage level threshold.

Default

no level

Parameters

lt

specifies a less-than value

gt

specifies a greater-than value

millivolts

specifies the voltage level in millivolts

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Values 0 to 75000

trigger

Syntax

trigger [**any** | **all**] {*alarm-input1* | *alarm-input2*... | *alarm-input8*}

no trigger

Context

config>external-alarms>alarm

Description

This command configures the inputs that will trigger the alarm. An alarm can be configured to trigger on any configured input or only when all enabled configured inputs are active. Administratively disabled inputs are ignored for alarm triggering.

Digital inputs are considered normally open. This means that a digital input becomes active only if it closes. Analog inputs have a customizable voltage threshold. This threshold can be configured using the thresholds command. Analog inputs become active when this threshold is crossed.

The **no** form of this command removes the trigger.

Default

no trigger

Parameters

any

specifies that any configured input trigger will raise an alarm

all

specifies that all configured input triggers that are enabled are required to raise an alarm

alarm-input

identifies the input trigger, up to a maximum of eight

for Ethernet ports, the format is:

port-*slot*/*mda*/*port* [*name*]

for the Auxiliary Alarm card, the format is:

alarm-*slot*/*mda*.{**d** | **a**}-*alarm-num* [*name*]

for the four alarm inputs on the fan module (for the 7705 SAR-8 Shelf V2), alarm connector (for the 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Wx, and 7705 SAR-X), and alarm module (for the 7705 SAR-18), the format is:

alarm.**d**-*alarm-num* [*name*]

where:

slot = card slot number for IOM (always 1 on the 7705 SAR)

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mda = Ethernet adapter card or Auxiliary Alarm card slot number (for Ethernet modules or ports on platforms with no card slots, the mda slot number is preconfigured)

port = port number for Ethernet ports

d = digital input

a = analog input

alarm-num = alarm port number (1 to 24 for digital on the Auxiliary Alarm card, 1 to 4 for digital on the four chassis alarm inputs, 1 or 2 for analog)

name = optional name assigned to the input

for example: alarm-1/3.d-3

windowOpen3

alarm.d-1

The *name* option lets users assign a more meaningful name (must be unique) to the alarm input; for example, windowOpen3 might be more meaningful to a user than the identifier alarm-1/3.d-3. Once the *name* has been configured, it can be used interchangeably with the alarm input identifier; for example, windowOpen3 can be used instead of alarm-1/3.d-3 as an alarm input trigger.

input

Syntax

input *alarm-input*

Context

config>external-alarms

Description

This command enables the context to configure the external alarm inputs on 7705 SAR Ethernet ports, on the Auxiliary Alarm card, and on the four alarm inputs on the fan module (for the 7705 SAR-8 Shelf V2), alarm connector (for the 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Wx, and 7705 SAR-X), and alarm module (for the 7705 SAR-18).

An alarm input must be associated with an alarm in order for the input to be triggered. See the trigger command. An input can be associated with up to four alarms.

Default

n/a

Parameters

alarm-input

identifies the alarm input

for Ethernet ports, the format is:

port-*slot*/*mda*/*port* [*name*]

for the Auxiliary Alarm card, the format is:

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alarm-*slot*/*mda*.{**d** | **a**}-*alarm-num* [*name*]

for the four alarm inputs on the fan module (for the 7705 SAR-8 Shelf V2), alarm connector (for the 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Wx, and 7705 SAR-X), and alarm module (for the 7705 SAR-18), the format is:

alarm.**d**-*alarm-num* [*name*]

where:

slot = card slot number for IOM (always 1 on the 7705 SAR)

mda = Ethernet adapter card or Auxiliary Alarm card slot number (for Ethernet modules or ports on platforms with no card slots, the mda slot number is preconfigured)

port = port number for Ethernet ports

d = digital input

a = analog input

alarm-num = alarm port number (1 to 24 for digital on the Auxiliary Alarm card, 1 to 4 for digital on the four chassis alarm inputs, 1 or 2 for analog)

name = optional name assigned to the input

for example:

alarm-1/3.d-3

windowOpen3

alarm.d-1

The *name* option lets users assign a more meaningful name (must be unique) to the alarm input; for example, windowOpen3 might be more meaningful to a user than the identifier alarm-1/3.d-3. Once the *name* has been configured, it can be used interchangeably with the alarm input identifier; for example, windowOpen3 can be used instead of alarm-1/3.d-3 as an alarm input trigger for the trigger command, or when performing a **show>external-alarms>input** or **show>external-alarms> output** command.

debounce

Syntax

debounce *seconds*

debounce detect *detect-seconds* **clear** *clear-seconds*

no debounce

Context

config>external-alarms>input

Description

This command configures the debounce time associated with detecting and clearing an alarm input. Debounce time is not supported on alarm inputs on Ethernet ports.

The **no debounce** form of the command sets both the detect time and clear time to 0.

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Default

2 (for both detect time and clear time)

Parameters

seconds

specifies the amount of time that the input must be on or off before it is accepted as changed from on to off (or from off to on)

Values 1 to 60

detect-seconds

specifies the amount of time that the input must be on before it is accepted as on by the system

Values 0 to 60

clear-seconds

specifies the amount of time that the input must be off before it is accepted as off by the system

Values 0 to 60

output

Syntax

output *alarm-output*

Context

config>external-alarms

Description

This command enables the context to configure the external alarm output relays.

Default

n/a

Parameters

alarm-output

identifies the output relay, in the following format:

relay-*slot*/*mda*.**d**-*relay-num* [*name*]

where:

slot = slot number of the card in the chassis (always 1 on the 7705 SAR)

mda = Auxiliary Alarm card slot number

d = digital output

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relay-num = output relay number (1to 8)

name = name assigned to the output relay

for example:

relay-1/3.d-5

doorHolder5

The *name* option lets users assign a more meaningful name (must be unique) to the output relay; for example, doorHolder5 might be more meaningful to a user than the output relay identifier relay-1/3.d-5. Once the name has been configured, it can be used interchangeably with the alarm identifier; for example, doorHolder5 can be used instead of relay-1/3.d-5 when performing a **show>external-alarms>output** command.

name

Syntax

name *name-string*

no name

Context

config>external-alarms>input

config>external-alarms>output

Description

This command configures a name for the alarm input or output relay. The configured name must be unique within the external alarms context; therefore, it must not be the same as an *alarm-input* name configured for the trigger or input command, or an *alarm-output* name configured for the output command. For example, alarm-1/3.d-1 or doorOpen1 cannot be used as a name for any alarm input, and relay-1/3.d-5 or doorHolder5 cannot be used as a name for any output relay.

The **no** form of this command does not associate a name with the alarm input or output relay.

Default

no name

Parameters

name-string

specifies a unique name for the alarm input or output relay (maximum of 15 characters)

normally

Syntax

normally {**open** | **closed**}

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Context

config>external-alarms>input

Description

This command configures the normal condition of the digital input – either normally open or normally closed. You cannot configure the normal condition on alarm inputs on Ethernet ports.

Default

normally open

3.14.2.6 APS port commands

port

Syntax

[**no**] **port** {**aps-***id*}

Context

config

Description

This command enables access to the context to configure APS on SONET/SDH ports and assigns an APS group ID. Both working and protection circuits must be configured with the same APS group ID on either the same 7705 SAR node (SC-APS) or on two 7705 SAR nodes (MC-APS).

Parameters

id

the APS group ID

Values 1 to 8

aps

Syntax

aps

Context

config>port

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Description

This command configures APS on SONET/SDH ports. An APS group contains a working and protection circuit with the same APS group ID on either a single 7705 SAR node (SC-APS) or on two 7705 SAR nodes (MC-APS).

The working circuit must be connected to the peer working circuit, and the protection circuit must be connected to the peer protection circuit.

The **aps** command is only available for APS groups, not for physical ports.

advertise-interval

Syntax

advertise-interval *advertise-interval*

no advertise-interval

Context

config>port>aps

Description

This command specifies the time interval, in 100s of milliseconds, between "I am operational" messages sent by the protection and working circuits to their neighbor in an MC-APS group. The **advertise-interval** value is valid only for an MC-APS.

Default

10

Parameters

advertise-interval

the time interval, in 100s of milliseconds, between transmitted operational messages

Values 10 to 650

hold-time

Syntax

hold-time *hold-time*

no hold-time

Context

config>port>aps

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Description

This command specifies how much time can pass without the node receiving an advertise packet from its neighbor before the MC-APS signaling link is considered operationally down. The hold time is in 100s of milliseconds and is usually the advertise-interval value multiplied by 3.

Parameters

hold-time

specifies, in 100s of milliseconds, how long to wait for an APS advertise packet before the neighbor in an MC-APS group is considered operationally down

Values 10 to 650

hold-time-aps

Syntax

hold-time-aps {[**lsignal-fail** *sf-time*] [**lsignal-degrade** *sd-time*]}

no hold-time-aps

Context

config>port>aps

Description

This command configures hold-down timers to debounce signal failure conditions (lais, b2err-sf) and signal degrade conditions (b2err-sd) for 1+1 unidirectional SC-APS switching mode. If the signal fail or signal degrade conditions exceed the configured hold-down time, APS is activated.

Default

no hold-time-aps (values are 0)

Parameters

sf-time

the signal failure hold-down time in milliseconds, from 1 to 100

sd-time

the signal degrade hold-down time in milliseconds, from 1 to 100

neighbor

Syntax

neighbor *ip-address*

no neighbor

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Context

config>port>aps

Description

This command specifies the neighbor IP address in an MC-APS group. When the value of the neighbor IP address is set to 0.0.0.0, or not set, this implies that the APS group is configured as an SC-APS group.

The route to the neighbor must not traverse the MC-APS member (working or protection) circuits. It is recommended that the neighbor IP address configured be on a shared network between the routers that own the working and protection circuits. The node should be connected with a direct interface to ensure optimum failover time.

By default, no neighbor address is configured and both the working and protection circuits should be configured on the same router as an SC-APS group.

Default

0.0.0.0

Parameters

ip-address

specifies the neighbor IPv4 or IPv6 address for MC-APS

protect-circuit

Syntax

protect-circuit *port-id*

no protect-circuit

Context

config>port>aps

Description

This command configures a physical port that will act as the protection circuit for this APS group.

The protection circuit port must contain only the default configuration and cannot belong to another APS group. The protection circuit port must be of the same type as the working circuit (SONET/SDH) for the APS group; if it is not, the command will return an error.

A protection circuit can only be added if the working circuit already exists. The protection circuit must be removed from the configuration before the working circuit can be removed.

When a port is a protection circuit of an APS group, the configuration options available in the **config>port port-id>sonet-sdh** context are not allowed for that port unless they are in the following exception list:

- clock-source
- [no] loopback
- [no] report-alarm
- section-trace

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- [no] threshold

When a port is configured as a protection circuit of an APS group, the configurations listed above and all service configurations related to the APS port are operationally inherited by the protection circuit. If the protection circuit cannot inherit the configurations (due to resource limitations), the configuration attempt fails and an error is returned to the user.

The protection circuit must be shut down before it can be removed from the APS group port. The inherited configuration for the circuit and APS operational commands for that circuit are not preserved when the circuit is removed from the APS group.

The **no** form of this command removes the protection circuit.

Default

n/a

Parameters

port-id

the physical port that will act as the protection circuit for this APS group in the format *slot/mda/port*

rdi-alarms

Syntax

[**no**] **rdi-alarms** {**suppress** | **circuit**}

Context

config>port>aps

Description

This command configures how RDI alarms (line, path, section) are generated on physical circuits of an APS port. The command is only supported in 1+1 unidirectional SC-APS mode. When you configure RDI alarms on a port on the 2-port OC3/STM1 Channelized Adapter card, the second port is automatically configured with a matching RDI alarms setting. As a consequence, both ports will then support only 1+1 unidirectional SC-APS mode.

Default

circuit

Parameters

suppress

RDI hardware generation on working and protection circuits is suppressed. No alarms are generated upon an Rx failure of that circuit.

circuit

RDI alarms are hardware-generated independently on each working and protection circuit based on an Rx failure of that circuit, regardless of APS line status

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revert-time

Syntax

revert-time *minutes*

no revert-time

Context

config>port>aps

Description

This command configures how long the 7705 SAR waits before switching back to the working circuit after it has been restored to service.

If the minutes value is changed, it takes effect at the next initiation of the wait-to-restore (WTR) timer.

This command does not modify the length of a WTR timer that has already been started. The WTR timer of a non-revertive switch can be assumed to be infinite.

The **no** form of this command restores the default (non-revertive) mode – the switch back does not occur unless the protection circuit fails or it is manually switched by the operator.

Parameters

minutes

the time to wait, in minutes, before reverting to the working circuit after it has been restored to service

Values 0 to 60

Default 5

switching-mode

Syntax

switching mode {**bi-directional** | **uni-1plus1**}

Context

config>port>aps

Description

This command configures the switching mode for the APS port. SC-APS supports both **bi-directional** and **uni-1plus1**; MC-APS supports only **bi-directional** switching mode.

Default

bi-directional

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Parameters

bi-directional

provides protection in both directions

uni-1plus1

provides protection in one direction

working-circuit

Syntax

working-circuit *port-id*

no working-circuit

Context

config>port>aps

Description

This command configures a physical port that will act as the working circuit for this APS group.

The working circuit port must contain only the default configuration and cannot be part of another APS group. The working circuit must be created before the protection circuit.

When a port is a working circuit of an APS group, the configuration options available in the **config>port port-id>sonet-sdh** context are not allowed for that port unless they are in the following exception list:

- clock-source
- [no] loopback
- [no] report-alarm
- section-trace
- [no] threshold

When a port is configured as a working circuit of an APS group, the configurations listed above and all service configurations related to the APS port are operationally inherited by the working circuit from the APS group ID. If the working circuit cannot inherit that configuration (for example, due to resource limitations), the configuration attempt fails and an error is returned to the user.

The working circuit must be shut down before it can be removed from an APS group. The inherited configuration for the circuit and APS operational commands for that circuit are not preserved when the circuit is removed from the APS group.

All configurations for the APS group under the **config>port** context and its submenus and all configuration for services that use this APS group ID are preserved as a non-activated configuration since the APS group no longer has any physical circuits assigned.

The **no** form of this command removes the working circuit. The working circuit can only be removed from the configuration after the protection circuit has been removed.

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Parameters

port-id

the physical port that will act as the working circuit for this APS group in the format *slot/mda/port*

3.14.2.7 T1/E1 LCR commands

lcr

Syntax

[**no**] **lcr lcr-***id*

Context

config

Description

This command enables access to the context to configure line card redundancy (LCR) parameters on T1/E1 ports or links. When the **lcr-***id* is specified, this command assigns an LCR group ID. Both working and protection adapter cards must be configured with the same LCR group ID and on the same card type. For SC-LCR, both working and protection adapter cards must be on the same 7705 SAR node. For MC-LCR, the working and protection adapter cards must be on different 7705 SAR nodes.

Parameters

lcr

keyword

id

the LCR group ID, from 1 to 6

advertise-interval

Syntax

advertise-interval *advertise-interval*

no advertise-interval

Context

config>lcr

Description

This command specifies the time interval between "I am operational" messages sent by the protection and working adapter cards to their neighbors in an MC-LCR group. The **advertise-interval** value is valid only for MC-LCR.

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Default

10

Parameters

advertise-interval

the time interval, in tenths of a second, between transmitted operational messages

Values 10 to 650

hold-time

Syntax

hold-time *hold-time*

no hold-time

Context

config>lcr

Description

This command specifies how much time can pass without the node receiving an advertise packet from its neighbor in an MC-LCR group before the neighbor is considered operationally down. The hold time is usually the advertise-interval value multiplied by 3.

Parameters

hold-time

specifies, in 100s of milliseconds, how long to wait for an LCR advertise packet before the neighbor in an MC-LCR group is considered operationally down

Values 10 to 650

neighbor

Syntax

neighbor *ip-address*

no neighbor

Context

config>lcr

Description

This command specifies the neighbor IP address in an MC-LCR group. When the value of the neighbor IP address is set to 0.0.0.0, or not set, this implies that the LCR group is configured as an SC-LCR group.

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The route to the neighbor must not traverse the MC-LCR member (working or protection) adapter cards. It is recommended that the neighbor be on a shared network between the nodes that are configured with the working and protection cards. The node should be connected with a direct interface to ensure optimum failover time.

By default, no neighbor address is configured and both the working and protection adapter cards should be configured as an SC-LCR group on the same node.

Default

0.0.0.0

Parameters

ip-address

specifies the neighbor IPv4 or IPv6 address for MC-LCR

protect-mda

Syntax

protect-mda *mda-id*

no protect-mda

Context

config>lcr

Description

This command configures an adapter card that will act as the protection card for this LCR group.

The protection adapter card must contain only the default configuration and cannot belong to another LCR group. The protection card must be of the same type as the working adapter card for the LCR group; if it is not, the command will return an error.

A protection card can only be added if the working card already exists in the LCR group. The protection card must be removed from the configuration before the working card can be removed.

The protection card must be shut down before it can be removed from the LCR group. The inherited configuration for the protection card and the configured LCR operational commands for that card are not preserved when it is removed from the LCR group.

The **no** form of this command removes the protection card from the LCR group.

Default

no protect-mda

Parameters

mda-id

the adapter card that will act as the protection card for this LCR group in the format *slot/mda*, where *slot* is the slot number of the IOM and *mda* is the slot number of the adapter card

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Values *slot* is 1

mda is from 1 to 16

revert-time

Syntax

revert-time *minutes*

no revert-time

Context

config>lcr

Description

This command configures how long the 7705 SAR waits before switching activity back to the working adapter card after it has been restored to service.

If the minutes value is changed, the change takes effect at the next initiation of the wait-to-restore (WTR) timer.

This command does not modify the duration of a WTR timer that has already been started. The WTR timer of a non-revertive switch can be assumed to be infinite.

The **no** form of this command restores the default (non-revertive) mode. The switch back does not occur unless the protection adapter card fails or activity is manually switched by the operator.

Default

no revert-time

Parameters

minutes

the time to wait, in minutes, before reverting to the working adapter card after it has been restored to service

Values 0 to 60

Default 5

working-mda

Syntax

working-mda *mda-id*

no working-mda

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Context

config>lcr

Description

This command configures an adapter card that will act as the working card for this LCR group.

The working card must contain only the default configuration and cannot be part of another LCR group. The working card must be created before the protection card.

The working card must be shut down before it can be removed from an LCR group. The inherited configuration for the card and configured LCR operational commands for that card are not preserved when it is removed from the LCR group.

The **no** form of this command removes the working card from the LCR group. The working card can only be removed from the configuration after the protection card has been removed.

Default

no working-mda

Parameters

mda-id

the adapter card that will act as the working card for this LCR group in the format *slot/mda*, where *slot* is the slot number of the IOM and *mda* is the slot number of the adapter card

Values *slot* is 1

mda is from 1 to 16

3.14.2.8 Microwave link commands

port

Syntax

[**no**] **port** *mw-link-id*

Context

config

Description

This command configure a microwave link on a 7705 SAR-8 Shelf V2 or 7705 SAR-18.

The **no** form of this command removes the microwave link configuration.

Parameters

mw-link-id

specifies the microwave link ID number, using the form **mw-link-***id*

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Values *id* = 1 to 24

mw

Syntax

mw

Context

config>port

Description

This command enables the context to configure microwave link parameters.

hold-time

Syntax

[**no**] **hold-time** {[**up** *hold-time-up*] [**down** *hold-time-down*]}

Context

config>port>mw

Description

This command configures dampening timers on a microwave link. Dampening timers guard against excessive link transitions reported to upper layer protocols.

The **no** form of this command removes the dampening timers configuration.

Default

down 0 or up 0 – no microwave link dampening is enabled; link transitions are immediately reported to upper layer protocols

Parameters

hold-time-up

the number of seconds before an up-state to down-state transition is reported to upper layer protocols

Values 0 to 900 s

hold-time-down

the number of seconds before a down-state to up-state transition is reported to upper layer protocols

Values 0 to 900 s

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peer-discovery

Syntax

[**no**] **peer-discovery**

Context

config>port>mw

Description

This command enables or disables peer discovery on the microwave link.

Peer discovery is used to discover the IP addresses of remote routers over the microwave link, as well as the physical ports of the remote routers corresponding to the primary radios for the microwave link.

Ports with peer discovery disabled do not send peer discovery packets and ignore any received peer discovery packets. The CLI does not display the IP address of peers when peer discovery is disabled.

protection

Syntax

[**no**] **protection**

Context

config>port>mw

Description

This command enables protection switching on a microwave link.

The **no** form of this command removes the protection switching on a microwave link.

radio

Syntax

radio *port-id* **create** [**main** | **spare**]

no radio *port-id*

Context

config>port>mw

Description

This command configures an MPR-e radio for a microwave link.

The **no** form of this command removes an MPR-e spare radio from the specified port

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Note: You cannot remove an MPR-e main radio that is associated with a microwave link. The microwave link must be deleted and then reconfigured with the required MPR-e radio.

Parameters

port-id

specifies a port on a Packet Microwave Adapter card on which an MPR-e radio is configured, in the format *slot/mda/port* (*port* = 1 through 4)

Note:

- The port must have an **encap-type** of dot1q and it cannot be used by any service or interface.
- Only a main radio can be configured on an odd-numbered port, that is, port 1 or 3.

create

creates the MPR-e radio (mandatory)

main

sets the MPR-e radio as the main (active) radio

spare

sets the MPR-e radio as the spare (standby) radio

database

Syntax

database *filename*

no database

Context

config>port>mw>radio

Description

This command configures the filename of the MPR-e radio database.

The **no** form of this command removes the MPR-e radio database configuration.

Default

n/a

Parameters

filename

specifies the name of the MPR-e radio database

Values up to 32 characters

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name

Syntax

name *name-string*

no name

Context

config>port>mw>radio

Description

This command specifies a name to be associated with an MPR-e radio.

The **no** form of this command removes the name configured for the MPR-e radio.

Default

n/a

Parameters

name-string

specifies the MPR-e radio name

Values up to 32 characters

perfmon

Syntax

perfmon [**g826**] [**power**] [**acm**]

Context

config>port>mw>radio

Description

This command enables MWA performance monitoring on microwave links in order to collect G.826, radio power, and Adaptive Coding and Modulation (ACM) level performance statistics.

The **no** form of this command disables MWA performance monitoring on microwave links.

Default

no perfmon

Parameters

g826

enables performance monitoring for G.826 statistics (BBE, ES, SES, and UAS)

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power

enables performance monitoring for radio power statistics

acm

enables performance monitoring for ACM level statistics

rsl-history

Syntax

rsl-history *file-url*

no rsl-history

Context

config>port>mw>radio

Description

This command enables the RSL history file for an MPR-e radio to be uploaded to the 7705 SAR.

The **no** form of this command removes the configuration.

Default

no rsl-history

Parameters

file-url

specifies the URL of the RSL history file for the specified radio

Values *local-url*: [*cflash-id*/][*file-path*]; 99 characters maximum

standalone

Syntax

[**no**] **standalone**

Context

config>port>mw>radio

Description

This command configures the MPR-e radio to operate in standalone mode.

The **no** form of this command removes the standalone designation and sets the MPR-e radio in MWA mode.

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Default

no standalone

suppress-faults

Syntax

suppress-faults [**hber**] [**rsl-threshold**] [**rdi**] [**all**]

[**no**] **suppress-faults**

Context

config>port>mw>radio

Description

This command suppresses detected faults on microwave links. If microwave link faults are detected, an event is logged and the link is disabled. When faults are suppressed, the event is still logged, but the microwave link is not disabled. By default, the system does not suppress faults for FFD.

The **no** form of this command removes fault suppression.

Default

no suppress-faults

Parameters

hber

suppresses high bit error rate faults

rsl-threshold

suppresses RSL threshold crossing faults

rdi

suppresses RDI faults

all

suppresses all faults

tx-mute

Syntax

[**no**] **tx-mute**

Context

config>port>mw>radio

Description

This command mutes the transmitter on the radio MPR-e radio.

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The **no** form of this command disables the mute configuration.

revert

Syntax

[**no**] **revert** [**eps**] [**rps**]

Context

config>port>mw

Description

This command configures the type of revertive switching on the microwave link. Revertive switching occurs when the MPR-e radio operation switches from the spare radio back to the main radio after a fault condition is cleared.

The **no** form of this command removes the revertive switching configuration.

Default

n/a

Parameters

eps

sets Equipment Protection Switching as the revertive switching type

Note: If EPS is configured as the revertive switching type, Transmission Protection Switching (TPS) is automatically applied as well; TPS cannot be enabled independently.

rps

sets Radio Protection Switching as the revertive switching type

3.14.2.9 General port commands

port

Syntax

port {*port-id* | *bundle-id*}

no port {*port-id* | *bundle-id*}

Context

config

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Description

This command enables access to the context to configure ports, multilink bundles, and IMA groups. Before a port can be configured, the chassis slot must be provisioned with a valid card type and the adapter card slot must be provisioned with a valid adapter card type. (See the card and mda commands.)

Default

n/a

Parameters

port-id

specifies the physical port ID in the *slot/mda/port* format, or a virtual port (v-port) on the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module (where *port-id* for the virtual port is either "v-port" or 3)

bundle-id

specifies the multilink bundle identifier

The command syntax must be configured as follows:

Syntax bundle-*type-slot/mda.bundle-num*

bundle[-**ppp**]-*slot/mda.bundle-num* (Creates a multilink PPP bundle)

bundle-ima-*slot/mda.bundle-num* (Creates an IMA group)

bundle: keyword

slot: card/adapter card slot numbers

bundle-num: 1 to 32

For example:

router1>config# port bundle-1/1.1 (multilink PPP bundle)

router1>config# port bundle-ima-1/1.2 (IMA group bundle)

ddm-events

Syntax

[**no**] **ddm-events**

Context

config>port

Description

This command enables or disables digital diagnostic monitoring (DDM) events for the port. DDM is supported on Ethernet SFP ports, OC3 SONET SFP ports, and v-ports.

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Default

no ddm-events

dwdm

Syntax

dwdm

Context

config>port

Description

This command configures the Dense Wavelength Division Multiplexing (DWDM) parameters.

channel

Syntax

channel *channel*

Context

config>port>dwdm

Description

This command configures the DWDM ITU channel for a tunable adapter card optical interface. The channel is expressed in a form that is derived from the laser's operational frequency. For example, 193.40 THz corresponds to DWDM ITU channel 34 in the 100 GHz grid and 193.45 THz corresponds to DWDM ITU channel 345 in the 50 GHz grid. The provisioned adapter card must support DWDM tunable optics. For a complete list of supported optics and associated adapter cards, contact your Nokia representative.

The DWDM channel must be set to a non-zero value before the port is set to **no shutdown**.

The port must be shut down before changing the DWDM channel, and the port must be a physical port to set the DWDM channel.

Parameters

channel

specifies the channel

Values 0: valid on disabled ports

17 to 61 inclusive: 100 GHz channels

175, 185 to 605: 50 GHz channels

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3.14.2.10 Ethernet commands

ethernet

Syntax

ethernet

Context

config>port

Description

This command enables access to the context to configure Ethernet port attributes on all cards, modules, and chassis that support Ethernet. For the Packet Microwave Adapter card, this command does not apply to ports that support microwave awareness.

access

Syntax

access

Context

config>port>ethernet

Description

This command enables access to the context to configure access mode parameters.

egress

Syntax

egress

Context

config>port>ethernet>access

Description

This command enables access to the context to configure the CIR rate for the aggregate of all the unshaped 4-priority SAPs on the port and to configure the shaper policy.

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shaper-policy

Syntax

shaper-policy *name*

no shaper-policy

Context

config>port>ethernet>access>egress

Description

This command assigns a shaper policy to the specified hybrid port.

For hybrid ports, the shaper policy is independently assigned to access or network egress traffic. When the Ethernet port mode is changed to hybrid mode, the default policy is assigned to access and network traffic. To change an access or network policy, use the commands **config>port>ethernet> access>egress>shaper-policy** and **config>port>ethernet> network>egress>shaper-policy**.

For access egress per-customer aggregate shaping, the shaper policy is assigned to a port and SAPs on that port must be bound to a shaper group within the shaper policy bound to that port.

The shaper policy defines shaper parameters such as shaper group, and PIR and CIR rates. The shaper policy is defined in the **config>qos>shaper-policy** context. See the 7705 SAR Quality of Service Guide, "QoS for Hybrid Ports" and "Per-Customer Aggregate shapers (Multiservice Site)", for more information.

Note:

- The port shaper rate applies to the bulk of access and network traffic. When the configured egress shaper rate is reached, both the access and network traffic scheduling pauses.
- For hybrid ports, there can be a single shaper policy on access egress and a single shaper policy on network egress. Therefore, all the SAP traffic and all the network traffic is each bound to its own shaper group in the shaper policy (access and network shaper policy, respectively). In other words, shaped SAPs and the bulk/aggregate of unshaped SAPs are shaped together as per the shaper policy assigned to the access egress. A similar behavior applies to network traffic, where the shaped interfaces and the bulk/aggregate of unshaped interfaces are shaped together as per the shaper policy assigned to the network egress.

The **no** form of this command reverts to the default.

Default

"default"

Parameters

name

specifies an existing shaper policy name

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unshaped-sap-cir

Syntax

unshaped-sap-cir *cir-rate*

no unshaped-sap-cir

Context

config>port>ethernet>access>egress

Description

This command sets the CIR rate for the aggregate of all the unshaped 4-priority SAPs on the port. The default *cir-rate* is 0 kb/s. When the *cir-rate* is set to **max**, the CIR rate adopts the maximum rate of the port, which is set using the egress-rate *sub-rate* command.

If the *cir-rate* is higher than the *sub-rate*, the *cir-rate* is stored in the configuration database but the *sub-rate* limit is used.

On a Gen-3-based port, this command can be set for mix-and-match LAG SAP purposes, but is not applied to the Gen-3-based port. See LAG support on mixed-generation hardware for more information.

The **no** form of the command sets the **unshaped-sap-cir** CIR rate to 0 kb/s.

Default

no unshaped-sap-cir

Parameters

cir-rate

the CIR rate for the aggregate of all the unshaped 4-priority SAPs on the port

Values 0 to 100000000 kb/s, or max

Default 0 kb/s

autonegotiate

Syntax

autonegotiate [**limited**]

no autonegotiate

Context

config>port>ethernet

Description

This command enables speed autonegotiation and duplex autonegotiation on Ethernet ports.

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The 8-port Gigabit Ethernet Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card in **x10-1gb-sfp** mode, and Packet Microwave Adapter card support speed autonegotiation and duplex autonegotiation on all SFP ports. Each port can run in full-duplex mode or in half-duplex mode at 10 or 100 Mb/s.

The 6-port Ethernet 10Gbps Adapter card and the 7705 SAR-X support speed autonegotiation and duplex autonegotiation on all SFP ports; SFP+ ports do not support autonegotiation. Each SFP port can run in full-duplex mode or half-duplex mode at 10 Mb/s or 100 Mb/s, and in full-duplex mode at 1 Gb/s. Each SFP+ port can run in full-duplex mode at 10 Gb/s.

Speed autonegotiation takes place automatically—all ports are configured for speed autonegotiation by default. Speed autonegotiation might need to be disabled (for example, if a port must be forced to a certain speed or to avoid speed negotiation loops between the Ethernet Adapter card and other devices). To turn off speed autonegotiation for a port, the user configures the port speed manually.

When autonegotiation is disabled on a port, the port does not attempt to autonegotiate and will only operate at the speed and duplex settings configured for the port. Also, when autonegotiation is disabled, the tx and rx pauses are enabled automatically (the tx and rx pauses are negotiated with the far end if autonegotiation is enabled).

If the **limited** keyword option is specified, the port will autonegotiate but will only advertise a specific speed and duplex mode. The speed and duplex mode advertised are the settings configured for the port. One use for limited mode is for multispeed gigabit ports to force gigabit operation while keeping autonegotiation enabled for compliance with IEEE 801.3.

The **no** form of this command disables autonegotiation on this port.

Caution:

- Autonegotiation must not be disabled on an Ethernet port if the port is connected to an MPR-e radio.
- For fiber SFP-based Gigabit Ethernet ports, it is recommended that autonegotiation be enabled. If autonegotiation is disabled and the configured speed does not correctly match the capability of the SFP, then the operational state of the link will remain down. Attempting to configure a speed and duplex mode to 1000 Mb/s, half-duplex, is an invalid combination and will be blocked from CLI.
- For RJ45 interfaces, autonegotiation is mandatory for 1000Base-T operation (if disabled, the behavior is undefined).

Note:

- If autonegotiation is turned off, the reception and transmission of IEEE 802.3x flow control frames is enabled by default and cannot be disabled. For more information, see Flow control on Ethernet ports.
- Ports belonging to a microwave link must have limited autonegotiation enabled before the link can be added to a LAG.

Default

autonegotiate

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cfm-loopback

Syntax

cfm-loopback priority {**low** | **high** | **dot1p**} [**match-vlan** {*vlan-range* | **none**}]

no cfm-loopback

Context

config>port>ethernet

Description

This command enables the port to respond to loopback messages (LBMs) and sets the queuing and scheduling conditions for handling CFM LBM frames. The user selects the desired QoS treatment by enabling the CFM loopback and including the high or low priority with the **high** or **low** keyword. The queue parameters and scheduler mappings associated with the **high** and **low** keywords are preconfigured and cannot be altered by the user.

The **priority dot1p** and **match-vlan** keywords apply only to physical ring ports on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module.

The parameters and mappings have the following settings:

- for network egress or access egress, where 4-priority scheduling is enabled:
  - **high-priority**: either cir = port_speed, which applies to all frames that are scheduled via an expedited in-profile scheduler, or RR for all other (network egress queue) frames that reside in expedited queues and are in an in-profile state
  - **low-priority**: either cir = 0, pir = port_speed, which applies to all frames that are scheduled via a best effort out-of-profile scheduler, or RR for all other frames that reside in best-effort queues and are in an out-of-profile state
- for the 8-port Gigabit Ethernet Adapter card, the 10-port 1GigE/1-port 10GigE X-Adapter card, and for the v-port on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module, for network egress, where 16-priority scheduling is enabled:
  - **high-priority**: has higher priority than any user frames
  - **low-priority**: has lower priority than any user frames
- for the physical ring ports on the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module, which can only operate as network egress, the priority of the LBR frame is derived from the dot1p setting of the received LBM frame. Based on the assigned ring-type network queue policy, dot1p-to-queue mapping is handled using the same mapping rule that applies to all other user frames.

CFM loopback support on a physical ring port on the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module differs from other Ethernet ports. For these ports, **cfm-loopback** is configured using **dot1p** and an optional list of up to 16 VLANs. The null VLAN is always applied. The CFM loopback message will be processed if it does not contain a VLAN header, or if it contains a VLAN header with a VLAN ID that matches one in the configured **match-vlan** list.

The **no** form of the command disables the handling of CFM loopback frames.

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Default

no cfm-loopback

Parameters

low

sets the queue parameters and scheduler mappings, as described above

high

sets the queue parameters and scheduler mappings, as described above

dot1p

sets the queue parameters and scheduler mappings on a physical ring port, as described above

match-vlan

sets the matching VLAN IDs that will allow a CFM loopback on a physical ring port when **priority** is set to **dot1p**, as described above

Values *vlan-range*: 1 to 4094 (for example, 1-10,33,2123)
none: only untagged CFM LBMs are accepted

Default none

crc-monitor

Syntax

crc-monitor

Context

config>port>ethernet

Description

This command enables the context to configure Ethernet CRC monitoring parameters.

sd-threshold

Syntax

sd-threshold *threshold* [**multiplier** *multiplier*]

no sd-threshold

Context

config>port>ethernet>crc-monitor

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Description

This command configures the error rate threshold at which the signal degrade condition is declared on an Ethernet interface. The error rate threshold value is the ratio of errored frames over total frames received, which is calculated as an average over the time set by the sliding window. The value is calculated as M × 10E-N, where M is the optional multiplier used to increase the error ratio, and N is the rate of errored frames allowed (threshold). For example, 3 × 10E-3 sets the error rate threshold at 3 errored frames per 1000 total frames received. If no **window-size** is configured, a default of 10-s is used. The CRC errors on the interface are sampled once per second.

The multiplier keyword is optional. If the multiplier keyword is omitted, the default value of 1 is used.

The **no** form of the command disables **sd-threshold** monitoring.

Default

no sd-threshold

Parameters

threshold

specifies the threshold value

Values 1 to 9

multiplier

specifies the multiplier value

Values 1 to 9

Default 1

sf-threshold

Syntax

sf-threshold *threshold* [**multiplier** *multiplier*]

no sf-threshold

Context

config>port>ethernet>crc-monitor

Description

This command configures the error rate threshold at which the signal fail condition is declared on an Ethernet interface. The error rate threshold value is the ratio of errored frames over total frames received, which is calculated as an average over the time set by the sliding window. The value is calculated as M × 10E-N, where M is the optional multiplier used to increase the error ratio, and N is the rate of errored frames allowed (threshold). For example, 3 × 10E-3 sets the error rate threshold at 3 errored frames per 1000 total frames received. If no **window-size** is configured, a default of 10-s is used. The CRC errors on the interface are sampled once per second.

The multiplier keyword is optional. If the multiplier keyword is omitted, the default value of 1 is used.

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The **no** form of the command disables **sf-threshold** monitoring.

Default

no sf-threshold

Parameters

threshold

specifies the threshold value

Values 1 to 9

multiplier

specifies the multiplier value

Values 1 to 9

window-size

Syntax

window-size *seconds*

no window-size

Context

config>port>ethernet>crc-monitor

Description

This command configures the sliding window size over which the Ethernet frames are sampled to detect signal fail or signal degrade conditions. The command is used jointly with the **sd-threshold** and the **sf-threshold** commands.

A sliding window (**window-size**) is used to calculate a statistical average of CRC error statistics collected every second. Each second, the oldest statistics are dropped from the calculation. For example, if the default 10-s sliding window is configured, at the 11th second the oldest second of statistical data is dropped and the 11th second is included. This sliding average is compared against the configured SD and SF thresholds to determine if the error rate over the window exceeds one or both of the thresholds, which will generate an alarm and log event.

The **no** form of the command disables **window-size** monitoring.

Default

10

Parameters

seconds

specifies the size of the sliding window over which the errors are measured

Values 5 to 60

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dot1q-etype

Syntax

dot1q-etype *0x0600 to 0xffff*

no dot1q-etype

Context

config>port>ethernet

Description

This command specifies the Ethertype expected when the port's encapsulation type is dot1q.

IEEE 802.1q (also known as VLAN tagging) defines a process to channelize a single Ethernet port or v-port into VLANs. Each VLAN can represent a customer or an application. Up to 4096 VLANs can be configured per port. For more information about VLANs and VLAN tagging, see "VLL Services" in the 7705 SAR Services Guide.

The Ethertype specifies the protocol being carried in an Ethernet frame. In 802.1q, the Ethertype is set to the Tag Protocol Identifier (TPID) value of 0x8100, which identifies the frame as an IEE 802.1Q-tagged frame. As well, 2 bytes of Tag Control Information (TCI), followed by 2 bytes containing the frame's original Ethertype are added to the frame. Together, the TPID and TCI make up the VLAN tag.

For Ethernet ports, when the port **encap-type** is **qinq**, the **dot1q-etype** value sets the Ethertype for the inner VLAN tag. The **qinq** encapsulation type is not supported by v-ports.

Network ports do not allow dot1q-etype settings.

The **no** form of this command resets the dot1q-etype value to the default.

Default

0x8100

Parameters

0x0600 to 0xffff

specifies the Ethertype to expect

down-when-looped

Syntax

down-when-looped

Context

config>port>ethernet

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Description

This command enables the down-when-looped feature on Ethernet ports or v-ports. When the down-when-looped feature is activated, a keepalive loop PDU is transmitted periodically toward the network. The port listens for returning keepalive loop PDUs. A loop is detected if any of the received PDUs have an Ethertype value of 9000 and the source and destination MAC addresses are identical to the MAC address of the port. When a loop is detected, the port is immediately brought down.

Ethernet port-layer line loopbacks and Ethernet port-layer internal loopbacks can be enabled on the same port with the down-when-looped feature. EFM OAM cannot be enabled on the same port with the down-when-looped feature.

keep-alive

Syntax

keep-alive *timer*

no keep-alive

Context

config>port>ethernet>down-when-looped

Description

This command configures the time interval between the keepalive PDUs transmitted toward the network during loop detection by the down-when-looped feature.

Default

10 s

Parameters

timer

the interval between keepalive PDUs

Values 1 to 120 s

retry-timeout

Syntax

retry-timeout *timer*

no retry-timeout

Context

config>port>ethernet>down-when-looped

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Description

This command configures the minimum wait time before re-enabling the Ethernet port or v-port after it is brought down due to a loop detection.

Default

120

Parameters

timer

the minimum wait time before re-enabling the Ethernet port or v-port

Values 0 s or 10 to 160 s

use-broadcast-address

Syntax

[**no**] **use-broadcast-address**

Context

config>port>ethernet>down-when-looped

Description

This command configures the down-when-looped feature to declare a loop when the destination MAC address matches the broadcast MAC address instead of the MAC address of the Ethernet port or v-port.

duplex

Syntax

duplex {**full** | **half**}

Context

config>port>ethernet

Description

This command configures the duplex mode of an Ethernet or Fast Ethernet port when autonegotiation is disabled.

The 10-port 1GigE/1-port 10GigE X-Adapter card must be in **x10-1gb-sfp** mode to support this command.

SFP slots hosting Ethernet or Fast Ethernet SFPs can be configured to full-duplex or half-duplex mode when autonegotiation is disabled. Duplex autonegotiation is automatically turned off when the user sets the mode with this command. SFP slots hosting optical GigE SFPs only support full-duplex mode; duplex autonegotiation is not supported.

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On 10 Gb/s ports, the mode is always full duplex and cannot be changed. This includes the ring Ethernet XFP ports and the v-port on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module.

Default

full

efm-oam

Syntax

efm-oam

Context

config>port>ethernet

Description

This command configures EFM-OAM attributes.

accept-remote-loopback

Syntax

[**no**] **accept-remote-loopback**

Context

config>port>ethernet>efm-oam

Description

This command enables reactions to loopback control OAMPDUs from peers.

The **no** form of this command disables reactions to loopback control OAMPDUs.

Default

no accept-remote-loopback

hold-time

Syntax

hold-time *time-value*

no hold-time

Context

config>port>ethernet>efm-oam

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Description

This command sets the amount of time that EFM-OAM will wait before going from a non-operational state to an operational state.

If EFM-OAM goes from an operational state to a non-operational state (other than link-fault), it enters the hold-time period. During this time, EFM-OAM continues to negotiate with the peer if possible, but will not transition to the "up" state until the hold time has expired.

If EFM-OAM goes down due to a lower-level fault (for example, the port goes down and EFM-OAM enters the link-fault state), the hold timer is not triggered. When the lower-level fault is cleared, EFM-OAM immediately starts running on the port and transitions to the operational state as soon as possible.

If EFM-OAM goes down because the user administratively disables the protocol, EFM-OAM immediately transitions to the disabled state. When the user re-enables EFM-OAM, the protocol enters the hold time period and EFM-OAM is not operational until the hold time expires.

A hold-time value of 0 indicates that EFM-OAM returns to the operational state without delay.

The hold time affects only the transition from a non-operational state to an operational state; it does not apply to a transition from an operational state to a non-operational state.

Default

no hold-time

Parameters

time-value

the number of seconds that EFM-OAM will wait before returning to an operational state from a non-operational state

Values 0 to 50

Default 0

ignore-efm-state

Syntax

[**no**] **ignore-efm-state**

Context

config>port>ethernet>efm-oam

Description

This command decouples the EFM OAM protocol from the port state and operational state.

When this command is configured on the port, any failure in the EFM protocol state (discovery, configuration, time-out, loops, and so on) does not affect the port. Only a protocol warning message is raised to indicate issues with the protocol.

When the command is not configured on a port, the port state is affected by any EFM OAM protocol fault or clear condition.

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If the port is a member of a microwave link, the **ignore-efm-state** command must be enabled before the EFM OAM protocol can be activated. This restriction is required because EFM OAM is not compatible with microwave links.

Default

no ignore-efm-state

mode

Syntax

mode {**active** | **passive**}

Context

config>port>ethernet>efm-oam

Description

This command configures the mode of OAM operation for this Ethernet port.

Active mode causes the port to initiate the negotiation process and continually send out efm-oam information PDUs. **Passive** mode waits for the peer to initiate the negotiation process. A passive mode port cannot initiate monitoring activities (such as loopback) with the peer.

Default

active

transmit-interval

Syntax

[**no**] **transmit-interval** *interval* [**multiplier** *multiplier*]

Context

config>port>ethernet>efm-oam

Description

This command configures the transmit interval of OAMPDUs.

Default

interval 10, multiplier 5

Parameters

interval

specifies the transmit interval

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Values 1 to 600 (in 100 ms)

multiplier

specifies the multiplier for the transmit-interval to set the local link down timer

Values 2 to 5

tunneling

Syntax

[**no**] **tunneling**

Context

config>port>ethernet>efm-oam

Description

This command enables EFM OAMPDU tunneling. OAMPDU tunneling is required when a loopback is initiated from a router end and must be transported over the existing network infrastructure to the other end. Enabling tunneling will allow the PDUs to be mapped to Epipes so that the OAM frames can be tunneled over MPLS to the far end.

To enable Ethernet EFM OAM 802.3ah on the port, use the **efm-oam>no shutdown** command.

The **no** form of the command disables tunneling.

Default

no tunneling

egress-rate

Syntax

egress-rate *sub-rate* [**include-fcs**] [**allow-eth-bn-rate-changes**] [**hold-time** *hold-time*]

no egress-rate

Context

config>port>ethernet

Description

This command configures the rate of traffic leaving the network.

With the **include-fcs** option, the egress rate limit is applied to the traffic rate egressing the port with the 4-byte Ethernet FCS field included. If this option is not configured, the egress rate limit is applied to the traffic rate egressing the port without the 4-byte Ethernet FCS field included, and the actual rate of packets leaving the port is slightly higher than the configured egress rate value.

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The **include-fcs** option is not supported on the 7705 SAR-A Fast Ethernet ports (ports 9 to 12) or 4-port SAR-H Fast Ethernet module. On the 6-port SAR-M Ethernet module, the **include-fcs** option is always on and cannot be disabled to compensate for the 4-byte FCS.

The **allow-eth-bn-rate-changes** option enables the Y.1731 ETH-BN client MEP option on the port. In applications such as a point-to-point microwave link, where degradation on the line can result in reduced link bandwidth, the egress rate can be dynamically changed based on the available bandwidth on the link as indicated by the ETH-BN server. When enabled, the received rate overrides the configured sub-rate for the port. For information about ETH-BN, including which Ethernet ports support this functionality, see the 7705 SAR OAM and Diagnostics Guide, "ITU-T Y.1731 Ethernet Bandwidth Notification (ETH-BN)".

The bandwidth indicated by the ETH-BN server includes the FCS; therefore, the **include-fcs** option must be selected if the **allow-eth-bn-rate-changes** option is selected or the dynamically changed bandwidth will not match the intended rate.

The *hold-time* is used to limit the number of bandwidth changes as requested by the ETH-BN server. After a rate change occurs based on a Bandwidth Notification Message (BNM), any BMN received before the hold timer expires will be ignored.

The **no** form of this command returns the value to the default.

Default

no egress-rate

Parameters

sub-rate

the egress rate in kb/s

Values 1 to 10000000

include-fcs

the egress rate limit is applied to the traffic rate egressing the port with the 4-byte Ethernet FCS field included. This option must be selected if the allow-eth-bn-rate-changes option is selected; otherwise, the dynamically changed bandwidth will not match the intended rate.

allow-eth-bn-rate-changes

enables the Y.1731 ETH-BN client MEP option on the port. The egress rate will be dynamically changed to the bandwidth indicated in messages received from an ETH-BN server MEP. When enabled, the received rate overrides the configured sub-rate for the port.

hold-time

configures the hold time for egress rate bandwidth changes based on a received BNM, in seconds

Values 1 to 600

Default 5

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encap-type

Syntax

encap-type {**dot1q** | **null** | **qinq**}

no encap-type

Context

config>port>ethernet

Description

This command configures the encapsulation method used to distinguish customer traffic on an Ethernet access port, network v-port, or different VLANs on a network port.

Before an MPR-e radio can be configured on an MWA port (see radio), the port must have an encapsulation type of **dot1q**.

The **qinq** encapsulation type is not supported by v-ports.

The **no** form of this command restores the default.

See also dot1q-etype and qinq-etype for information about tagging and encapsulation.

Default

null

Parameters

dot1q

ingress frames carry 802.1Q tags, where each tag signifies a different service

null

ingress frames will not use any tags to delineate a service. As a result, only one service can be configured on a port with a null encapsulation type.

qinq

ingress frames carry two stacked tags, where the outer tag is the service provider tag and the inner tag is the customer service tag as defined in 802.1ad

group-encryption

Syntax

[**no**] **group-encryption**

Context

config>port>ethernet

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Description

This command enables network group encryption (NGE) on the Ethernet port. When NGE is enabled on the port, all received Layer 2 IS-IS and LLDP packets are considered to be NGE packets and must be encrypted using a valid set of keys from any preconfigured key group on the system.

The **no** form of the command disables NGE on the Ethernet port. NGE cannot be disabled unless all key groups and IP exception filters are removed.

Default

no group-encryption

encryption-keygroup

Syntax

encryption-keygroup *keygroup-id* **direction** {**inbound** | **outbound**}

no encryption-keygroup direction {**inbound** | **outbound**}

Context

config>port>ethernet>group-encryption

Description

This command is used to bind a key group to an Ethernet port for inbound or outbound packet processing. When configured in the outbound direction, packets egressing the router use the **active-outbound-sa** associated with the configured key group. When configured in the inbound direction, received packets must be encrypted using one of the valid security associations configured for the key group.

The **no** form of the command removes the key group from the Ethernet port in the specified direction.

Default

no encryption-keygroup direction inbound

no encryption-keygroup direction outbound

Parameters

keygroup-id

the ID number of the key group being configured

Values 1 to 127 | *keygroup-name* (64 characters maximum)

inbound

binds the key group in the inbound direction

outbound

binds the key group in the outbound direction

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hold-time

Syntax

hold-time {[**up** *hold-time-up*] [**down** *hold-time-down*] [**seconds** | **centiseconds**]}

no hold-time

Context

config>port>ethernet

Description

This command configures port link dampening timers, which reduce the number of link transitions reported to upper layer protocols.

The **hold-time** value is used to dampen interface transitions.

When an interface transitions from an up state to a down state, interface down transitions are not advertised to upper layers until the *hold-time-down* interval has expired. When an interface transitions from a down state to an up state, interface up transitions are not advertised until the *hold-time-up* interval has expired.

If the *hold-time-down* or *hold-time-up* value is 0, interface down and interface up transitions are immediately reported to upper layer protocols.

The **no** form of this command reverts to the default values.

Default

down 0 or up 0 – no port link dampening is enabled; link transitions are immediately reported to upper layer protocols

Parameters

hold-time-up

the interval, in seconds or centiseconds, before an interface transition from a down state to an up state is reported to upper layer protocols

Values 0 to 900 (seconds)

0 | 10 to 90000 (centiseconds, in 5-cs increments)

hold-time-down

the interval, in seconds or centiseconds, before an interface transition from an up state to a down state is reported to upper layer protocols

Values 0 to 900 (seconds)

0 | 10 to 90000 (centiseconds, in 5-cs increments)

seconds

defines the time interval in seconds

centiseconds

defines the time interval in centiseconds

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ingress-rate

Syntax

ingress-rate *ingress-rate* **cbs** *size* [**bytes** | **kilobytes**]

no ingress-rate

Context

config>port>ethernet

Description

This command configures a policing action to rate-limit the ingress traffic. Ingress rate enforcement uses dedicated hardware for rate limiting, however software configuration is required at the port level (ingress rate limiter) to ensure that the network processor or adapter card or port never receives more traffic than they are optimized for.

The configured ingress rate ensures that the network processor does not receive traffic greater than this configured value on a per-port basis. When the ingress rate value is reached, all subsequent frames are dropped. The ingress rate limiter drops excess traffic without classifying whether the traffic has a higher or lower priority.

Similar to the egress rate configuration, the ingress rate configuration survives port mode changes. If a port mode is changed (for example, from access to network mode), the ingress rate and configured CBS still remain when the port comes back up.

The **no** form of this command returns the value to the default.

Default

no ingress-rate

Parameters

ingress-rate

the ingress rate in Mb/s

Values 1 to 10000

cbs

specifies the committed burst size that the hard policer can accept while complying with the configured ingress rate. Set the **cbs** value to at least two times the ingress packet size so that the datapath can make a proper policing and forwarding decision.

Note: CBS is integrated with the **ingress-rate** command and you must always specify the CBS size every time you configure the ingress rate. If you use the default CBS size, you must explicitly indicate that it is the CBS default.

size

specifies the committed burst size in bytes or kilobytes. If configured in bytes, the committed burst size must be a multiple of 256 bytes and must include the **bytes**

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parameter. If configured in kilobytes, the maximum value is 127 and must include the **kilobytes** parameter. If configured as default, the value is set to 130816 bytes.

Values 256 to 130816 bytes
1 to 127 kilobytes
default

Default 130816

src-pause

Syntax

src-pause

no src-pause

Context

config>port>ethernet>ingress-rate

Description

This command sends a notification to slow down the transmission rate when it exceeds the bandwidth limit.

If incoming traffic exceeds the configured ingress rate, an src-pause frame is sent to the far end to hold transmission (src-pause delay timer). When the src-pause delay timer expires, the far end resumes transmission. The src-pause delay timer varies based on the difference between the incoming traffic rate and the configured ingress rate on the port. If the difference is large, then the far end must wait for a longer period before resuming transmission. The src-pause frame helps to prioritize far-end traffic so that the ingress rate limiter does not drop high-priority traffic.

The ingress rate limiter can be configured with or without src-pause; however, src-pause is disabled whenever the ingress rate limiter is disabled.

The **no** form of this command disables the src-pause feature.

This command is blocked for the 6-port SAR-M Ethernet module.

Default

no src-pause

lacp-tunnel

Syntax

lacp-tunnel

no lacp-tunnel

Context

config>port>ethernet

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Description

This command enables LACP packet tunneling for the Ethernet port. When tunneling is enabled, the port does not process any LACP packets, but tunnels them instead. A port with LACP packet tunneling enabled cannot be added as a member of a link aggregation group (LAG).

The **no** form of this command disables LACP packet tunneling for the Ethernet port.

Default

no lacp-tunnel

loopback

Syntax

loopback {**line** | **internal**} {**timer** {**0** | **30 .. 86400**} | **persistent**} [**swap-src-dst-mac**]

no loopback

Context

config>port>ethernet

Description

This command configures timed line loopbacks on Ethernet network and access ports, timed line loopbacks on ring Ethernet network ports, untimed line loopbacks on Ethernet access ports, and timed and untimed internal loopbacks on Ethernet ports.

For Ethernet ports, a line loopback loops frames received on the corresponding port back toward the transmit (egress) direction inside the network processor. Line loopbacks are supported on ports configured in network or access mode.

You can swap the source and destination MAC addresses of the received frames using the **swap-src-dst-mac** keyword. The **swap-src-dst-mac** keyword is not supported on ring Ethernet ports.

An internal loopback loops the frames that are coming in an egress direction from the fabric toward the framer, back to the fabric. This type of loopback is usually referred to as an equipment loopback. Internal loopbacks are supported on ports configured in access mode.

Loopback timers can be configured for 30 s to 86400 s. All non-zero timed loopbacks are turned off under the following conditions: an adapter card reset, an activity switch, or timer expiry. Line or internal loopbacks can also be configured as a latched loopback by setting the timer to 0 s, or as a persistent loopback with the **persistent** keyword.

Latched and persistent loopbacks are enabled indefinitely until turned off by the user. Latched loopbacks survive adapter card resets and activity switches, but are lost if there is a system restart. Persistent loopbacks survive adapter card resets and activity switches and can survive a system restart if the **admin-save** or **admin-save-detail** command was executed prior to the restart. Latched (untimed) persistent loopbacks can be enabled only on Ethernet access ports.

If a loopback exists on a port, it must be disabled or the timer must expire before another loopback can be configured on the same port. An Ethernet loopback cannot be configured on a port that has EFM-OAM enabled on it; EFM-OAM cannot be enabled on a port that has an Ethernet loopback enabled on it.

Persistent loopbacks are the only Ethernet loopbacks saved to the database by the **admin-save** and **admin-save-detail** commands.

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The **no** form of this command disables the specified type of loopback.

Parameters

line

places the associated Ethernet port or ring Ethernet port into line loopback mode

internal

places the associated Ethernet access port into internal loopback mode; not supported on ring Ethernet ports

persistent

places the associated Ethernet access port or ring Ethernet port into persistent loopback mode

swap-src-dst-mac

swaps source and destination MAC addresses for Ethernet line loopbacks; not supported on ring Ethernet ports

timer

the timer set for Ethernet loopbacks, in seconds

Values 0 | 30 to 86400

mac

Syntax

mac *ieee-address*

no mac

Context

config>port>ethernet

Description

This command assigns a specific MAC address to an Ethernet port, ring Ethernet port, or v-port. When the command is issued while the port is operational, IP will issue an ARP, if appropriate, and BPDUs are sent with the new MAC address.

The **no** form of this command returns the MAC address to the default value.

Default

a default MAC address is assigned by the system

Parameters

ieee-address

specifies the 48-bit MAC address in the form aa:bb:cc:dd:ee:ff or aa-bb-cc-dd-ee-ff where aa, bb, cc, dd, ee, and ff are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC, and non-IEEE reserved MAC addresses.

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mode

Syntax

mode {**access** | **network** | **hybrid**}

no mode

Context

config>port>ethernet

Description

This command configures an Ethernet port for access, network, or hybrid mode operation, or configures a ring Ethernet port or v-port for network mode. On ring Ethernet ports and the v-port, the mode is always network and cannot be changed.

An **access** port is used for customer-facing traffic on which services are configured. A service access point (SAP) can only be configured on an access port or channel. When an Ethernet port has been configured for access mode, multiple services can be configured on it.

A **network** port participates in the service provider transport or infrastructure network when network mode is selected.

A **hybrid** Ethernet port allows the combination of network and access modes of operation on a per-VLAN basis and must be configured for either dot1q or qinq encapsulation.

A hybrid port must use dot1q encapsulation to be configured as a network IP interface. Binding a network IP interface to a qinq encapsulation is blocked. In hybrid mode, qinq encapsulation is for access mode use only.

If the hybrid port is configured for dot1q encapsulation, the user configures a SAP inside a service or a network IP interface as follows:

- configure a SAP under **config>service** by providing the SAP ID, which must include the *port-id* value of the hybrid port and an unused VLAN tag value. The format is *port-id*:*qtag1*. A SAP of format *port-id*:* is also supported.
- configure a network IP interface under **config>router>if>port** by providing the *port-name*, which consists of the *port-id* of the hybrid port and an unused VLAN tag value. The format is *port-id*:*qtag1*. The user must explicitly enter a valid value for *qtag1*. The *port-id*:* value is not supported on a network IP interface. The VLAN tag space on the port (range of 0 to 4094) is shared among VLAN SAPs and VLAN network IP interfaces.

If the hybrid port is configured for qinq encapsulation, the user configures a SAP inside a service as follows:

- configure a SAP under **config>service** by providing the SAP ID, which must include the *port-id* value of the hybrid port and the outer and inner VLAN tag values. The format is *port-id*:*qtag1*.*qtag2*. A SAP of format *port-id*: *qtag1*.* is also supported. The outer VLAN tag value must not have been used to create an IP network interface on this port. In addition, the *qtag1*.*qtag2* value combination must not have been used by another SAP on this port.

The **no** form of this command restores the default.

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Default

access (except as listed below)

network

- 10-port 1GigE/1-port 10GigE X-Adapter card (in 1-port 10GigE mode, the port operates in network mode only)
- 2-port 10GigE (Ethernet) Adapter card
- 2-port 10GigE (Ethernet) module

Parameters

access

configures the port as service access

network

configures the port for transport network use

hybrid

configures the port for hybrid use (transport network and service access per VLAN)

mtu

Syntax

mtu *mtu-bytes*

no mtu

Context

config>port>ethernet

Description

This command configures the maximum payload MTU size for an Ethernet port or a v-port on an Ethernet Ring adapter card (for ring Ethernet ports, the MTU value is fixed at 9728 bytes).

The port-level MTU parameter indirectly defines the largest physical packet the port can transmit or the far-end Ethernet port can receive. Packets to be transmitted over a given port that are larger than the MTU of the port will be fragmented or discarded, depending on whether the DF bit is set in the packet header.

If the port mode or encapsulation type is changed, the MTU assumes the default values of the new mode or encapsulation type.

The **no** form of this command restores the default values.

Table 37: Port MTU default and maximum values

Port type	Mode	Encap type	Default (bytes)	Max MTU (bytes)
10/100 Ethernet[1]	Access/ Network	null	1514	9724 [2]
		dot1q	1518	9728 [2]

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Port type	Mode	Encap type	Default (bytes)	Max MTU (bytes)
		qinq [3]	1522 (access only)	9732 (access only) [2]
GigE SFP [1] and 10-GigE SFP+	Access/ Network	null	1514 (access) 1572 (network)	9724 (access and network)
		dot1q	1518 (access) 1572 (network)	9728 (access and network)
		qinq [3]	1522 (access only)	9732 (access only)
Ring port	Network	null	9728 (fixed)	9728 (fixed)
v-port (on Ring adapter card)	Network	null	1572	9724
		dot1q	1572	9728

Notes:

1. The maximum MTU value is supported only on cards that have buffer chaining enabled.
2. On the Packet Microwave Adapter card, MWA ports support 4 bytes less than Ethernet ports. MWA ports therefore support a maximum MTU of 9720 bytes (null) or 9724 bytes (dot1q). MWA ports do not support qinq.
3. QinQ is supported only on access ports.

Default

The default MTU value depends on the port type, mode, and encapsulation as listed in Table 37: Port MTU default and maximum values .

Parameters

mtu-bytes

sets the maximum allowable size of the MTU, expressed as an integer (see Table 37: Port MTU default and maximum values)

Values 128 to 9732 bytes (Ethernet ports)

phy-tx-clock

Syntax

[**no**] **phy-tx-clock** {**auto-pref-master** | **auto-pref-slave** | **slave** | **master**}

Context

config>port>ethernet

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Description

This command configures the 1000Base-T physical layer transmit clock. The mode affects the establishment of the master-slave relationship between two ports sharing a link segment during auto-negotiation. The master port uses a local clock to determine the timing of transmitter operations. The slave port recovers the clock from the signal it receives and uses the signal to determine the timing of transmitter operations. For ports that do not support 1000Base-T, the value defaults to N/A and cannot be changed.

The phy-tx-clock configuration is supported on SFP ports whether or not the SFP is inserted. The **phy-tx-clock** command applies only to copper-based RJ45 synchronous Ethernet ports. The command can be used on an SFP port that supports fiber and copper, but the command has no effect if a fiber SFP is installed.

The correct value must be set to ensure that the synchronous Ethernet clock relay is correctly configured. See the 7705 SAR Basic System Configuration Guide for more information about synchronous Ethernet.

Default

The default value for the MWA 1000Base-T Ethernet ports on the Packet Microwave Adapter card is master. On other adapter cards, the default value is auto-pref-slave for ports that support 1000Base-T Ethernet connections. The default value is n/a for ports that do not support 1000Base-T Ethernet connections.

Parameters

auto-pref-master

prefers to be master during autonegotiation

auto-pref-slave

prefers to be slave during autonegotiation

slave

forces the port to be the slave clocking source

master

forces the port to be the master clocking source

poe

Syntax

poe [**plus**]

no poe

Context

config>port>ethernet

Description

The **poe** command enables an RJ45 or RJ point five port that is Power over Ethernet (PoE) capable to deliver power to a "Powered Device" at levels compatible with the IEEE 802.3af standard.

The **poe plus** command enables an RJ45 or RJ point five port that is PoE+ capable to deliver power to a "Powered Device" at levels compatible with the IEEE 802.3at standard.

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On the 7705 SAR-H, 7705 SAR-Hc, and 6-port SAR-M Ethernet module, a PoE-capable port can be configured for PoE and PoE+. On the 7705 SAR-Wx, a PoE-capable port only supports PoE+ and can only be enabled using the **poe plus** command.

On the 7705 SAR-H, before a port can be configured for either PoE or PoE+, the PoE power source option must first be configured as either internal or external using the **config>system>poe-power-source** command; see the 7705 SAR Basic System Configuration Guide, "System command reference", for information.

When the 7705 SAR-H is configured for the internal power source option, PoE capability is allowed on ports 5 and 6 only. Port 5 can be configured for PoE+ but in that case, port 6 cannot support PoE. When the system is configured for the external power source option, a mix of PoE and PoE+ is allowed on ports 5, 6, 7, and 8. PoE+ is supported only on ports 5 and 7. The following table describes the allowed mix of PoE and PoE+ ports on the 7705 SAR-H.

Table 38: Supported PoE/PoE+ combinations on the 7705 SAR-H

PoE power supply source	Port 5	Port 6	Port 7	Port 8	Supported PoE/PoE+ combinations
Internal	PoE	PoE	No PoE	No PoE	Two PoE ports
Internal	PoE+	No PoE	No PoE	No PoE	One PoE+ port
External	PoE	PoE	PoE	PoE	Four PoE ports
External	PoE	PoE	PoE+	PoE	Three PoE ports and one PoE+ port
External	PoE+	No PoE	PoE+	PoE	One PoE port and two PoE + ports

On the 6-port SAR-M Ethernet module, ports 5 and 6 on the module can each support PoE. Port 5 can also support PoE+, but if it is configured for PoE+, then port 6 cannot support PoE power.

On the 7705 SAR-Hc, ports 5 and 6 each support PoE and PoE+. If configured for PoE, both ports can be used for PoE simultaneously. Both ports are also capable of supporting PoE+ but not simultaneously; if one port is configured for PoE+, the other port can only be configured for PoE. Ports 5 and 6 can also operate in non-PoE mode.

On the 7705 SAR-Wx, port 5 (the RJ45 port labeled PoE) supports PoE+. The port can also operate in non-PoE+ mode.

To disable PoE/PoE+ on a port and prevent it from delivering power, use the **no** form of the command. Performing a **shutdown** command on the port does not disable PoE/PoE+ on the port.

Default

n/a

Parameters

plus

enables PoE+ on the 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Wx, and 6-port SAR-M Ethernet module

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ptp-asymmetry

Syntax

ptp-asymmetry *ptp-asymmetry*

no ptp-asymmetry

Context

config>port>ethernet

Description

This command configures the PTP asymmetry delay delta on an Ethernet port. The command corrects for known asymmetry for time of day/phase recovery of PTP packets on both local and downstream PTP slave clocks as well as on end-to-end transparent clocks.

Parameters

ptp-asymmetry

the value in nanoseconds that the forward path delay varies from the mean path delay; the value can be a negative number

qinq-etype

Syntax

qinq-etype *0x0600 to 0xffff*

no qinq-etype

Context

config>port>ethernet

Description

This command specifies the Ethertype expected when the port's encapsulation type is qinq. The **qinq-etype** value sets the Ethertype for the outer VLAN tag when qinq encapsulation is used.

IEEE 802.1ad (also known as VLAN stacking) defines a process to channelize a single Ethernet port or v-port into double-tagged VLANs. Each VLAN can represent a customer or an application. Each tag allows for up to 4096 VLANs to be configured on a port (4096 × 4096 total). For more information about VLANs and VLAN tagging, see "VLL Services" in the 7705 SAR Services Guide.

The Ethertype specifies the protocol being carried in an Ethernet frame. In 802.1q, the Ethertype is set to the Tag Protocol Identifier (TPID) value of 0x8100, which identifies the frame as an IEEE 802.1Q-tagged frame. As well, 2 bytes of Tag Control Information (TCI), followed by 2 bytes containing the frame's original Ethertype are added to the frame for each tag (4 bytes total). Together, the TPID and TCI make up a VLAN tag.

The **qinq-etype** command is not supported by v-ports.

Network ports do not allow **qinq-etype** settings.

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The **no** form of this command resets the qinq-etype value to the default.

Default

0x8100

Parameters

0x0600 to 0xffff

specifies the Ethertype to expect

report-alarm

Syntax

[**no**] **report-alarm** [**signal-fail**] [**remote**] [**local**] [**no-frame-lock**] [**high-ber**]

Context

config>port>ethernet

Description

This command specifies when and if to generate alarms and alarm clear notifications for this port.

The command applies only to the physical 10GigE ports on the 7705 SAR-X, 6-port Ethernet 10Gbps Adapter card, 2-port 10GigE (Ethernet) Adapter card, and 2-port 10GigE (Ethernet) module, and on the 10-port 1GigE/1-port 10GigE X-Adapter card in 1-port 10GigE mode (select x1-10GigE-sf+ with the mda-mode command).

Parameters

signal-fail

reports an Ethernet signal lost alarm

remote

reports remote faults

local

reports local faults

no-frame-lock

reports a "not locked on the ethernet framing sequence" alarm

high-ber

reports a high bit error rate alarm

speed

Syntax

speed {**10** | **100** | **1000** | **2500** | **10000**}

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Context

config>port>ethernet

Description

This command configures the port speed of an Ethernet port, ring Ethernet port, or v-port when autonegotiation is disabled.

Default

100 (for Fast Ethernet ports on the 7705 SAR-A (ports 9 to 12), 7705 SAR-Hc (ports 3 and 4), 4-port SAR-H Fast Ethernet module, and 6-port SAR-M Ethernet module (ports 1 and 2))

1000 (for Gigabit Ethernet ports on all adapter cards, modules, and fixed platforms)

2500 on a v-port (this default cannot be changed)

10000 (for the 10-port 1GigE/1-port 10GigE X-Adapter card in 1-port 10GigE mode, 2-port 10GigE (Ethernet) Adapter card, 2-port 10GigE (Ethernet) module, 6-port Ethernet 10Gbps Adapter card (ports 5 and 6), 7705 SAR-X (ports 1/2/7 and 1/3/7)

Parameters

10

sets the link speed to 10 Mb/s

100

sets the Ethernet port speed to 100 Mb/s

1000

sets the Ethernet port speed to 1000 Mb/s (only supported on GigE SFPs)

2500

sets the v-port speed to 2500 Mb/s (only supported on a v-port)

10000

sets the ring Ethernet port speed (only supported on GigE XFPs) and the SFP+ ports speed on the 6-port Ethernet 10Gbps Adapter card or the 7705 SAR-X to 10 000 Mb/s

ssm

Syntax

ssm

Context

config>port>ethernet

Description

This command enables the Ethernet Synchronization Message Channel (ESMC) capability on a synchronous Ethernet port on the following:

- 2-port 10GigE (Ethernet) Adapter card

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- 2-port 10GigE (Ethernet) module
- 6-port Ethernet 10Gbps Adapter card
- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card
- Packet Microwave Adapter card
- 4-port SAR-H Fast Ethernet module
- 7705 SAR-A
- 7705 SAR-Ax
- 7705 SAR-H
- 7705 SAR-Hc
- 7705 SAR-M
- 7705 SAR-Wx
- 7705 SAR-X

The **ssm** command is enabled and disabled using the **no shutdown** and **shutdown** commands.

On the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module, SSM frames received on the ring Ethernet ports are extracted for processing through the v-port. Therefore, the v-port must be active (that is, in **no shutdown** mode) in order for SSM to function. The v-port must also be active in order for the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module to transmit SSM frames. No additional interface or IP configuration is required on the v-port for SSM.

Default

shutdown

code-type

Syntax

code-type {**sonet** | **sdh**}

Context

config>port>ethernet>ssm

Description

This command specifies whether to use SDH or SONET values for the encoding of synchronous status messages on a:

- synchronous ring Ethernet port on the 2-port 10GigE (Ethernet) Adapter card
- synchronous ring Ethernet port on the 2-port 10GigE (Ethernet) module
- synchronous Ethernet port on the 6-port Ethernet 10Gbps Adapter card
- synchronous Ethernet port on the 8-port Gigabit Ethernet Adapter card
- synchronous Ethernet port on the 10-port 1GigE/1-port 10GigE X-Adapter card

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- synchronous Ethernet port on the Packet Microwave Adapter card
- synchronous Ethernet port on the 4-port SAR-H Fast Ethernet module
- synchronous Ethernet port on the 7705 SAR-A
- synchronous Ethernet port on the 7705 SAR-Ax
- synchronous Ethernet port on the 7705 SAR-H
- synchronous Ethernet port on the 7705 SAR-Hc
- synchronous Ethernet port on the 7705 SAR-M
- synchronous Ethernet port on the 7705 SAR-Wx
- synchronous Ethernet port on the 7705 SAR-X

Default

sdh

Parameters

sonet

specifies the values used on a G.781 option 1 compliant network

sdh

specifies the values used on a G.782 option 1 compliant network

tx-dus

Syntax

[**no**] **tx-dus**

Context

config>port>ssm

config>port>ethernet>ssm

Description

This command sets the quality level value transmitted from the Synchronization Status Messaging (SSM) channel of the following ports to QL-DUS/QL-DNU (do not use for synchronization for timing purposes):

- synchronous Ethernet port on the 2-port 10GigE (Ethernet) Adapter card
- synchronous Ethernet port on the 2-port 10GigE (Ethernet) module
- synchronous Ethernet port on the 6-port Ethernet 10Gbps Adapter card
- synchronous Ethernet port on the 8-port Gigabit Ethernet Adapter card
- synchronous Ethernet port on the 10-port 1GigE/1-port 10GigE X-Adapter card
- synchronous Ethernet port on the Packet Microwave Adapter card
- synchronous Ethernet port on the 4-port SAR-H Fast Ethernet module
- synchronous Ethernet port on the 7705 SAR-A

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- synchronous Ethernet port on the 7705 SAR-Ax
- synchronous Ethernet port on the 7705 SAR-H
- synchronous Ethernet port on the 7705 SAR-Hc
- synchronous Ethernet port on the 7705 SAR-M
- synchronous Ethernet port on the 7705 SAR-Wx
- synchronous Ethernet port on the 7705 SAR-X

Default

enabled for fiber ports

disabled (no tx-dus) for copper ports

util-stats-interval

Syntax

util-stats-interval *seconds*

Context

config>port>ethernet

Description

This command configures the interval over which to calculate and display an average percentage of the maximum possible port utilization for an Ethernet port.

Default

300

Parameters

seconds

the utilization statistics calculation interval in seconds

Values 30 to 600

vlan-filter

Syntax

[**no**] **vlan-filter** *filter-id*

Context

config>port>ethernet

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Description

This command associates a VLAN filter policy with an ingress ring port on the 2-port 10GigE (Ethernet) Adapter card or 2-port 10GigE (Ethernet) module.

Filter policies control the forwarding and dropping of packets based on matching criteria. Only one filter policy can be applied to a ring port at a time. The same filter policy can be applied to both ring ports.

The *filter-id* must already be defined before the **vlan-filter** command is executed. If the filter policy does not exist, the operation will fail and an error message will be displayed.

The **no** form of the command removes any configured *filter-id* association with the ring port. The filter policy cannot be deleted until it is removed from all ring ports where it is applied.

Default

n/a

Parameters

filter-id

the VLAN filter policy ID number or filter name

Values 1 to 65535 or *filter-name* (up to 64 characters)

xgig

Syntax

xgig {**lan** | **wan**}

Context

config>port>ethernet

Description

This command configures the specified 10-Gb/s interface in LAN or WAN mode. When configuring the port for WAN mode, you can change some SONET/SDH parameters to reflect the SONET/SDH requirements for this port. When you configure a port for LAN mode, all SONET/SDH parameters are predetermined and not configurable. The command is supported on the 7705 SAR-X, 6-port Ethernet 10Gbps Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card, 2-port 10GigE (Ethernet) Adapter card, and 2-port 10GigE (Ethernet) module.

On the 6-port Ethernet 10Gbps Adapter card, both 10-Gb/s interfaces (ports 5 and 6) operate in the same **xgig** mode, either LAN mode or WAN mode. Setting the **xgig** mode for either port sets the mode for both ports.

Default

lan

Parameters

lan

specifies that the port operates in LAN mode

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wan

specifies that the port operates in WAN mode

xor-mode

Syntax

xor-mode {**rj45** | **rjp5** | **sfp**}

Context

config>port>ethernet

Description

This command configures the operational mode of Ethernet XOR combination ports. Ethernet XOR ports on the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-H, and 7705 SAR-X can be configured to operate as either RJ45 ports or SFP ports. Ethernet XOR ports on the 6-port SAR-M Ethernet module can be configured to operate as either RJ point five ports or SFP ports. The mode can be configured on each port independently. See the individual hardware installation guides for more information.

Default

rj45 (for applicable 7705 SAR chassis); rjp5 (for 6-port SAR-M Ethernet module)

Parameters

rj45

specifies that the port operate as a 10/100/1000Base-T electrical RJ45 port (applicable 7705 SAR chassis only)

rjp5

specifies that the port operate as a 10/100/1000Base-T electrical RJ point five port (6-port SAR-M Ethernet module only)

sfp

specifies that the port operate as an SFP port

3.14.2.11 GNSS commands

gnss

Syntax

gnss

Context

config>port

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Description

This command enters the context to perform GNSS receiver port configuration.

Default

n/a

antenna-cable-delay

Syntax

antenna-cable-delay *0 .. 32767*

no antenna-cable-delay

Context

config>port>gnss

Description

This command configures the expected signal delay resulting from the length of the antenna cable.

The **no** form of this command returns the value to the default.

Default

0

Parameters

0 .. 32767

the signal delay, in nanoseconds

elevation-mask-angle

Syntax

elevation-mask-angle *0 .. 89*

no elevation-mask-angle

Context

config>port>gnss

Description

This command configures the elevation mask angle. It provides a method of filtering satellites to be used by the system.

Configuring an elevation mask angle below 10° is not recommended.

The **no** form of this command returns the value to the default.

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Default

10

Parameters

0 .. 89

the elevation mask angle, in degrees.

type

Syntax

[**no**] **type** [**gps**] [**glonass**]

Context

config>port>gnss

Description

This command configures which GNSS system or systems will be used by the GNSS receiver.

The **no** form of this command removes the specified GNSS system or systems.

By default, **gps** is configured. Configuring **glonass** does not remove **gps**; the GNSS receiver will use both GPS and GLONASS systems.

Default

gps

Parameters

gps

configures the GNSS receiver to use the American GPS GNSS system

glonass

configures the GNSS receiver to use the Russian GLONASS GNSS system

3.14.2.12 IEEE 802.1x Ethernet port commands

dot1x

Syntax

dot1x

Context

config>port>ethernet

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Description

This command enables access to the context to configure port-specific 802.1x authentication attributes on an Ethernet port.

mac-auth

Syntax

[**no**] **mac-auth**

Context

config>port>ethernet>dot1x

Description

This command enables MAC-based authentication. To use MAC-based authentication, 802.1x authentication must first be enabled using the port-control **auto** command.

When MAC-based authentication is enabled, and the mac-auth-wait timer expires, the 7705 SAR begins listening on the port for valid Ethernet frames. The source address of a received frame is used for MAC-based authentication.

The **no** form of this command disables MAC-based authentication.

Default

no mac-auth

mac-auth-wait

Syntax

mac-auth-wait *seconds*

no mac-auth-wait

Context

config>port>ethernet>dot1x

Description

This command configures the delay period before MAC authentication is activated and the 7705 SAR searches for a valid client MAC address.

The **no** form of this command disables the delay and allows MAC authentication to be used immediately.

Default

no mac-auth-wait

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Parameters

seconds

specifies the MAC authentication delay period in seconds

Values 1 to 3600

macsec

Syntax

macsec

Context

config>port>ethernet>dot1x

Description

This command enables the context to configure Media Access Control security (MACsec) settings on this port.

exclude-mac-policy

Syntax

exclude-mac-policy *mac-policy-id*

no exclude-mac-policy

Context

config>port>ethernet>dot1x>macsec

Description

This command specifies the MAC policy to be excluded from MACsec encryption.

The **no** form of this command removes the policy from MACsec and allows all destination MAC addresses.

Default

no exclude-mac-policy

Parameters

mac-policy-id

the MAC policy to exclude from the configuration

Values 1 to 1024

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exclude-protocol

Syntax

[no] exclude-protocol [lacp] [lldp] [cdp] [eapol-start] [efm-oam] [eth-cfm] [ptp] [ubfd]

Context

config>port>ethernet>dot1x.>macsec

Description

This command specifies the protocols whose packets are not secured using MACsec when MACsec is enabled on a port.

When this option is enabled in a connectivity association (CA) that is attached to an interface, MACsec is not enabled for all packets of the specified protocols that are sent and received on the link.

When this option is enabled on a port where MACsec is configured, packets of the specified protocols are sent and accepted in clear text.

The **no** form of this command secures the packets of the specified protocols.

Default

no exclude-protocol

rx-must-be-encrypted

Syntax

[**no**] **rx-must-be-encrypted**

Context

config>port>ethernet>dot1x>macsec

Description

This command specifies whether all traffic that is not secured using MACsec that is received on the port is dropped.

When the command is enabled, all arriving traffic that is not secured using MACsec is dropped.

Note: This command is only available on the NULL port level and does not have per-VLAN granularity.

The **no** form of the command accepts all traffic received on the port whether or not it is secured by MACsec.

Default

rx-must-be-encrypted

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sub-port

Syntax

sub-port *port-id* [**create**]

no sub-port *port-id*

Context

config>port>ethernet>dot1x>macsec

Description

This command creates a MACsec instance on a physical port, targeting the specific subset of traffic defined by the **encap-match** command.

The **no** form of this command removes the MACsec instance.

Parameters

port-id

the subport ID

Values 1 to 1023

create

mandatory keyword when creating a new subport

ca-name

Syntax

ca-name *ca-name*

no ca-name

Context

config>port>ethernet>dot1x>macsec>sub-port

Description

This command specifies the connectivity association (CA) to be used with this MACsec subport. The specified CA provides the MACsec parameter to be used or negotiated with other peers.

The **no** form of this command removes the CA from the MACsec subport.

Parameters

ca-name

the CA to be used with this MACsec subport

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eapol-destination-address

Syntax

eapol-destination-address *address*

no eapol-destination-address

Context

config>port>ethernet>dot1x>macsec>sub-port

Description

This command specifies the EAPOL destination MAC address. The default destination MAC address used by EAPOL is the MAC address 01:80:C2:00:00:03. Some networks cannot tunnel these packets over the network and may consume them, causing the MKA session to fail. This command changes the destination MAC address of the EAPOL packets to the unicast address of the MACsec peer, resulting in EAPOL and MKA signaling being unicasted between two peers.

The **no** form of this command reverts to the default value.

Default

no eapol-destination-address

Parameters

address

the destination MAC address, in hexadecimal format, to be used by the EAPOL MKA packets of this subport

encap-match

Syntax

encap-match {**all-encap** | **double-tag** *encap-value* | **single-tag** *encap-value* | **untagged**}

no encap-match

Context

config>port>ethernet>dot1x>macsec>sub-port

Description

This command defines the subset of traffic on this MACsec subport.

To establish an end-to-end communication between the remote MACsec peers encrypting VLAN-tagged traffic, the MKA packets must be able to traverse the network using the same path as the encrypted traffic. MKA packets are generated with specific tags depending on the traffic match criteria configured, as shown in the following table.

The **no** form of this command removes all traffic subset definitions from the MACsec subport.

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Table 39: MKA packet generation

Configuration	Config example (<s-tag>.<c-tag>)	MKA packet generation	Traffic pattern match/behavior
Port all-encap	**config>port>ethernet>dot1x>macsec** Sub-port 10 encap-match all-encap ca-name 10	Untagged MKA packet	Matches all traffic on port, including untagged, single-tag, double-tag This is the default behavior
Untagged	**config>port>ethernet>dot1x>macsec** Sub-port 1 encap-match untagged ca-name 2	Untagged MKA packet	Matches only untagged traffic on port
802.1Q single S-TAG (specific S-TAG)	**config>port>ethernet>dot1x>macsec** Sub-port 2 encap-match dot1q 1 ca-name 3	MKA packet generated with S-TAG=1	Matches only single-tag traffic on port with tag ID of 1
802.1Q single S-TAG (any S-TAG)	**config>port>ethernet>dot1x>macsec** Sub-port 3 encap-match dot1q * ca-name 4	Untagged MKA packet	Matches any single-tag traffic on port
802.1ad double tag (both tags have specific TAGs)	**config>port>ethernet>dot1x>macsec** Sub-port 4 encap-match qinq 1.1 ca-name 5	MKA packet generated with S-tag=1 and C-TAG=1	Matches only double-tag traffic on port with service tag of 1 and customer tag of 1
802.1ad double tag (specific S-TAG, any C-TAG)	**config>port>ethernet>dot1x>macsec** Sub-port 6 encap-match qinq 1.* ca-name 7	MKA packet generated with S-TAG=1	Matches only double-tag traffic on port with service tag of 1 and customer tag of any
802.1ad double tag (any S-TAG, any C-TAG	**config>port>ethernet>dot1x>macsec** Sub-port 7 encap-match double-tag *.* ca-name 8	Untagged MKA packet	Matches any double-tag traffic on port

Default

encap-match all-encap

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Parameters

all-encap

all encapsulated traffic (untagged, single-tag, or double-tag) is matched and encrypted

untagged

only untagged traffic is matched and encrypted

single-tag

only dot1q traffic is matched. Either all single-tag traffic can be matched by using *, or a specific dot1q tag can be matched.

double-tag

only qinq traffic is matched. The service tag can be specifically matched or a wildcard match (*.*) can be used.

encap-value

specifies the type and value of the packet encapsulation to match for this MACsec subport

Type	Parameter
all-encap	—
untagged	—
dot1q	[*| s] (s =0 to 4094)
qinq	[*.*| s.*| s.c] (s =1 to 4094 and c = 0 to 4094)

where:

- s = service tag
- c = customer tag

max-peer

Syntax

max-peer *max-peer*

no max-peer

Context

config>port>ethernet>dot1x>macsec>sub-port

Description

This command configures the maximum number of peers allowed under this MACsec instance. Up to 8 peers are supported in each of security zones 1, 2, 3, and 4, and up to 32 peers are supported in security zone 5.

Note: Peers are established on a first-come, first-served basis. See SA exhaustion behavior .

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The **no** form of this command reverts to the default value.

Default

no max-peer

Parameters

max-peer

the maximum number of peers supported on this subport

Values for each security zone in zones 1 through 4: 0 to 8

for security zone 5: 0 to 32

shutdown

Syntax

[no] shutdown

Context

config>port>ethernet>dot1x>macsec>sub-port

Description

This command shuts down MACsec under this subport, including MKA negotiation. In the shutdown state, this subport is not MACsec-capable and all PDUs are transmitted and received without encryption and authentication.

The **no** form of this command puts the subport in MACsec-enabled mode. A valid CA that is different from any other CA configured on any other subport of this port and a **max-peer** value that is greater than 0 must be configured. In MACsec-enabled mode, packets are sent in clear text until the MKA session is up, and if the **rx-must-be-encrypted** command is set on the port, all incoming packets with no MACsec encapsulations are dropped.

Default

shutdown

max-auth-req

Syntax

max-auth-req *max-auth-request*

no max-auth-req

Context

config>port>ethernet>dot1x

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Description

This command configures the maximum number of times that the 7705 SAR will send an access request RADIUS message to the RADIUS server. If a reply is not received from the RADIUS server after the specified number of attempts, the 802.1x authentication process is considered to have failed.

The **no** form of this command returns the value to the default.

Default

2

Parameters

max-auth-req

the maximum number of RADIUS retries

Values 1 to 10

port-control

Syntax

port-control {**auto** | **force-auth** | **force-unauth**}

no port-control

Context

config>port>ethernet>dot1x

Description

This command configures the 802.1x authentication mode.

The **no** form of this command returns the value to the default.

Default

force-auth

Parameters

auto

enables 802.1x authentication. The port starts in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. Both the 7705 SAR and the host (supplicant) can initiate an authentication process. The port will remain in the unauthorized state until the first supplicant is authenticated successfully. After this, traffic is allowed on the port for all connected hosts.

force-auth

disables 802.1x authentication and causes the port to transition to the authorized state without requiring any authentication exchange. The port transmits and receives normal traffic without requiring 802.1x-based host authentication.

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force-unauth

causes the port to remain in the unauthorized state, ignoring all attempts by the hosts to authenticate. The authenticator cannot provide authentication services to the host through the interface.

quiet-period

Syntax

quiet-period *seconds*

no quiet-period

Context

config>port>ethernet>dot1x

Description

This command configures the time between two authentication sessions during which no EAPOL frames are sent by the 7705 SAR. The timer is started after sending an EAP-Failure message or after expiry of the supplicant timeout timer.

The **no** form of this command returns the value to the default.

Default

60

Parameters

seconds

specifies the quiet period in seconds

Values 1 to 3600

radius-plcy

Syntax

radius-plcy *name*

no radius-plcy

Context

config>port>ethernet>dot1x

Description

This command configures the RADIUS policy to be used for 802.1x authentication. An 802.1x RADIUS policy must be configured (under **config>system>security>dot1x**) before it can be associated with a

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port. If the RADIUS policy ID does not exist, an error is returned. Only one 802.1x RADIUS policy can be associated with a port at a time.

The **no** form of this command removes the RADIUS policy association.

Default

no radius-plcy

Parameters

name

specifies an existing 802.1x RADIUS policy name

re-auth-period

Syntax

re-auth-period *seconds*

no re-auth-period

Context

config>port>ethernet>dot1x

Description

This command configures the number of seconds the system will wait before performing reauthentication. This value is only relevant if reauthentication is enabled with the re-authentication command.

The **no** form of this command returns the value to the default.

Default

3600

Parameters

seconds

specifies the reauthentication delay period in seconds

Values 1 to 9000

re-authentication

Syntax

[**no**] **re-authentication**

Context

config>port>ethernet>dot1x

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Description

This command enables or disables periodic 802.1x reauthentication.

When reauthentication is enabled, the 7705 SAR will reauthenticate clients on the port after waiting the number of seconds defined by the re-auth-period command.

The **no** form of this command disables 802.1x reauthentication.

Default

no re-authentication

server-timeout

Syntax

server-timeout *seconds*

no server-timeout

Context

config>port>ethernet>dot1x

Description

This command configures the time during which the 7705 SAR waits for the RADIUS server to respond to its access request message. When this timer expires, the 7705 SAR will resend the access request message, up to the number of times specified by the max-auth-req command.

The **no** form of this command returns the value to the default.

Default

30

Parameters

seconds

specifies the server timeout period in seconds

Values 1 to 300

supplicant-timeout

Syntax

supplicant-timeout *seconds*

no supplicant-timeout

Context

config>port>ethernet>dot1x

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Description

This command configures the time the 7705 SAR waits for a client to respond to its EAPOL messages. When the supplicant timeout period expires, the 802.1x authentication session is considered to have failed.

The **no** form of this command returns the value to the default.

Default

30

Parameters

seconds

specifies the supplicant timeout period in seconds

Values 1 to 300

transmit-period

Syntax

transmit-period *seconds*

no transmit-period

Context

config>port>ethernet>dot1x

Description

This command configures the time after which the 7705 SAR sends a new EAPOL request message.

The **no** form of this command returns the value to the default.

Default

30

Parameters

seconds

specifies the server transmit period in seconds

Values 1 to 3600

tunneling

Syntax

[**no**] **tunneling**

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Context

config>port>ethernet>dot1x

Description

This command enables the tunneling of untagged 802.1x frames received on a port for both Epipe and VPLS services using a null SAP or a default SAP on a dot1q or qinq port. When configured, untagged 802.1x frames are switched into the service with the corresponding supported SAP. 802.1x tunneling is supported only when the port-control command is set to **force-auth**.

The **no** form of this command disables tunneling of untagged 802.1x frames.

Default

no tunneling

3.14.2.13 LLDP Ethernet port commands

See the 7705 SAR Basic System Configuration Guide, "System management", for LLDP system commands.

lldp

Syntax

lldp

Context

config>port>ethernet

Description

This command enables the context to configure LLDP parameters on the specified port.

Note: In order for LLDP to be operational on the Ethernet ports on the 2-port 10GigE (Ethernet) Adapter card/module, the v-port must be active (that is, in **no shutdown** mode).

dest-mac

Syntax

dest-mac {**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**}

Context

config>port>ethernet>lldp

Description

This command configures destination MAC address parameters.

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Parameters

nearest-bridge

configures the LLDP to use the nearest bridge

nearest-non-tpmr

configures the LLDP to use the nearest non-two-port MAC relay (TPMR) bridge

nearest-customer

configures the LLDP to use the nearest customer bridge

admin-status

Syntax

admin-status {**rx** | **tx** | **tx-rx** | **disabled**}

Context

config>port>ethernet>lldp>dest-mac

Description

This command specifies the administratively desired status of the local LLDP agent.

Default

disabled

Parameters

rx

specifies that the LLDP agent will receive, but will not transmit, LLDP frames on this port

tx

specifies that the LLDP agent will transmit LLDP frames on this port and will not store any information about the remote systems connected to it

tx-rx

specifies that the LLDP agent will transmit and receive LLDP frames on this port

disabled

specifies that the LLDP agent will not transmit or receive LLDP frames on this port. If there is remote system information that was received on this port and stored in other tables before the port's admin-status was disabled, the information will naturally age out.

notification

Syntax

[**no**] **notification**

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Context

config>port>ethernet>lldp>dest-mac

Description

This command enables LLDP notifications.

The **no** form of the command disables LLDP notifications.

Default

no notification

port-id-subtype

Syntax

port-id-subtype {**tx-if-alias** | **tx-if-name** | **tx-local**}

Context

config>port>ethernet>lldp>destmac

Description

This command specifies how to encode the port ID TLV transmit to the peer. The default setting **tx-local** (ifindex value) is required by some versions of the NSP NFM-P to properly build the Layer 2 topology map using LLDP. Changing this value to transmit the ifName (**tx-if-name**) or ifAlias (**tx-if-alias**) in place of the ifindex (**tx-local**) may affect the ability of the NSP NFM-P to build the Layer 2 topology map using LLDP.

Default

tx-local

Parameters

tx-if-alias

transmits the ifAlias string (subtype 1) that describes the port as stored in the IF-MIB, either user-configured or the default entry (that is, 10/100/Gig Ethernet SFP)

tx-if-name

transmits the ifName string (subtype 5) that describes the port as stored in the IF-MIB ifName info

tx-local

the interface ifindex value (subtype 7) as the port ID

tx-mgmt-address

Syntax

tx-mgmt-address [**system**] [**system-ipv6**]

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no tx-mgmt-address

Context

config>port>ethernet>lldp>dest-mac

Description

This command specifies which management address to transmit. The 7705 SAR can only be configured to send or not send the system address.

If the **no** form of the command is used, the port will not include the system management address TLV in any LLDPDUs it transmits.

Default

no tx-mgmt-address

Parameters

system

specifies to use the system IPv4 address. The system address is only transmitted after it has been configured.

system-ipv6

specifies to use the system IPv6 address. The system address is only transmitted after it has been configured.

tx-tlvs

Syntax

tx-tlvs [**port-desc**] [**sys-name**] [**sys-desc**] [**sys-cap**]

no tx-tlvs

Context

config>port>ethernet>lldp>dest-mac

Description

This command specifies which LLDP optional TLVs to transmit.

If the **no** form of the command is used, the port will not include any optional TLVs in any LLDPDUs it transmits.

Default

no tx-tlvs

Parameters

port-desc

indicates that the LLDP agent should transmit port description TLVs

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sys-name
indicates that the LLDP agent should transmit system name TLVs

sys-desc
indicates that the LLDP agent should transmit system description TLVs

sys-cap
indicates that the LLDP agent should transmit system capabilities TLVs

3.14.2.14 MACsec commands

macsec

Syntax

macsec

Context

config

Description

This command enables the context for MACsec configuration. The MACsec MKA profile can be configured under this command.

connectivity-association

Syntax

connectivity-association *ca-name* [**create**]

no connectivity-association *ca-name*

Context

config>macsec

Description

This command configures a connectivity association (CA). MACsec connectivity associations are applied to a dot1x port to enable MACsec on that port.

The **no** form of this command removes the connectivity association.

Default

no connectivity-association *ca-name*

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Parameters

ca-name

the name of the connectivity association, up to 32 characters

create

mandatory keyword when creating a CA

anysec

Syntax

[**no**] **anysec**

Context

config>macsec>connectivity-association

Description

This command configures the CA for the exclusive use of ANYsec encryption.

When ANYsec is configured on the CA, the following commands cannot be configured:

- **clear-tag-mode**
- **encryption-offset**
- **macsec-encrypt**
- **replay-protection**
- **replay-window-size**

The **no** form of this command removes ANYsec from the CA configuration.

Default

no anysec

cipher-suite

Syntax

cipher-suite *cipher-suite*

no cipher-suite

Context

config>macsec>connectivity-association

Description

This command configures the encryption of data path PDUs. When all parties in the CA have the security association key (SAK), they use the specified algorithm in conjunction with the SAK to encrypt the data path PDUs.

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The 64-bit extended packet number (XPN) can be used for higher-rate ports such as 10 GigE to minimize the window rollover and renegotiation of the SAK.

The **no** form of this command disables encryption of data path PDUs.

Default

cipher-suite gcm-aes-xpn-128

Parameters

cipher-suite

specifies the encryption algorithm

Values gcm-aes-128 – used for control plane encryption

gcm-aes-256 – used for control plane encryption

gcm-aes-xpn-128 – algorithm with extended packet number is used for control plane encryption

gcm-aes-xpn-256 – algorithm with extended packet number is used for control plane encryption

clear-tag-mode

Syntax

clear-tag-mode *clear-tag-mode*

no clear-tag-mode

Context

config>macsec>connectivity-association

Description

This command puts dot1q tags in clear text before the SecTAG. The 7705 SAR supports two modes: single-tag and dual-tag.

The following table describes the encrypted dot1q and QinQ packet formats when this command is set to single-tag mode or dual-tag mode.

The **no** form of this command puts all dot1q tags after the SecTAG, which encrypts them.

Table 40: Encrypted dot1q and QinQ packet formats

Unencrypted format	Clear-tag-mode	Pre-encryption (Tx)	Pre-decryption (Rx)
Single tag (dot1q)	single-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTAG
Single tag (dot1q)	dual-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTAG

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Unencrypted format	Clear-tag-mode	Pre-encryption (Tx)	Pre-decryption (Rx)
Double tag (QinQ)	single-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, SecTAG
Double tag (QinQ)	dual-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, IPID2, VID2, SecTAG

Default

no clear-tag-mode

Parameters

clear-tag-mode

specifies the clear tag mode

Values single-tag or dual-tag

encryption-offset

Syntax

encryption-offset *encryption-offset*

no encryption-offset

Context

config>macsec>connectivity-association

Description

This command specifies the offset of the encryption in a MACsec packet.

The encryption offset is distributed by the MACsec key agreement (MKA) key server to all parties.

The offset is signaled via MACsec capabilities. There are four basic settings for MACsec capabilities as described in the following table.

Table 41: MACsec capability settings

Setting	Description
0	MACsec is not implemented
1	Integrity without confidentiality
2	The following are supported: • integrity without confidentiality

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Setting	Description
	• integrity and confidentiality with a confidentiality offset of 0
3	The following are supported: • Integrity without confidentiality • Integrity and confidentiality with a confidentiality offset of 0, 30, or 50

The 7705 SAR supports setting 3.

The **no** form of this command sets the encryption offset to its default value.

Default

encryption-offset 0

Parameters

encryption-offset

specifies the encryption value

Values 0 — encrypt the entire payload

30 — leave the IPv4 header in clear text

50 — leave the IPv6 header in clear text

macsec-encrypt

Syntax

[**no**] **macsec-encrypt**

Context

config>macsec>connectivity-association

Description

This command enables or disables PDU encryption.

The **no** form of this command specifies that all PDUs are transmitted with clear text, but are still authenticated and have the trailing ICV.

Default

macsec-encrypt

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replay-protection

Syntax

[**no**] **replay-protection**

Context

config>macsec>connectivity-association

Description

This command enables replay protection and is used in conjunction with the **replay-window-size** command. When replay protection is enabled, the sequence IDs of the received packets are checked. If a packet arrives out of sequence and the difference between the packet number and the number of the preceding packet exceeds the configured replay protection window size, the packet is dropped by the receiving port.

Replay protection is especially useful for fighting man-in-the-middle attacks. A packet that is replayed by a man-in-the-middle attacker on the Ethernet link will arrive on the receiving link out of sequence, so replay protection helps ensure the replayed packet is dropped instead of forwarded through the network.

Replay protection should not be enabled when packets are expected to arrive out of order.

The **no** form of this command reverts to the default value.

Default

no replay-protection

replay-window-size

Syntax

replay-window-size *number-of-packets*

no replay-window-size

Context

config>macsec>connectivity-association

Description

This command specifies the size of the replay protection window.

The **replay-protection** command must be enabled before this command can be configured. When replay protection is enabled, the sequence IDs of the received packets are checked. If a packet arrives out of sequence and the difference between the packet number and the number of the preceding packet exceeds the replay protection window size, the packet is dropped by the receiving port. For example, if the replay protection window size is set to five and a packet assigned an ID of 1006 arrives on the receiving link immediately after a packet assigned an ID of 1000, the packet that is assigned the ID of 1006 is dropped because it falls outside the parameters of the replay protection window.

When the *number-of-packets* is set to 0, all packets that arrive out of order are dropped.

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The **no** form of this command reverts to the default value.

Default

replay-window-size 0

Parameters

number-of-packets

the size of the replay window

Values 0 to 4294967294

shutdown

Syntax

[**no**] **shutdown**

Context

config>macsec>connectivity-association

Description

This command shuts down the CA profile, disabling MACsec. Any ports using this profile will not transmit PDUs.

Default

shutdown

static-cak

Syntax

[**no**] **static-cak**

Context

config>macsec>connectivity-association

Description

This command enables the context to configure a connectivity association key (CAK). The CAK is responsible for managing the MKA.

Default

n/a

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active-psk

Syntax

active-psk *active-pre-shared-key*

no active-psk

Context

config>macsec>connectivity-association>static-cak

Description

This command specifies the active transmitting pre-shared key (PSK). If two pre-shared keys are configured, the arriving MACsec MKA can be decrypted using the CAK of either pre-shared key; however, only the active PSK is used for transmitting encryption of MKA PDUs.

Before enabling the active PSK, administratively disable the CA.

Default

active-psk 1

Parameters

active-pre-shared-key

specifies the index of the active transmitting pre-shared key

Values 1 or 2

mka-hello-interval

Syntax

mka-hello-interval *mka-hello-interval*

no mka-hello-interval

Context

config>macsec>connectivity-association>static-cak

Description

This command configures the interval at which MKA hello packets are sent or received for the connectivity association.

The **no** form of this command reverts to the default value.

Default

mka-hello-interval 2

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Parameters

mka-hello-interval

MKA hello interval, in seconds

Values 2 to 6

mka-key-server-priority

Syntax

mka-key-server-priority *key-server-priority*

no mka-key-server-priority

Context

config>macsec>connectivity-association>static-cak

Description

This command specifies the key server priority used by the MKA protocol to select the key server when MACsec is enabled using static CAK security mode.

The **no** form of this command reverts to the default value.

Default

mka-key-server-priority 16

Parameters

key-server-priority

specifies the priority of the server

Values 0 to 255

pre-shared-key

Syntax

pre-shared-key *pre-shared-key-index* [**encryption-type** *encryption-type*] [**create**]

no pre-shared-key *pre-shared-key-index*

Context

config>macsec>connectivity-association>static-cak

Description

This command specifies the pre-shared key (PSK) used to enable MACsec using static CAK security mode. This command also specifies the algorithm used for encrypting the security association key (SAK).

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A PSK is configured on both devices at each end of a point-to-point link. The PSK includes a connectivity association key name (CKN) and a connectivity association key (CAK). The PSK, the CKN, and the CAK must match at both ends of the link.

The MKA protocol is enabled after a successful MKA liveness negotiation.

The encryption type is used for encrypting the SAK and authenticating the MKA packet. The symmetric encryption key SAK must be encrypted using the specified algorithm. The AES key is derived from the PSK.

The **no** form of the command removes the PSK.

Default

no pre-shared-key *pre-shared-key-index*

Parameters

pre-shared-key-index

specifies the index of the pre-shared key

Values 1, 2

encryption-type

specifies the type of encryption for the SAK

Values aes-128-cmac, aes-256-cmac

create

mandatory keyword when creating a PSK

cak

Syntax

cak *hex-string* [**hash** | **hash2**]

no cak

Context

config>macsec>connectivity-association>static-cak>pre-shared-key

Description

This command specifies the connectivity association key (CAK) for the pre-shared key. Two values are derived from the CAK:

- the key encryption key (KEK), which is used to encrypt the MKA and SAK (symmetric key used for data path PDUs) to be distributed among all members
- the integrity check value (ICK), which is used to authenticate the MKA and SAK PDUs to be distributed among all members

The **no** form of this command removes the CAK.

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Default

no cak

Parameters

hex-string

the value of the CAK, 32 hexadecimal characters for 128- bit key and 64 hexadecimal characters for 256-bit key

hash

specifies that the key is entered in an encrypted form. If the **hash** or **hash2** parameter is not used, the key is assumed to be in an unencrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the **hash** or **hash2** parameter specified.

hash2

specifies that the key is entered in a more complex encrypted form that involves more variables than the key value alone, meaning that the **hash2** encrypted key cannot be copied and pasted. If the **hash** or **hash2** parameter is not used, the key is assumed to be in an unencrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the **hash** or **hash2** parameter specified.

ckn

Syntax

ckn *hex-string*

no ckn

Context

config>macsec>connectivity-association>static-cak>pre-shared-key

Description

This command specifies the connectivity association key name (CKN) for the pre-shared key. The CKN is appended to the MKA to identify the appropriate CAK by the peer.

The **no** form of this command removes the CKN.

Default

no ckn

Parameters

hex-string

the value of the CKN, up to 64 hexadecimal characters

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primary-keychain

Syntax

primary-keychain *keychain-name*

no primary-keychain

Context

config>macsec>connectivity-association>static-cak

Description

This command configures the primary keychain.

The **no** form of this command disables the primary keychain.

Default

no primary-keychain

Parameters

keychain-name

the primary keychain name, up to 32 characters

mac-policy

Syntax

mac-policy *mac-policy-id* [**create**]

no mac-policy *mac-policy-id*

Context

config>macsec

Description

This command configures a MAC address policy group.

The **no** form of this command removes the specified MAC address policy group configuration.

Default

no mac-policy *mac-policy-id*

Parameters

mac-policy-id

the identifier of the MAC address policy

Values 1 to 1024

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create

mandatory keyword when configuring a MAC address policy group

dest-mac-address

Syntax

dest-mac-address *mac-address* [**create**]

no dest-mac-address *mac-address*

Context

config>macsec>mac-policy

Description

This command configures the destination MAC address under the specified MAC address policy .

The **no** form of this command removes the MAC address from the MAC address policy.

Default

no mac-policy *mac-address*

Parameters

mac-address

the 6-byte destination MAC address in hexadecimal format

Values xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx

create

mandatory keyword when specifying a destination MAC address

3.14.2.15 Ring MAC operations commands

disable-aging

Syntax

[**no**] **disable-aging**

Context

config>card>mda>ring

Description

This command disables MAC address aging across an Ethernet ring.

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As is the case for a Layer 2 switch, learned MACs can be aged out if no packets are sourced from the MAC address for a period of time (the aging time). In each ring, there are independent aging timers for local learned MAC and remote learned MAC entries in the FDB. The **disable-aging** command turns off aging for local and remote learned MAC addresses.

The **no** form of this command enables aging on the ring.

Default

no disable-aging

disable-learning

Syntax

[**no**] **disable-learning**

Context

config>card>mda>ring

Description

This command disables learning of new MAC addresses in the ring FDB.

When **disable-learning** is enabled, new source MAC addresses will not be entered in the ring FDB. This is true for both local and remote MAC addresses.

When **disable-learning** is disabled, new source MAC addresses will be learned and entered into the ring FDB.

This parameter is mainly used in conjunction with the **discard-unknown-source** command.

The **no** form of this command enables learning of MAC addresses.

Default

no disable-learning

discard-unknown-source

Syntax

[**no**] **discard-unknown-source**

Context

config>card>mda>ring

Description

This command specifies that packets with an unknown source MAC address received on a ring port will be dropped if the source MAC is not already in the FDB (that is, the source MAC was not learned before the **discard-unknown-source** command was enabled or is not a static entry already created for the packet MAC).

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When disabled, the packets are flooded to the other ring port or forwarded to the v-port (if the packets are addressed to the v-port).

The **no** form of this command disables discard-unknown-source.

Default

no discard-unknown-source

fdb-table-high-wmark

Syntax

fdb-table-high-wmark *high-water-mark*

no fdb-table-high-wmark

Context

config>card>mda>ring

Description

This command specifies the upper threshold value for learned FDB entries. The high-water-mark is configured as a percentage of the FDB. When the number of FDB entries exceeds the *high-water-mark*, the system raises a log event.

The **no** form of this command returns the maximum FDB table high-water-mark to the default (95%).

Default

no fdb-table-high-wmark

Parameters

high-water-mark

specifies the upper threshold for FDB entries as a percentage of FDB table size, which when exceeded, causes the system to raise a log event

Values 0 to 100

fdb-table-size

Syntax

fdb-table-size *table-size*

no fdb-table-size

Context

config>card>mda>ring

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Description

This command specifies the maximum number of MAC entries in the dynamic FDB for the ring.

The **no** form of this command returns the maximum FDB table size to the default (512).

Default

no fdb-table-size

Parameters

table-size

the maximum number of learned MAC entries in the FDB for the ring

Values 4 to 512

mac-pinning

Syntax

[**no**] **mac-pinning port** *port-id*

Context

config>card>mda>ring

Description

This command keeps MAC address information that has been learned from a source frame in the FDB until the expiry of the mac-aging timer, which is specified using the remote-age command). If a MAC address is pinned and a frame with an existing source MAC address is received from the other ring port, the FDB entry is not altered—the address that was learned from the first source frame is preserved until the expiry of the aging timer. If the aging timer is disabled, then the MAC address remains pinned until the timer is enabled again.

The **no** form of this command disables mac-pinning.

Default

no mac-pinning

Parameters

port-id

specifies the physical ring port

remote-age

Syntax

remote-age *aging-timer*

no remote-age

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Context

config>card>mda>ring

Description

This command specifies the aging time for remotely learned MAC addresses in the FDB.

As is the case for a Layer 2 switch, learned MAC addresses can be aged out if no packets are sourced from the MAC address for a period of time (the aging time). The **remote-age** timer specifies the aging time for remotely learned MAC addresses.

The **no** form of this command returns the remote aging timer to the default value (900 s).

Default

no remote-age

Parameters

aging-timer

the aging time for remote MAC addresses, expressed in seconds

Values 60 to 86400

static-mac

Syntax

[**no**] **static-mac mac** *ieee-address* **port** *port-id* [**create**]

Context

config>card>mda>ring

Description

This command creates a local static MAC entry in the FDB for the specified port. The maximum number of static MAC addresses per ring adapter card is 256.

Static MAC definitions on one edge device are not propagated to other edge devices; that is, each edge device has an independent FDB.

Only one static MAC entry (local or remote) can be defined per MAC address per instance.

By default, no static MAC address entries are defined.

The **no** form of this command deletes the static MAC entry with the specified MAC address associated with the port from the FDB.

Parameters

ieee-address

specifies the 48-bit MAC address for the static ARP in the form *aa*:*bb*:*cc*:*dd*:*ee*:*ff* or *aa-bb-cc-dd-ee-ff* where *aa*, *bb*, *cc*, *dd*, *ee* and *ff* are hexadecimal numbers (cannot be all zeros). Allowed values are any non-broadcast, non-multicast MAC, and non-IEEE reserved MAC addresses.

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port-id

specifies the port that is associated with the specified MAC address

create

this keyword is mandatory when specifying a static MAC address

3.14.2.16 Serial commands

serial

Syntax

serial

Context

config>port

Description

This command enables the context to configure RS-232, V.35, X.21, or RS-530 parameters for a port on a channelized 12-port Serial Data Interface card, or to configure RS-232 parameters for an RS-232 port on the 7705 SAR-Hc or on the 4-port T1/E1 and RS-232 Combination module. This context cannot be accessed by any other adapter card, module, or platform.

On the 12-port Serial Data Interface card version 2, if the port has been enabled for an RS-530 interface through the use of an adapter cable, X.21 configuration applies to the RS-530 interface. There is no configuration specifically for RS-530 operation on this card version. For the 12-port Serial Data Interface card, version 3, there is a separate rs530 command to configure RS-530 channel parameters.

A serial port configuration allows some or all of the bandwidth to be dedicated to a port by aggregating a number of DS0s into a single bundle.

Serial data transmission rates below the rate of a single DS0, that is, less than 64 kb/s, are achieved using a proprietary protocol called high capacity multiplexing (HCM). These speeds, known as subrate speeds, are supported on RS-232, X.21, and RS-530 ports.

Default

n/a

rs232

Syntax

[**no**] **rs232**

Context

config>port>serial

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Description

This command enables the context to configure RS-232 parameters for a channel. When one of the ports on a connector has been configured for an RS-232 channel, the other ports on the connector can only be configured for RS-232.

The **no** form of this command deletes the RS-232 channel.

Default

n/a

rs530

Syntax

[**no**] **rs530**

Context

config>port>serial

Description

This command enables the context to configure RS-530 parameters for a channel on a 12-port Serial Data Interface card, version 3. When one port on a connector is configured for an RS-530 channel, the other port on the connector can only be configured for RS-530.

The **no** form of this command deletes the RS-530 channel.

Default

n/a

v35

Syntax

[**no**] **v35**

Context

config>port>serial

Description

This command enables the context to configure V.35 parameters for a channel. When one of the ports on a connector has been configured for a V.35 channel, the other ports on the connector can only be configured for V.35. The **no** form of this command deletes the V.35 channel.

The **no** form of this command deletes the V.35 channel.

Default

n/a

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x21

Syntax

[**no**] **x21**

Context

config>port>serial

Description

This command enables the context to configure X.21 parameters for a channel. When one of the ports on a connector has been configured for an X.21 channel, the other ports on the connector can only be configured for X.21.

On a 12-port Serial Data Interface card version 2, if the port has been enabled for an RS-530 interface through the use of an adapter cable, X.21 configuration applies to the RS-530 interface. There is no configuration specifically for RS-530 operation. All X.21 functionality is available on the RS-530 interface, except that only DCE operation is supported for RS-530. However, because X.21 does not support all the control leads available for RS-530, only a subset of the RS-530 control leads are supported.

The **no** form of this command deletes the X.21 channel.

Default

n/a

character-length

Syntax

character-length {**6** | **7** | **8**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>x21

Description

This command configures the number of data bits used to transmit a character. This command is valid only if device-mode is asynchronous. The value for this command cannot be 8 if the value for parity is anything other than no parity (that is, anything other than none) and the value for stop-bits is 2.

Default

8

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Parameters

6

specifies six bits in a character

7

specifies seven bits in a character

8

specifies eight bits in a character

clock-source

Syntax

clock-source {**external** | **slave** | **dcr-serial**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command configures the source of the transmit clock. The command is valid only if device-mode is synchronous.

The 12-port Serial Data Interface card version 2, 4-port T1/E1 and RS-232 Combination module, and 7705 SAR-Hc support slave clocking only. The 12-port Serial Data Interface card, version 3, supports all clocking options.

The following table describes the clocking options. See the device-gender command for information about setting DTE or DCE on serial data interface ports.

Table 42: Synchronization clocking options

Attached device gender		7705 SAR port gender		Tx clock option	Description
DTE	DCE	DTE	DCE		
✓			✓	Slave	DCE slave: the transmit and receive clocks are derived from the Baud Rate Generator (BRG) locked to the system timing
	✓	✓		Slave	DTE slave: the transmit and receive clocks are supplied by the attached DCE device
✓			✓	DCR serial	DCR DCE: the transmit and receive clocks are derived from the far-end clock transported via

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Attached device gender		7705 SAR port gender		Tx clock option	Description
DTE	DCE	DTE	DCE		
					DCR serial (12-port Serial Data Interface card, version 3, only)
	✓	✓		DCR serial	DCR DTE: the transmit and receive clocks are supplied by the attached DCE device (12-port Serial Data Interface card, version 3, only)
✓			✓	External [1]	DCE Ext: the transmit clock is provided by the attached DTE device. The received clock is derived from the internal BRG. (12-port Serial Data Interface card, version 3, only)
	✓	✓		External [1]	DTE Ext: the transmit clock is provided by the attached DCE device. The received clock is derived from the internal BRG. (12-port Serial Data Interface card, version 3, only)

Note:

1. External is commonly referred to as terminal timing.

Default

slave

Parameters

external

terminal timing mode

slave

slave mode

dcr-serial

the Rx Clk signal from the DTE port is used as the source of the clock, which is also transported to the DCE port across the network; only supported for SAToP serial Cpipes for synchronous RS-232 and RS-530 ports on the 12-port Serial Data Interface card, version 3

control-lead

Syntax

control-lead {**input** | **monitor** | **output**}

Context

config>port>serial>rs232

config>port>serial>rs530

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config>port>serial>v35

config>port>serial>x21

Description

This command enables access to the context to configure the input and output leads that carry control signals. Control signals provide the handshaking for call setup, teardown, and synchronization.

Note: Although the parameters for **control-lead** can be configured, they are not meaningful for MDDB SCADA bridges. Only data traffic is allowed between the master and the RTU sites.

The following table summarizes the supported control leads for each protocol.

Table 43: Control leads

Protocol		DCE	DTE
RS-232	Input	DTR, RTS, ALB, RDL	DSR, DCD, CTS, RI
	Output	DSR, DCD, CTS, RI	DTR, RTS, ALB, RDL
V.35	Input	DTR, RTS, ALB	DSR, DCD, CTS
	Output	DSR, DCD, CTS	DTR, RTS, ALB
X.21	Input	C	I
	Output	I	C
RS-530	Input	DTR, RTS, RL, LL	DSR, DCD, CTS, TM
	Output	DSR, DCD, CTS, TM	DTR, RTS, RL, LL

Default

n/a

input

Syntax

input

Context

config>port>serial>rs232>control-lead

config>port>serial>rs530>control-lead

config>port>serial>v35>control-lead

config>port>serial>x21>control-lead

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Description

This command enables access to the context to configure the input control leads.

Default

n/a

alb-cts

Syntax

alb-cts {**high** | **low** | **end-to-end**}

Context

config>port>serial>rs232>control-lead>input

config>port>serial>v35>control-lead>input

Description

This command configures the Analog Loopback (ALB) or Clear To Send (CTS) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is ALB. For a DTE device, the input signal is CTS.

This command is valid only for RS-232 and V.35 interfaces.

Default

high

Parameters

high

the input control lead is assumed to be on

low

the input control lead is assumed to be off

end-to-end

the input control lead follows that of the remote end. This parameter is not supported for interface speeds ≥ 64 kb/s.

c-i

Syntax

c-i {**high** | **low** | **end-to-end**}

Context

config>port>serial>x21>control-lead>input

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Description

This command configures the Control (C) or Indication (I) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is C. For a DTE device, the input signal is I.

This command is valid only for X.21 interfaces.

Default

high

Parameters

high

the input control lead is forced on

low

the input control lead is forced off

end-to-end

the input control lead follows that of the remote end

dtr-dsr

Syntax

dtr-dsr {**high** | **low**}

Context

config>port>serial>rs232>control-lead>input

config>port>serial>rs530>control-lead>input

config>port>serial>v35>control-lead>input

Description

This command configures the Data Terminal Ready (DTR) or Data Set Ready (DSR) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is DTR. For a DTE device, the input signal is DSR.

This command is valid only for RS-232, RS-530, and V.35 interfaces.

Default

high

Parameters

high

the input control lead is assumed to be on

low

the input control lead is assumed to be off

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ll-tm

Syntax

ll-tm {**high** | **low**}

Context

config>port>serial>rs530>control-lead>input

Description

This command configures the Local Loopback (LL) or Test Mode (TM) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is LL. For a DTE device, the input signal is TM.

This command is valid only for RS-530 interfaces.

Default

on

Parameters

high

the input control lead is assumed to be on

low

the input control lead is assumed to be off

rdl-ri

Syntax

rdl-ri {**high** | **low**}

Context

config>port>serial>rs232>control-lead>input

Description

This command configures the Remote Digital Loopback (RDL) or Ring Indicator (RI) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is RDL. For a DTE device, the input signal is RI.

This command is valid only for RS-232 interfaces.

Default

high

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Parameters

high

the input control lead is assumed to be on

low

the input control lead is assumed to be off

rl-cts

Syntax

rl-cts {**high** | **low** | **end-to-end**}

Context

config>port>serial>rs530>control-lead>input

Description

This command configures the Remote Loopback (RL) or Clear To Send (CTS) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is RL. For a DTE device, the input signal is CTS.

This command is valid only for RS-530 interfaces.

Default

high

Parameters

high

the input control lead is assumed to be on

low

the input control lead is assumed to be off

end-to-end

the input control lead follows that of the remote end

rts-dcd

Syntax

rts-dcd {**high** | **low** | **end-to-end**}

Context

config>port>serial>rs232>control-lead>input

config>port>serial>rs530>control-lead>input

config>port>serial>v35>control-lead>input

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Description

This command configures the Request To Send (RTS) or Data Carrier Detect (DCD) input control lead. The input signal that is sent depends on the device-gender setting. For a DCE device, the input signal is RTS. For a DTE device, the input signal is DCD.

This command is valid only for RS-232, RS-530, and V.35 interfaces.

Default

high

Parameters

high

the input control lead is assumed to be on

low

the input control lead is assumed to be off

end-to-end

the input control lead follows that of the remote end. This parameter is not supported for interface speeds ≥ 64 kb/s on RS-232 and V.35 interfaces.

monitor

Syntax

monitor

Context

config>port>serial>rs232>control-lead

config>port>serial>rs530>control-lead

config>port>serial>v35>control-lead

config>port>serial>x21>control-lead

Description

This command enables access to the context to monitor the input control leads. When monitoring is enabled on a control lead, the 7705 SAR polls the status of the control lead every second. Any change in state of the control lead causes an alarm to be raised. This functionality provides an indication to the operator of a problem in the DTE-to-DCE path; for example, it can indicate that the far-end device is disconnected.

Monitoring is enabled on a per-lead basis. The monitoring functionality is supported on ports configured for either DTE or DCE.

Default

n/a

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alb-cts

Syntax

alb-cts {**on** | **off** | **high** | **low**}

Context

config>port>serial>rs232>control-lead>monitor

config>port>serial>v35>control-lead>monitor

Description

This command enables monitoring on the Analog Loopback (ALB) or Clear To Send (CTS) input control lead. For a DCE device, the input control lead is ALB. For a DTE device, the input control lead is CTS.

This command is valid only for RS-232 and V.35 interfaces.

Default

off

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

high

enable monitoring and force link down when lead is high (only supported on 12-port Serial Data Interface card, version 3)

low

enable monitoring and force link down when lead is low (only supported on 12-port Serial Data Interface card, version 3)

c-i

Syntax

c-i {**on** | **off** | **high** | **low**}

Context

config>port>serial>x21>control-lead>monitor

Description

This command enables monitoring on the Control (C) or Indication (I) input control lead. For a DCE device, the input control lead is C. For a DTE device, the input control lead is I.

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This command is valid only for an X.21 interface.

Default

off

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

high

enable monitoring and force link down when lead is high (only supported on 12-port Serial Data Interface card, version 3)

low

enable monitoring and force link down when lead is low (only supported on 12-port Serial Data Interface card, version 3)

dtr-dsr

Syntax

dtr-dsr {**on** | **off** | **high** | **low**}

Context

config>port>serial>rs232>control-lead>monitor

config>port>serial>rs530>control-lead>monitor

config>port>serial>v35>control-lead>monitor

Description

This command enables monitoring on the Data Terminal Ready (DTR) or Data Set Ready (DSR) input control lead. For a DCE device, the input control lead is DTR. For a DTE device, the input control lead is DSR.

This command is valid only for RS-232, RS-530, and V.35 interfaces.

Default

off

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

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high

enable monitoring and force link down when lead is high (only supported on 12-port Serial Data Interface card, version 3)

low

enable monitoring and force link down when lead is low (only supported on 12-port Serial Data Interface card, version 3)

ll-tm

Syntax

ll-tm {**on** | **off** | **high** | **low**}

Context

config>port>serial>rs530>control-lead>monitor

Description

This command enables monitoring on the Local Loopback (LL) or Test Mode (TM) input control lead. For a DCE device, the input signal is LL. For a DTE device, the input signal is TM.

This command is valid only for RS-530 interfaces.

Default

on

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

high

enable monitoring and force link down when lead is high

low

enable monitoring and force link down when lead is low

rl-cts

Syntax

rl-cts {**on** | **off** | **high** | **low**}

Context

config>port>serial>rs530>control-lead>monitor

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Description

This command enables monitoring on the Remote Loopback (RL) or Clear To Send (CTS) input control lead. For a DCE device, the input signal is RL. For a DTE device, the input signal is CTS.

This command is valid only for RS-530 interfaces.

Default

high

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

high

enable monitoring and force link down when lead is high

low

enable monitoring and force link down when lead is low

rdl-ri

Syntax

rdl-ri {**on** | **off** | **high** | **low**}

Context

config>port>serial>rs232>control-lead>monitor

Description

This command enables monitoring on the Remote Digital Loopback (RDL) or Ring Indicator (RI) input control lead. For a DCE device, the input control lead is RDL. For a DTE device, the input control lead is RI.

This command is valid only for RS-232 interfaces.

Default

off

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

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high

enable monitoring and force link down when lead is high (only supported on 12-port Serial Data Interface card, version 3)

low

enable monitoring and force link down when lead is low (only supported on 12-port Serial Data Interface card, version 3)

rts-dcd

Syntax

rts-dcd {**on** | **off** | **high** | **low**}

Context

config>port>serial>rs232>control-lead>monitor

config>port>serial>rs530>control-lead>monitor

config>port>serial>v35>control-lead>monitor

Description

This command enables monitoring on the Request To Send (RTS) or Data Carrier Detect (DCD) input control lead. For a DCE device, the input control lead is RTS. For a DTE device, the input control lead is DCD.

This command is valid only for RS-232, RS-530, and V.35 interfaces.

Default

off

Parameters

on

monitoring is enabled on the lead

off

monitoring is disabled on the lead

high

enable monitoring and force link down when lead is high (only supported on 12-port Serial Data Interface card, version 3)

low

enable monitoring and force link down when lead is low (only supported on 12-port Serial Data Interface card, version 3)

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output

Syntax

output

Context

config>port>serial>rs232>control-lead

config>port>serial>rs530>control-lead

config>port>serial>v35>control-lead

config>port>serial>x21>control-lead

Description

This command enables access to the context to configure the output control leads.

Default

n/a

cts-alb

Syntax

cts-alb {**high** | **low** | **end-to-end**}

Context

config>port>serial>rs232>control-lead>output

config>port>serial>v35>control-lead>output

Description

This command configures the Clear To Send (CTS) or Analog Loopback (ALB) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is CTS. For a DTE device, the output signal is ALB.

This command is valid only for RS-232 and V.35 interfaces.

Default

high

Parameters

high

the output control lead is forced on

low

the output control lead is forced off

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end-to-end

the output control lead follows that of the remote end, except when the output control lead is carrying a CTS signal on an RS-232 port operating at subrate speeds. In this case, the control lead follows the HCM status:

- if the HCM status is Up, the CTS output control lead is 1
- if the HCM status is Down, the CTS output control lead is 0

cts-rl

Syntax

cts-rl {**high** | **low** | **end-to-end**}

Context

config>port>serial>rs530>control-lead>output

Description

This command configures the Clear To Send (CTS) or Remote Loopback (RL) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is CTS. For a DTE device, the output signal is RL.

This command is valid only for RS-530 interfaces.

Default

high

Parameters

high

the output control lead is forced on

low

the output control lead is forced off

end-to-end

the output control lead follows that of the remote end

dcd-rts

Syntax

dcd-rts {**high** | **low** | **end-to-end**}

Context

config>port>serial>rs232>control-lead>output

config>port>serial>rs530>control-lead>output

config>port>serial>v35>control-lead>output

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Description

This command configures the Data Carrier Detect (DCD) or Request To Send (RTS) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is DCD. For a DTE device, the output signal is RTS.

This command is valid only for RS-232, RS-530, and V.35 interfaces.

Default

high

Parameters

high

the output control lead is forced on

low

the output control lead is forced off

end-to-end

the output control lead follows that of the remote end

dsr-dtr

Syntax

dsr-dtr {**high** | **low**}

Context

config>port>serial>rs232>control-lead>output

config>port>serial>rs530>control-lead>output

config>port>serial>v35>control-lead>output

Description

This command configures the Data Set Ready (DSR) or Data Terminal Ready (DTR) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is DSR. For a DTE device, the output signal is DTR.

This command is valid only for RS-232, RS-530, and V.35 interfaces.

Default

high

Parameters

high

the output control lead is forced on

low

the output control lead is forced off

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tm-ll

Syntax

dsr-dtr {**high** | **low**}

Context

config>port>serial>rs530>control-lead>output

Description

This command configures the Test Mode (TM) or Local Loopback (LL) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is TM. For a DTE device, the output signal is LL.

This command is valid only for RS-530 interfaces.

Default

high

Parameters

high

the output control lead is forced on

low

the output control lead is forced off

i-c

Syntax

i-c {**high** | **low** | **end-to-end**}

Context

config>port>serial>x21>control-lead>output

Description

This command configures the Indication (I) or Control (C) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is I. For a DTE device, the output signal is C.

This command is valid only for X.21 interfaces.

Default

high

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Parameters

high

the output control lead is forced on

low

the output control lead is forced off

end-to-end

the output control lead follows that of the remote end

ri-rdl

Syntax

ri-rdl {**high** | **low**}

Context

config>port>serial>rs232>control-lead>output

Description

This command configures the Ring Indicator (RI) or Remote Digital Loopback (RDL) output control lead. The output signal that is sent depends on the device-gender setting. For a DCE device, the output signal is RI. For a DTE device, the output signal is RDL.

This command is valid only for RS-232 interfaces.

Default

high

Parameters

high

the output control lead is forced on

low

the output control lead is forced off

data-position

Syntax

data-position {**F0-B5** | **F0-B6**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>x21

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Description

This command configures the HCM data start position for an RS-232, RS-530, or X.21 interface.

When s-bit-signaling is on, the F0-B6 option is blocked. When the data position is set to F0-B6, S-bit signaling cannot be turned on.

This command is only valid for ports configured for subrate speeds.

Note: The HCM frame (10-row by 8-column matrix) cannot be displayed on the CLI.

Default

F0-B5

Parameters

F0-B5

HCM data start position is F0-B5

F0-B6

HCM data start position is F0-B6

device-gender

Syntax

device-gender {**dte** | **dce**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command configures the gender of the device.

Data and control signals are transmitted and received over wire pairs. The gender of a device indicates which wire in the pair is used to send and receive the signal.

On ports on the 12-port Serial Data Interface card, version 2, the data and control signals are electrically wired as DCE. Regardless of the gender configured, the Tx pin on the port is always an input pin and the Rx pin on the port is always an output pin. Changing a port from DCE to DTE does not change the pin orientation. Therefore, when a port is configured as DTE, a crossover cable is required in order to interconnect with some serial devices. If the port has been enabled for an RS-530 interface through the use of an adapter cable, only DCE operation is supported.

Note: On the 12-port Serial Data Interface card, version 3, **device-gender** must match the cable type being used (either DCE or DTE).

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Default

dce

Parameters

dte

the device is performing the role of the data terminal equipment

dce

the device is performing the role of the data communications equipment

device-mode

Syntax

device-mode {**synchronous** | **asynchronous**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command configures the mode of operation for the device. An RS-232, RS-530, or X.21 channel can be configured for either synchronous or asynchronous mode. Asynchronous mode is not supported on a V.35 channel; V.35 can only be configured for synchronous mode.

Asynchronous mode is supported only on channels with subrate speeds of 38 400 b/s or less with the exception of RS-232 interfaces configured as raw sockets. See the socket and speed commands for more information.

On the 12-port Serial Data Interface card, version 3, a V.35, X.21, or RS-530 channel operating at a super-rate speed can be configured for synchronous mode.

Default

synchronous

Parameters

synchronous

transmits data continuously based on timing

asynchronous

transmits data one character at a time

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duplex

Syntax

duplex {**half** | **full**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command configures the duplex mode.

Half-duplex mode uses a single transmission path.

Full-duplex mode uses two independent transmission paths, one in each direction, allowing two connected devices to transmit and receive data simultaneously.

Half-duplex mode is not user-selectable; an error message is displayed if this option is selected. Half-duplex mode is selected automatically if multidrop data bridge (multi-drop) is configured in slave mode (applies to RS-232 only).

Default

full

Parameters

half

uses a single transmission path

full

uses two independent transmission paths, one in each direction

hold-time

Syntax

hold-time {[**up** *hold-time-up*] [**down** *hold-time-down*]}

no hold-time

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

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config>port>serial>x21

Description

This command configures the serial link dampening timers in 100s of milliseconds, which guards against reporting excessive interface transitions. Once implemented, subsequent transitions of the interface from one state to another are not advertised to upper layer protocols until the configured timer has expired.

Default

no hold-time

Parameters

hold-time-up

the hold-timer for link-up event dampening. A value of zero (0) indicates that an up transition is reported immediately.

Values 0 to 100 (in 100s of milliseconds)

hold-time-down

the hold-timer for link-down event dampening. A value of zero (0) indicates that a down transition is reported immediately.

Values 0 to 100 (in 100s of milliseconds)

invert-clock

Syntax

[**no**] **invert-clock**

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command enables the inverting of the receive clock used to sample data in order to improve performance under noisy conditions.

The **no** form of this command disables loopback on the inverting of the clock used to sample data.

This command is only supported on the 12-port Serial Data Interface card, version 3.

Default

n/a

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loopback

Syntax

loopback {**bidir-b** | **bidir-e** | **bidir-e-signalling**}

no loopback

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command puts the specified interface into a loopback mode. The corresponding interface must be in a shutdown state in order for the loopback mode to be enabled.

In the serial context, a bidirectional loopback B or E can be configured. A bidirectional loopback is a circuit loopback that loops traffic from the line back to the line and simultaneously loops traffic from the system back to the system. Bidirectional loopback B takes place on the control card (CSM) side of the adapter card, and is closer to the system. Loopback E takes place on the data device side of the adapter card, and is closer to the line.

This command is not saved in the system configuration between boots.

The **no** form of this command disables loopback on the interface.

Default

no loopback

Parameters

bidir-b

specifies that the loopback is bidirectional loopback B (not supported on the 12-port Serial Data Interface card, version 3)

bidir-e

specifies that the loopback is bidirectional loopback E

bidir-e-signalling

specifies that the loopback is bidirectional loopback E and is looping the internal signaling; this option is only supported on RS-530 interfaces

mon-clock-deviation

Syntax

mon-clock-deviation {[**raise** *debounce-time-r*] [**clear** *debounce-time-c*]}

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no mon-clock-deviation

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

Description

This command raises or clears the debounce time for monitoring clock deviation.

The **no** form of this command removes the monitoring clock deviation configuration.

This command is only supported on the 12-port Serial Data Interface card, version 3.

Default

no mon-clock-deviation

Parameters

raise

raises the debounce time

debounce-time-r

specifies how much debounce time to raise

Values 10 to 100 s, increments of 10 s

clear

clears the debounce time

debounce-time-c

specifies how much debounce time to clear

Values 10 to 100 s, increments of 10 s

mon-data-inactivity

Syntax

mon-data-inactivity {[**raise** *debounce-time-r*] [**clear** *debounce-time-c*]}

no mon-data-inactivity

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>v35

config>port>serial>x21

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Description

This command raises or clears the debounce time for monitoring data inactivity.

The **no** form of this command removes the monitoring data inactivity configuration.

This command is only supported on the 12-port Serial Data Interface card, version 3.

Default

no mon-data-inactivity

Parameters

raise

raises the debounce time

debounce-time-r

specifies how much debounce time to raise

Values 10 to 100 s, increments of 10 s

clear

clears the debounce time

debounce-time-c

specifies how much debounce time to clear

Values 10 to 100 s, increments of 10 s

multi-drop

Syntax

multi-drop {**disabled** | **slave** | **master**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>x21

Description

This command configures the multidrop data bridge (MDDB) mode. MDDB is a polling scheme used on SCADA networks (supervisory or control systems used in utility, oil and gas, and other vertical applications) to communicate with multiple remote terminal units (RTUs) over a single RS-232, RS-530, or X.21 link.

In an MDDB, several circuits take turns using the same bandwidth to communicate with one circuit. Each slave device transmits data in that bandwidth when requested by the master device. The master device sends polling messages to, and looks for data from, the slave devices in that bandwidth.

One example of a multidrop data bridge is several terminals taking turns to communicate with a host computer. The circuit that all the other circuits communicate with is connected to a master device (a

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computer) and is designated the master; the rest of the circuits are connected to slave devices (terminals) and are designated slaves.

In a SCADA network, the 7705 SAR provides the communications infrastructure to connect the central masters to multiple RTUs at remote locations, where the masters and RTUs communicate over serial RS-232 and X.21 synchronous or asynchronous links, or serial RS-530 asynchronous links (RS-530 links are only supported on the 12-port Serial Data Interface card, version 3). The 7705 SAR-8 Shelf V2 or 7705 SAR-18 located at the master site contains the Integrated Services card, which provides the MDDB bridge functionality and acts as the MDDB master. Remote 7705 SAR nodes connected to RTUs are referred to as MDDB slaves.

For both master and slave applications, the 7705 SAR must be physically connected to the SCADA device by one of the following:

- a 7705 SAR-8 Shelf V2 or 7705 SAR-18 using the 12-port Serial Data Interface card
- a 7705 SAR-H using the 4-port T1/E1 and RS-232 Combination module (supports RS-232 links only)
- a 7705 SAR-Hc using an on-board RS-232 serial port (supports RS-232 links only)

Note: The 12-port Serial Data Interface card, version 2, supports the RS-530/RS-422 interface with the use of an adapter cable that connects to a DB15 connector on the front of the X.21 distribution panel. There is no configuration specifically for the RS-530/RS-422 interface on this card; configuration is done in X.21 mode and applies to the RS-530/RS-422 interface when it is physically enabled through hardware. For information about 12-port Serial Data Interface card adapter cables, see the 7705 SAR Serial Data Interface Card Installation Guide. The 12-port Serial Data Interface card, version 3, supports the RS-530 interface without the need for an adapter cable.

Multidrop data bridge is supported only at subrate speeds (less than 64 kb/s) on X.21 interfaces.

When an RS-232 interface is configured as an MDDB slave, the duplex mode is automatically set to half-duplex and s-bit-signaling is forced off. When multidrop data bridge is disabled, the duplex mode is set back to the default of full-duplex and S-bit signaling is turned on (but can be set back to off).

Note: An X.21 interface configured as an MDDB slave does not change duplex mode; half-duplex is not supported on X.21.

When either an RS-232, RS-530, or X.21 interface is configured as an MDDB master, the duplex mode is automatically set to full-duplex and S-bit signaling is forced off.

Default

disabled

Parameters

disabled

MDDB mode is off

slave

the port is operating as an MDDB slave device

master

the port is operating as an MDDB master device

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parity

Syntax

parity {**odd** | **even** | **mark** | **space**}

no parity

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>x21

Description

This command configures the parity bit in a character. Parity is an error detection method that adds an extra bit to each character, based on the number of 0s or 1s in the character.

This command is valid only if device-mode is asynchronous. The value for this command must be **no parity** (that is, none) if the character-length value is 8 and the stop-bits value is 2.

The **no** form of this command disables the parity bit in a character.

Default

no parity

Parameters

odd

the parity bit is set to 0 or 1 to make the total number of 1s in the set of bits odd

even

the parity bit is set to 0 or 1 to make the total number of 1s in the set of bits even

mark

the parity bit is present but not used and is always set to 1

space

the parity bit is present but not used and is always set to 0

report-alarm

Syntax

[**no**] **report-alarm** [**hcmOof** | **hcmRai**] [**ctrlLeadMon**] [**monClockDev**] [**monDataInac**]

Context

config>port>serial>rs232

config>port>serial>rs530

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config>port>serial>v35

config>port>serial>x21

Description

This command enables logging of alarms.

The **no** form of this command disables the logging of the specified alarms.

Parameters

hcmOof

reports local HCM out-of-frame errors. When configured, hcmOof events are raised and cleared.

Default HCM out-of-frame alarms are issued

hcmRai

reports remote HCM alarm indications. When configured, hcmRai events are raised and cleared.

Default HCM alarm indications are issued

ctrlLeadMon

reports input control lead monitoring alarm indications (only supported on the 12-port Serial Data Interface card, version 3)

Default input control lead monitoring alarm indications are issued

monClockDev

reports clock deviation monitoring alarm indications (only supported on the 12-port Serial Data Interface card, version 3)

Default clock deviation monitoring alarm indications are issued

monDataInac

reports data inactivity monitoring alarm indications (only supported on the 12-port Serial Data Interface card, version 3)

Default data inactivity monitoring alarm indications are issued

s-bit-signaling

Syntax

s-bit-signaling {**on** | **off**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>x21

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Description

This command configures the S-bit signaling option on an RS-232, RS-530, or X.21 interface.

For RS-232 interfaces only, if multi-drop is configured as slave or master, the system automatically turns S-bit signaling off. The signaling mode cannot then be changed. If multi-drop is configured as disabled, the system automatically turns S-bit signaling on. When multi-drop is in disabled mode, S-bit signaling can be turned off or on.

This command is only valid for ports configured for subrate speeds.

Default

on

Parameters

on

enables S-bit signaling

off

disables S-bit signaling

socket

Syntax

[**no**] **socket** *socket-id*

Context

config>port>serial>rs232

Description

This command creates a socket on an RS-232 port. When a socket is configured, the RS-232 channel-group command is blocked. If the port is already configured as a channel group before the socket is configured, this command is blocked.

The RS-232 port must be in asynchronous mode.

The **no** form of the command deletes the socket from the serial port.

Default

n/a

Parameters

socket-id

specifies the raw socket ID number

Values 1

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encap-type

Syntax

encap-type *encap-type*

Context

config>port>serial>rs232>socket

Description

This command specifies the encapsulation type for a socket. When the encapsulation type is set, then the socket is considered operational and the port can be further configured as an IP transport subservice under an IES or VPRN service.

If the serial port has already been configured as an IES or VPRN IP transport subservice, then this command is blocked until the IP transport subservice is deconfigured.

Default

raw

Parameters

encap-type

specifies the encapsulation type to be used with the socket

Values raw

rx

Syntax

rx

Context

config>port>serial>rs232>socket

Description

This command enables the context to configure parameters for data packets received over a serial port's raw socket.

Default

n/a

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eop

Syntax

eop

Context

config>port>serial>rs232>socket>rx

Description

This command enables the context to configure end-of-packet (EOP) parameters for data packets received over the socket.

Note: An end-of-packet will be declared by whichever EOP condition is encountered first.

Default

n/a

idle-timeout

Syntax

idle-timeout *milliseconds*

Context

config>port>serial>rs232>socket>rx>eop

Description

This command specifies how long a serial port can remain idle before an EOP is declared and the packet is sent over the socket.

Default

50 ms

Parameters

milliseconds

specifies the length of time, in milliseconds, that a serial port can remain idle before an EOP is declared

Values 10 to 5000

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length

Syntax

length *bytes*

Context

config>port>serial>rs232>socket>rx>eop

Description

This command specifies the number of characters (converted to bytes) received on the serial port that triggers the node to encapsulate the characters in an IP transport packet and send it over an IES or VPRN service.

Default

1500

Parameters

bytes

the number of characters (in bytes) to trigger sending an IP transport packet

Values 1 to 1500

special-char

Syntax

special-char *value*

no special-char

Context

config>port>serial>rs232>socket>rx>eop

Description

This command specifies a special character that, if received on the serial port, declares an EOP and triggers the node to encapsulate previously received queued characters in an IP transport packet and send it over an IES or VPRN service.

Note: Other than declaring the EOP, the special character is otherwise treated as regular data; that is, it is added to the packet.

The **no** form of the command disables checking for a special character.

Default

no special-char

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Parameters

value

specifies the special character, in a decimal or hexadecimal format, that triggers end of packet

Values 0 to 255, or 0x00 to 0xFF

squelch-delay

Syntax

squelch-delay *seconds*

no squelch-delay

Context

config>port>serial>rs232>socket>rx

Description

This command specifies how long a serial port can receive a continuous data stream before an alarm is raised indicating that the serial port has locked up and triggering the squelching function.

The **no** form of the command disables the squelching function on the serial port.

Default

no squelch-delay

Parameters

seconds

the number of seconds that a serial port can receive data before the squelching function is triggered

Values 1 to 120

squelch-reset

Syntax

squelch-reset

Context

config>port>serial>rs232>socket>rx

Description

This command allows an operator to manually clear squelching on a serial port’s raw socket without having to configure a time limit on the squelching function.

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Squelching can also be set to clear automatically after a time limit has been reached with the unsquelch-delay command.

Default

n/a

unsquelch-delay

Syntax

unsquelch-delay *seconds*

no unsquelch-delay

Context

config>port>serial>rs232>socket>rx

Description

This command clears squelching on a raw socket by setting a limit on the amount of time that squelching can remain active on the port. When the time limit is reached, the auto-clear function is enabled and the serial port's raw socket is put back into a normal state.

Squelching can also be cleared manually with the squelch-reset command.

The **no** form of the command disables the auto-clear function on a serial port.

Default

no unsquelch-delay

Parameters

seconds

the number of seconds before the auto-clear function is activated

Values 1 to 120

tx

Syntax

tx

Context

config>port>serial>rs232>socket

Description

This command enables the context to configure parameters for data packets transmitted over a serial port's raw socket.

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inter-session-delay

Syntax

inter-session-delay *milliseconds*

Context

config>port>serial>rs232>socket>tx

Description

This command specifies a time delay that the node inserts between a session’s data that is being transmitted over a serial port and the next queued session’s data. The next session's data is not sent until the current session's data is sent and the **inter-session-delay** is reached.

Default

10 ms

Parameters

milliseconds

the time delay, in milliseconds, between a session’s data that is being transmitted over a serial port and the next queued session’s data

Values 0 to 5000

speed

Syntax

speed {**600** | **1200** | **2400** | **4800** | **8000** | **9600** | | **14400** | **16000** | **19200** | **24000** | **32000** | **38400** | **56000** | **57600** | **64k** | **115200**}

Context

config>port>serial>rs232

Description

This command configures the speed of the interface. The speed also determines the DS0 timeslots assigned to the channel group.

RS-232 interfaces that are functioning as raw sockets support speeds up to 115 200 b/s but do not support 56 000 b/s.

RS-232 interfaces that are not functioning as raw sockets support speeds up to 56 000 b/s.

Speeds of 56 000 b/s and greater are only supported if the device-mode is synchronous (with the exception of raw sockets).

The following speeds are supported only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3; **8000**, **14400**, **16000**, **24000**, **32000**, and **64k**.

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Default

9600

Parameters

600

sets the link speed to 600 b/s

1200

sets the link speed to 1200 b/s

2400

sets the link speed to 2400 b/s

4800

sets the link speed to 4800 b/s

8000

sets the link speed to 8000 b/s (only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3)

9600

sets the link speed to 9600 b/s

14400

sets the link speed to 14 400 b/s (only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3)

16000

sets the link speed to 16 000 b/s (only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3)

19200

sets the link speed to 19 200 b/s

24000

sets the link speed to 24 000 b/s (only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3)

32000

sets the link speed to 32 000 b/s (only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3)

38400

sets the link speed to 38 400 b/s

56000

sets the link speed to 56 000 b/s (not supported on RS-232 raw sockets)

57600

sets the link speed to 57 600 b/s (supported on RS-232 raw sockets only)

64k

sets the link speed to 64 kb/s (only on RS-232 interfaces on the 12-port Serial Data Interface card, version 3)

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115200

sets the link speed to 115 200 b/s (supported on RS-232 raw sockets only)

speed

Syntax

speed {**600** | **1200** | **2400** | **4800** | **8000** | **9600** | **14400** | **16000** | **19200** | **32000** | **38400** | **56000** | **64k** | **128k** | | **192k** | **256k** | **288k** | **336k** | **384k** | **512k** | **640k** | **704k** | **768k** | **896k** | **1024k** | **1152k** | **1280k** | **1344k** | **1408k** | **1536k** | **1664k** | **1792k** |**1920k** | **2048k** | **3072k** | **4096k** | **5120k** | **6144k** | **7168k** | **8192k** | **9216k** | **10240k** | **11264k** | **12288k** | **13312k** | **14336k** | **15360k** | **16384k**}

Context

config>port>serial>rs530

Description

This command configures the speed of the interface. The speed also determines the DS0 timeslots assigned to the channel group.

Speeds of 56 000 b/s and greater are only supported if the device-mode is synchronous.

Default

64k

Parameters

600

sets the link speed to 600 b/s

1200

sets the link speed to 1200 b/s

2400

sets the link speed to 2400 b/s

4800

sets the link speed to 4800 b/s

8000

sets the link speed to 8000 b/s

9600

sets the link speed to 9600 b/s

14400

sets the link speed to 14 400 b/s

16000

sets the link speed to 16 000 b/s

19200

sets the link speed to 19 200 b/s

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32000
sets the link speed to 32 000 b/s

38400
sets the link speed to 38 400 b/s

56000
sets the link speed to 56 000 b/s

64k
sets the link speed to 64 kb/s

128k
sets the link speed to 128 kb/s

192k
sets the link speed to 192 kb/s

256k
sets the link speed to 256 kb/s

288k
sets the link speed to 288 kb/s

336k
sets the link speed to 336 kb/s

384k
sets the link speed to 384 kb/s

512k
sets the link speed to 512 kb/s

640k
sets the link speed to 640 kb/s

704k
sets the link speed to 704 kb/s

768k
sets the link speed to 768 kb/s

896k
sets the link speed to 896 kb/s

1024k
sets the link speed to 1024 kb/s

1152k
sets the link speed to 1152 kb/s

1280k
sets the link speed to 1280 kb/s

1344k
sets the link speed to 1344 kb/s

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1408k
sets the link speed to 1408 kb/s

1536k
sets the link speed to 1536 kb/s

1664k
sets the link speed to 1664 kb/s

1792k
sets the link speed to 1792 kb/s

1920k
sets the link speed to 1920 kb/s

2048k
sets the link speed to 2048 kb/s

3072k
sets the link speed to 3072 kb/s

4096k
sets the link speed to 4096 kb/s

5120k
sets the link speed to 5120 kb/s

6144k
sets the link speed to 6144 kb/s

7168k
sets the link speed to 7168 kb/s

8192k
sets the link speed to 8192 kb/s

9216k
sets the link speed to 9216 kb/s

10240k
sets the link speed to 10 240 kb/s

11264k
sets the link speed to 11 264 kb/s

12288k
sets the link speed to 12 288 kb/s

13312k
sets the link speed to 13 312 kb/s

14336k
sets the link speed to 14 336 kb/s

15360k
sets the link speed to 15 360 kb/s

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16384k

sets the link speed to 16 384 kb/s

speed

Syntax

speed {**56k** | **64k** | **128k** | **192k** | **256k** | **384k** | **512k** | **640k** | **768k** | **896k** | **1024k** | **1152k** | **1280k** | **1334k** | **1408k** | **1536k** | **1664k** | **1792k** |**1920k** | **2048k** | **4096k** | **5120k** | **7168k**}

Context

config>port>serial>v35

Description

This command configures the speed of the interface. The speed also determines the DS0 timeslots assigned to the channel group.

The following speeds are supported only on V.35 interfaces on the 12-port Serial Data Interface card, version 3; **56k, 192k**, **1334k**, **2048k**, **4096k**, **5120k**, and **7168k**.

Default

64k

Parameters

56k

sets the link speed to 56 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

64k

sets the link speed to 64 kb/s

128k

sets the link speed to 128 kb/s

192k

sets the link speed to 192 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

256k

sets the link speed to 256 kb/s

384k

sets the link speed to 384 kb/s

512k

sets the link speed to 512 kb/s

640k

sets the link speed to 640 kb/s

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768k

sets the link speed to 768 kb/s

896k

sets the link speed to 896 kb/s

1024k

sets the link speed to 1024 kb/s

1152k

sets the link speed to 1152 kb/s

1280k

sets the link speed to 1280 kb/s

1334k

sets the link speed to 1334 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

1408k

sets the link speed to 1408 kb/s

1536k

sets the link speed to 1536 kb/s

1664k

sets the link speed to 1664 kb/s

1792k

sets the link speed to 1792 kb/s

1920k

sets the link speed to 1920 kb/s

2048

sets the link speed to 2048 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

4096k

sets the link speed to 4096 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

5120k

sets the link speed to 5120 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

7168k

sets the link speed to 7168 kb/s (only on V.35 interfaces on the 12-port Serial Data Interface card, version 3)

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speed

Syntax

speed {**1200** | **2400** | **4800** | **9600** | **19200** | **38400** | **56000** | **64k** | **128k** | **256k** | **384k** | **512k** | **640k** | **768k** | **896k** | **1024k** | **1152k** | **1280k** | **1408k** | **1536k** | **1664k** | **1792k** |**1920k** | **2048k**}

Context

config>port>serial>x21

Description

This command configures the speed of the interface. The speed also determines the DS0 timeslots assigned to the channel group.

Speeds of 56 000 b/s and greater are only supported if the device-mode is synchronous.

The 2048 kb/s value is supported only on X.21 interfaces on the 12-port Serial Data Interface card, version 3.

Default

64k

Parameters

1200

sets the link speed to 1200 b/s

2400

sets the link speed to 2400 b/s

4800

sets the link speed to 4800 b/s

9600

sets the link speed to 9600 b/s

19200

sets the link speed to 19 200 b/s

38400

sets the link speed to 38 400 b/s

56000

sets the link speed to 56 000 b/s

64k

sets the link speed to 64 kb/s

128k

sets the link speed to 128 kb/s

256k

sets the link speed to 256 kb/s

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384k
sets the link speed to 384 kb/s

512k
sets the link speed to 512 kb/s

640k
sets the link speed to 640 kb/s

768k
sets the link speed to 768 kb/s

896k
sets the link speed to 896 kb/s

1024k
sets the link speed to 1024 kb/s

1152k
sets the link speed to 1152 kb/s

1280k
sets the link speed to 1280 kb/s

1408k
sets the link speed to 1408 kb/s

1536k
sets the link speed to 1536 kb/s

1664k
sets the link speed to 1664 kb/s

1792k
sets the link speed to 1792 kb/s

1920k
sets the link speed to 1920 kb/s

2048k
sets the link speed to 2048 kb/s (only supported on X.21 interfaces on the 12-port Serial Data Interface card, version 3)

stop-bits

Syntax

stop-bits {**1** | **2**}

Context

config>port>serial>rs232

config>port>serial>rs530

config>port>serial>x21

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Description

This command configures the number of stop bits used to signify the end of a character.

This command is valid only if the device-mode is asynchronous.

This command cannot have a value of 2 if the character-length value is 8 and the parity value is anything other than no parity (that is, anything other than none).

Default

1

Parameters

1

specifies one stop bit in a character

2

specifies two stop bits in a character

3.14.2.17 RS-232, RS-530, V.35, and X.21 channel group commands

channel-group

Syntax

[**no**] **channel-group** *channel-group-id*

Context

config>port>serial>rs232>channel-group

config>port>serial>rs530>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command creates a DS0 channel group on a channelized RS-232, RS-530, V.35, or X.21 circuit.

RS-530 channel groups are only supported on the 12-port Serial Data Interface card, version 3.

Note: When a socket is configured using the socket command, the RS-232 **channel-group** command is blocked.

Channel groups cannot be further subdivided.

The **no** form of this command deletes the specified channel group.

Default

n/a

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Parameters

channel-group-id

specifies the channel group ID number

Values RS-232: 1
RS-530: 1
V.35: 1
X.21: 1

crc

Syntax

crc {**16** | **32**}

Context

config>port>serial>rs232>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command configures the precision of the cyclic redundancy check. The command is valid only if the **encap-type** is **frame-relay** or **ipcp**.

Default

16

Parameters

16

a 16-bit checksum is used for the channel group

32

a 32-bit checksum is used for the channel group

encap-type

Syntax

encap-type {**cem** | **ipcp** | **frame-relay** | **hdlc** | **cisco-hdlc**}

no encap-type

Context

config>port>serial>rs232>channel-group

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config>port>serial>rs530>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command configures the encapsulation method used for the channel group.

When **encap-type** is specified, the channel group must be deleted before **encap-type** can be changed.

The **frame-relay**, **ipcp**, **hdlc**, and **cisco-hdlc** encapsulation types are not supported on RS-232 or RS-530 interfaces or on ports with subrate speeds (below 64 kb/s). For RS-232 and RS-530 interfaces, only **cem** is supported.

The **no** form of this command restores the default value.

Default

no encap-type

Parameters

cem

specifies the encapsulation type as circuit emulation mode

frame-relay

specifies the encapsulation type as frame relay mode

ipcp

specifies the encapsulation type as ipcp mode for a PPP channel group in access mode

hdlc

specifies the encapsulation type as hdlc mode

cisco-hdlc

specifies the encapsulation type as cisco-hdlc mode

idle-cycle-flag

Syntax

idle-cycle-flag {**flags** | **ones**}

no idle-cycle-flag

Context

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command defines the value to be transmitted by the channel group during its idle cycle. The command is valid only if the **encap-type** is **frame-relay** or **ipcp**.

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Default

flags

Parameters

flags

defines the 8-bit value to be transmitted as 01111110

ones

defines the 8-bit value to be transmitted as 11111111

idle-payload-fill

Syntax

idle-payload-fill {**all-ones** | **pattern**}

no idle-payload-fill

Context

config>port>serial>rs232>channel-group

config>port>serial>rs530>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command defines the data pattern to be transmitted when the circuit emulation service is not operational or temporarily experiences underrun conditions.

This command is valid only if **encap-type** is cem.

The **no** form of this command restores the default value.

Default

all-ones

Parameters

all-ones

defines the 8-bit value to be transmitted as 11111111

pattern

defines the 8-bit value to be transmitted as accepted in decimal, hex or binary format, from 0 to 255

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mode

Syntax

mode {**access** | **network**}

Context

config>port>serial>rs232>channel-group

config>port>serial>rs530>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command configures a channel group for access mode or network operation. Only access mode is supported on serial channels; if the user selects the network option, the CLI returns an error message.

An access port or channel is used for customer-facing traffic on which services are configured. SAPs can only be configured on an access port or channel. When a serial port is configured for access mode, multiple services can be configured on the port.

Default

access

Parameters

access

configures the serial channel as service access

network

configures the serial channel for transport network use

mtu

Syntax

mtu {*mtu-bytes*}

no mtu

Context

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command defines the maximum MTU size that the channel group can support. The command is valid only if the **encap-type** is **frame-relay** or **ipcp**.

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Default

1514 for frame relay

1502 for ipcp

Parameters

mtu-bytes

578 to 2090

ppp

Syntax

[**no**] **ppp**

Context

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command enables access to the context to configure the LCP operational parameters for a V.35 or X.21 channel group. This command is available only if the **encap-type** is set to **ipcp** and therefore does not apply to RS-232 ports or to X.21 ports configured for subrate speeds.

The **no** form of the command removes the LCP operational parameters.

Default

no ppp

keepalive

Syntax

keepalive *time-interval* [**dropcount** *drop-count*]

no keepalive

Context

config>port>serial>v35>channel-group>ppp

config>port>serial>x21>channel-group>ppp

Description

This command enables the sending of keepalive messages and configures the time between messages and how many messages can be missed before the link is brought down. The **no** form of this command disables the sending of keepalive messages.

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Default

keepalive 10 dropcount 3

Parameters

time-interval

the time, in seconds, between keepalive messages

Values 1 to 60

drop-count

the number of consecutive failed keepalive request attempts or remote replies that can be missed before the link is operationally brought down

Values 1 to 255

3.14.2.18 SONET/SDH port commands

sonet-sdh

Syntax

sonet-sdh

Context

config>port

Description

This command enables access to the context to configure SONET/SDH ports. This context can only be used when configuring an OC3/OC12 or STM1/STM4 port on an appropriate adapter card.

SONET/SDH ports can be configured on the following adapter cards:

- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 4-port OC3/STM1 Clear Channel Adapter Card
- 2-port OC3/STM1 Channelized Adapter card

clock-source

Syntax

clock-source {**loop-timed** | **node-timed**}

Context

config>port>sonet-sdh

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Description

This command configures the clock for transmitted data from either the internal clock or from a clock recovered from the line's receive data stream.

Default

node-timed

Parameters

loop-timed

the link recovers the clock from the received data stream. The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card does not support loop timing.

node-timed

the link uses the internal clock when transmitting data

framing

Syntax

framing {**sonet** | **sdh**}

Context

config>port>sonet-sdh

Description

This command specifies the SONET/SDH framing to be either SONET or SDH.

Changing the framing mode on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card causes the adapter card to reset.

Default

sonet

Parameters

sonet

configures the port for SONET framing

sdh

configures the port for SDH framing

group

Syntax

group *sonet-sdh-index* **payload** {**tu3** | **vt2** | **vt15**}

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Context

config>port>sonet-sdh

Description

This command configures the SONET/SDH group payload on a 2-port OC3/STM1 Channelized Adapter card or a 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.

Default

n/a

Parameters

sonet-sdh-index

specifies the group index for the port on the 2-port OC3/STM1 Channelized Adapter card or 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card configured for OC3. When configured for OC12, the *sonet-sdh-index* specifies the **tug3**-*index*, where *index* is from 1 to 3.

tu3

specifies the tributary unit group (TUG3) on a path and configures the port or channel for transport network use (supported only on the 2-port OC3/STM1 Channelized Adapter card)

vt2

configures the path as a VT2 type virtual tributary group

vt15

configures the path as a VT1.5 type virtual tributary group

hold-time

Syntax

hold-time {[**up** *hold-time-up*] [*down hold-time-down*]}

no hold-time

Context

config>port>sonet-sdh

Description

This command configures SONET link dampening timers in 100s of milliseconds, to guard against reporting excessive interface transitions. Once implemented, subsequent transitions of the interface from one state to another are not advertised to upper layer protocols until the configured timer has expired.

Default

no hold-time

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Parameters

hold-time-up

the hold-timer for link up event dampening. A value of zero (0) indicates that an up transition is reported immediately.

Values 0 to 100 (in 100 ms)

hold-time-down

the hold-timer for link down event dampening. A value of zero (0) indicates that a down transition is reported immediately.

Values 0 to 100 (in 100 ms)

loopback

Syntax

loopback {**line** | **internal**}

no loopback

Context

config>port>sonet-sdh

Description

This command activates a loopback on the SONET/SDH port. The SONET port must be in a shutdown state to activate any type of loopback. The loopback setting is never saved to the generated/saved configuration file.

Note: Loopback mode changes on a SONET/SDH port may affect traffic on the remaining ports.

Default

no loopback

Parameters

line

sets the port into a line loopback state. A line loopback loops frames received on the corresponding port back toward the transmit (egress) direction. Line loopbacks are supported on ports configured in network mode.

internal

sets the port into an internal loopback state. An internal loopback loops the frames that are coming in an egress direction from the fabric toward the framer, back to the fabric. This type of loopback is usually referred to as an equipment loopback. Internal loopbacks are supported on ports configured in access mode.

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report-alarm

Syntax

[**no**] **report-alarm** [**loc**] [**lais**] [**lrdi**] [**ss1f**] [**lb2er-sd**] [**lb2er-sf**] [**slof**] [**slos**] [**lrei**]

Context

config>port>sonet-sdh

Description

This command enables logging of SONET/SDH line and section alarms for a SONET/SDH port. When configured, logging is enabled for the raising and clearing of the specified alarms.

The **no** form of this command disables logging of the specified alarms.

Parameters

loc

reports a loss of clock that causes the operational state of the port to be shut down

Default loss of clock alarms are issued

lais

reports line alarm indication signal errors

Default line alarm indication signal alarms are not issued

lrdi

reports line remote defect indication errors. Line remote defect indication errors are caused by remote loss of frame (LOF), loss of clock (LOC), and loss of signal (LOS) conditions.

Default line remote defect indication alarms are issued

ss1f

reports section synchronization failure, which is detected when the S1 byte is not consistent for eight consecutive frames. When configured, ss1f alarms are raised and cleared. Although this option is shown on the CLI, it is not available for use on the 7705 SAR.

Default section synchronization failure alarms are not issued

lb2er-sd

reports line signal degradation BER (bit interleaved parity) errors

Default line signal degradation BER alarms are not issued

lb2er-sf

reports line signal failure BER errors

Default line signal failure BER alarms are issued

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slof

reports section loss of frame errors

Default section loss of frame alarms are issued

slos

reports a section loss of signal error on the transmit side

Default section loss of signal alarms are issued

lrei

reports a line error condition raised by the remote end as a result of b1 errors received from this node. When configured, line error alarms are raised but not cleared.

Default line error alarms are not issued

section-trace

Syntax

section-trace {**increment-z0** | **byte** *value* | **string** *string*}

Context

config>port>sonet-sdh

Description

This command configures the section trace bytes in the SONET section header to interoperate with some older versions of ADMs or regenerators that require an incremental STM ID. You can explicitly configure an incremental STM value instead of a static one in the SDH overhead by specifying an **increment-z0** value.

The **increment-z0** parameter is not supported on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.

Default

byte 0x1

Parameters

increment-z0

configures an incremental STM ID instead of a static value

value

sets values in SONET header bytes

Values 0 to 255 or 0x00 to 0xFF

Default 0x1

string

specifies a text string that identifies the section

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Values a string up to 16 bytes

speed

Syntax

speed {**oc3** | **oc12**}

Context

config>port>sonet-sdh

Description

This command configures the speed of a SONET/SDH port.

Although the **oc3** option is shown in the CLI, it is not configurable. And, although the **oc12** option is shown in the CLI, it is not available for use on the 7705 SAR. Users can change between **oc3** and **oc12** on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card by using the **mda-mode** keyword in the **config>card>mda** context and selecting either the **p4-oc3** or **p1-oc12** option. The adapter card automatically reboots to make the change.

The **no** form of this command reverts to the default value.

Default

oc3

Parameters

oc3

sets the speed of the port to OC3

oc12

sets the speed of the port to OC12 (not available on the 7705 SAR)

threshold

Syntax

threshold {**ber-sd** | **ber-sf**} **rate** *threshold-rate*

no threshold {**ber-sd** | **ber-sf**}

Context

config>port>sonet-sdh

Description

This command configures the line signal (b2) degradation bit error rate (BER) and line signal failure thresholds.

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Alarms are raised if the line signal bit interleaved parity error rates exceed either the degradation or failure thresholds. If the failure threshold is crossed, the link will be set to operationally down.

The **no** form of this command reverts to the default value.

Default

threshold ber-sd 6 - signal degrade BER threshold of 10^{-6}

threshold ber-sf 3 - signal failure BER threshold of 10^{-3}

Parameters

ber-sd

specifies the BER for signal degradation

ber-sf

specifies the BER for signal failure

threshold-rate

specifies the BER negative exponent (n in 10^{-n}), expressed as a decimal integer

Values 3 to 9 (10^{-3} to 10^{-9})

tx-dus

Syntax

[**no**] **tx-dus**

Context

config>port>sonet-sdh

Description

This command allows the Quality Level (QL) value transmitted from the Synchronization Status Messaging (SSM) channel of a SONET/SDH port to be set to QL-DUS/QL-DNU (do not use for synchronization for timing purposes).

Default

no tx-dus

3.14.2.19 SONET/SDH path commands

path

Syntax

[**no**] **path** [*sonet-sdh-index*]

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Context

config>port>sonet-sdh

Description

This command defines the SONET/SDH path.

The **no** form of this command removes the specified SONET/SDH path.

Default

no index is specified

Parameters

sonet-sdh-index

specifies the components making up the SONET/SDH path. Depending on the SONET/SDH adapter card and the type of SONET/SDH port, the *sonet-sdh-index* must specify one or more path indexes to identify the payload location of the path. The CLI uses the same *sonet-sdh-index* syntax nomenclature to configure SONET and SDH paths.

In addition, the support of virtual tributary circuits adds another level of complexity and several levels of indexes, which means that one or more **path** commands may be needed to set up the container in the path.

On the 4-port OC3/STM1 Clear Channel Adapter card, *sonet-sdh-index* is optional; if used, the value must be sts3.

Values sts12, sts3, sts1, tu3, vt2, vt15 *sonet-sdh-index*

See SONET/SDH channelized port ID, Configuring SONET/SDH port parameters and SONET/SDH channelized port configuration examples for more information and examples.

crc

Syntax

crc {**16** | **32**}

Context

config>port>sonet-sdh>path

Description

This command specifies a cyclic redundancy check on a SONET/SDH path on a SONET/SDH port.

Default

32 (if the **encap-type** is set to **atm**; this default cannot be changed)

16 (if the **encap-type** is set to **ppp-auto**; port is configured for POS)

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Parameters

16

specifies that a 16-bit checksum be used for the associated port/channel

32

specifies that a 32-bit checksum be used for the associated port/channel

encap-type

Syntax

encap-type {**atm** | **ppp-auto**}

Context

config>port>sonet-sdh>path

Description

This command configures the encapsulation method used to distinguish customer traffic on a SONET/SDH path on a SONET/SDH port.

The **encap-type** of **atm** is used for access mode (4-port OC3/STM1 Clear Channel Adapter card and 2-port OC3/STM1 Channelized Adapter card), and the **encap-type** of **ppp-auto** is used for network mode (4-port OC3/STM1 / 1-port OC12/STM4 Adapter card).

When **encap-type** is **atm**, the crc default of 32 cannot be changed.

When **encap-type** is **atm**, ATM sublayer verification specified in GR-1248-CORE, *Generic Requirements for Operations of ATM Network Element*s, is automatically enabled. The result of the verification includes:

- Out of Cell Delineation (OCD) event count – the OCD event count is described in RFC 2515, *Definitions of Managed Objects for ATM Management*. Multiple events occurring within 1 s will be counted as one event for ATM and ASAP adapter cards as a result of a hardware limit.
- Loss of Cell Delineation (LCD) defect/alarm – the LCD defect/alarm is defined in RFC 2515, *Definitions of Managed Objects for ATM Management*. When a path is in an LCD defect state, the path's operational status is down. When a path exits the LCD state, the path's operational status will change to up (assuming nothing else causes the path to stay down). A trap is raised to indicate the LCD status change, and a Path Remote Defect Indicator (PRDI) is sent to indicate the defect to the remote end.

To change the **encap-type**, the path must first be removed and then recreated with the new **encap-type**. For example, to change the **encap-type**from **atm** to **ppp-auto**:

CLI syntax:

```
config>port>sonet-sdh>path# back
config>port>sonet-sdh# no path
config>port>sonet-sdh# path
config>port>sonet-sdh>path# mode network
config>port>sonet-sdh>path# encap-type ppp-auto
config>port>sonet-sdh>path#
```

Default

no encap-type

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Parameters

atm

specifies that the encapsulation on the port is ATM

ppp-auto

enables PPP on the associated port or channel. The activation of IPCP and MPLSCP is automatic depending on the protocol configuration.

mode

Syntax

mode {**access** | **network**}

Context

config>port>sonet-sdh>path

Description

This command configures the mode of operation for a SONET/SDH port or channel on a 4-port OC3/STM1 Clear Channel Adapter card or 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.

An access port or channel is used for customer-facing traffic on which services are configured. A SAP can only be configured on an access port or channel. When a port or channel on the 4-port OC3/STM1 Clear Channel Adapter card is configured for access mode, the **encap-type** must be set to **atm**. The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card does not support ATM when configured for access mode.

A network port or channel configured for Packet over SONET (POS) is used as an uplink to connect to the packet network and transport the configured services. When a port or channel is configured for network mode, the **encap-type** must be set to **ppp-auto**.

To change the mode, the path must first be removed and then recreated with the new mode. For example, to change the **mode** from **access** to **network**:

CLI syntax:

```
config>port>sonet-sdh>path# back
config>port>sonet-sdh# no path
config>port>sonet-sdh# path
config>port>sonet-sdh>path# mode network
config>port>sonet-sdh>path#
```

Default

access

Parameters

access

configures the port or channel for access mode

network

configures the port or channel for network mode

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mtu

Syntax

mtu *mtu*

no mtu

Context

config>port>sonet-sdh>path

Description

This command configures the maximum payload MTU size for a SONET/SDH port on a 4-port OC3/STM1 Clear Channel Adapter card. When **encap-type** is **atm**, the path MTU value cannot be changed. See the 7705 SAR Services Guide, "Global Service Command Reference", for information about configuring the path MTU.

The **no** form of this command restores the default value.

Default

1524 (for access mode)

1572 (for network mode)

Parameters

mtu

sets the maximum allowable size of the MTU, expressed as an integer

Values 578 to 2090 (in bytes)

payload

Syntax

payload {**sts12** | **sts3** | **tug3** | **ds3** | **e3** | **vt2** | **vt15** | **ds1** | **e1**}

Context

config>port>sonet-sdh>path

Description

This command configures the SONET/SDH path on a channelized adapter card (2-port OC3/STM1 Channelized Adapter card or 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card) as an asynchronous circuit or a virtual tributary group.

Default

n/a

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Parameters

sts12

configures the STS12/STM4 (OC12/OC3) payload as clear channel

sts3

configures the STS3/STM1 payload as clear channel

tug3

configures the STS3/STM1 payload as tributary unit group 3 (TUG3)

ds3

configures the port or channel as D3 STS1/VC3

e3

configures the VC3 payload as E3

vt2

configures the STS1 payload as virtual tributary group 2

vt15

configures the path as virtual tributary group 1.5

ds1

configures the port or channel VT1.5 or VT2 payload as DS1

e1

configures the VT2 payload as E1

ppp

Syntax

ppp

Context

config>port>sonet-sdh>path

Description

This command enables access to the context to configure the link control protocol (LCP) operational parameters for a Packet over SONET (POS) Point-to-Point Protocol (PPP) link on a 4-port OC3/STM1 Clear Channel Adapter card.

Default

n/a

keepalive

Syntax

keepalive *time-interval* [**dropcount** *drop-count*]

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no keepalive

Context

config>port>sonet-sdh>path>ppp

Description

This command enables the sending of keepalive echo messages on a 4-port OC3/STM1 Clear Channel Adapter card and configures the time between messages and how many reports can be missed before the link is brought down.

The **no** form of this command disables the sending of echo requests.

Default

keepalive 10 dropcount 3

Parameters

time-interval

the time interval, in seconds, that echo requests are issued

Values 1 to 60

Default 10

drop-count

the number of keepalive messages that can be missed before the link is brought down

Values 1 to 255

Default 3

report-alarm

Syntax

[**no**] **report-alarm** [**pais**] [**plop**] [**prdi**] [**pplm**] [**prei**] [**puneq**] [**plcd**]

Context

config>port>sonet-sdh>path

Description

This command enables logging of SONET/SDH path alarms for a SONET/SDH port.

The **no** form of this command disables logging of the specified alarms.

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Parameters

pais

reports path alarm indication signal errors. When configured, path alarm indication signal alarms are raised and cleared.

Default path alarm indication signal alarms are not issued

plop

reports path loss of pointer errors, per tributary. When configured, path loss of pointer alarms are raised but not cleared.

Default path loss of pointer alarms are issued

prdi

reports path remote defect indication errors. When configured, path remote defect indication alarms are raised and cleared.

Default path remote defect indication alarms are not issued

pplm

reports a path payload mismatch, which places the channel operationally down. When configured, path payload mismatch alarms are raised but not cleared.

Default path payload mismatch alarms are issued

prei

reports a path error condition raised by the remote end as a result of b3 errors received from this node. When configured, path error alarms are raised but not cleared. (This parameter is not supported on the 4-port OC3/STM1 card.)

Default path error alarms are not issued

puneq

reports path unequipped errors

Default path unequipped alarms are issued

plcd

reports path loss of code group delineation errors. It is applicable only when the value of **xgig** is set to WAN. Although this option is shown on the CLI, it is not available for use on the 7705 SAR.

Default path loss of code traps are not issued

scramble

Syntax

[**no**] **scramble**

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Context

config>port>sonet-sdh>path

Description

This command enables SONET/SDH payload scrambling on a 4-port OC3/STM1 Clear Channel Adapter card.

Scrambling randomizes the pattern of 1s and 0s carried in a SONET frame. Scrambling, or rearranging, the pattern prevents continuous strings of all 1s or all 0s and meets the needs of physical layer protocols that rely on sufficient transitions between 1s and 0s to maintain clocking.

For ATM, this command enables or disables ATM cell-level payload scrambling or descrambling using the x43+1 polynomial as defined in ITU-T I.432.1. Scrambling is enabled by default for the ATM path or channel. This scrambling is done in addition to SONET/SDH frame scrambling or descrambling, which is always enabled in the framer.

The **no** form of this command disables scrambling.

Default

scramble

signal-label

Syntax

signal-label *value*

no signal-label

Context

config>port>sonet-sdh>path

Description

This command sets the C2 byte value. The purpose of this byte is to communicate the payload type being encapsulated by SONET framing.

Default

0xcf

Parameters

value

specifies the C2 byte value, expressed as a decimal integer or a hexadecimal value

Values 1 to 254 or 0x01 to 0xfe

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trace-string

Syntax

trace-string [*trace-string*]

no trace-string

Context

config>port>sonet-sdh>path

Description

This command specifies the path trace identifier for the circuit that is continuously inserted at source. This identifier corresponds to J1 or J2 in the SONET/SDH overhead, depending on the associated path. The specified trace string can be checked against the expected value by the receiver. If no trace string is entered, a null string is used.

The **no** form of this command resets the string to its default.

Default

The default path trace value is ALU 7705 SAR. The value does not change when the **encap-type** changes. The path trace string contains all zeros for a non-provisioned path.

Parameters

trace-string

specifies an alphanumeric string value. If the string contains spaces, enclose it in quotation marks.

Values 1 to 62 bytes for SONET or 1 to 15 bytes for SDH

3.14.2.20 Network port commands

network

Syntax

network

Context

config>port>ethernet

config>port>sonet-sdh>path

config>port>tdm>ds1>channel-group

config>port>tdm>ds3

config>port>tdm>e1>channel-group

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config>port>tdm>e3

Description

This command enables access to the context to configure network port parameters.

Default

n/a

accounting-policy

Syntax

accounting-policy *policy-id*

no accounting-policy

Context

config>port>ethernet>network

config>port>sonet-sdh>path>network

config>port>tdm>ds1>channel-group>network

config>port>tdm>ds3>network

config>port>tdm>e1>channel-group>network

config>port>tdm>e3>network

Description

This command configures an accounting policy that can apply to an interface.

An accounting policy must be configured before it can be associated to an interface. If the accounting *policy-id* does not exist, an error is returned.

Accounting policies associated with service billing can only be applied to SAPs. Accounting policies associated with network ports can only be associated with interfaces. Only one accounting policy can be associated with an interface at a time.

No accounting policies are specified by default. You must explicitly specify a policy. If configured, the accounting policy configured as the default under the **config>log>accounting-policy>default** command is used.

The **no** form of this command removes the accounting policy association from the network interface, and the accounting policy reverts to the default.

Default

n/a

Parameters

policy-id

specifies the accounting *policy-id* of an existing policy. Accounting policies record either service (access) or network information. A network accounting policy can only be

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associated with the network port configurations. Accounting policies are configured in the **config>log>accounting-policy** context.

Values 1 to 99

collect-stats

Syntax

[**no**] **collect-stats**

Context

config>port>ethernet>network

config>port>sonet-sdh>path>network

config>port>tdm>ds1>channel-group>network

config>port>tdm>ds3>network

config>port>tdm>e1>channel-group>network

config>port>tdm>e3>network

Description

This command enables the collection of accounting and statistical data for the network interface. When applying accounting policies, the data, by default, is collected in the appropriate records and written to the designated billing file.

When the **no collect-stats** command is issued, the statistics are still accumulated by the adapter cards. However, the CPU does not obtain the results and write them to the billing file. If the **collect-stats** command is issued again (enabled), then the counters written to the billing file will include the traffic collected while the **no collect-stats** command was in effect.

Default

no collect-stats

egress

Syntax

egress

Context

config>port>ethernet>network

Description

This command enables access to the context to assign network egress parameters.

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Default

n/a

shaper-policy

Syntax

shaper-policy *name*

no shaper-policy

Context

config>port>ethernet>network>egress

Description

This command assigns a shaper policy to the specified port.

The shaper policy defines shaper parameters such as shaper group, and PIR and CIR rates. The shaper policy is defined in the **config>qos>shaper-policy** context. See the 7705 SAR Quality of Service Guide, "QoS for Hybrid Ports", for more information.

Note:

- The port shaper rate applies to the bulk of access and network traffic. Thus, once the configured egress shaper rate is reached, both the access and network traffic scheduling pauses.
- For hybrid ports, there can be a single shaper policy on access egress and a single shaper policy on network egress. Therefore, all the SAP traffic and all the network traffic is each bound to its own shaper group in the shaper policy (access and network shaper policy, respectively). In other words, shaped SAPs and the bulk/aggregate of unshaped SAPs are shaped together as per the shaper policy assigned to the access egress. A similar behavior applies to network traffic, where the shaped interfaces and the bulk/aggregate of unshaped interfaces are shaped together as per the shaper policy assigned to the network egress.

The **no** form of this command reverts to the default.

Default

"default"

Parameters

name

specifies an existing shaper policy name

unshaped-if-cir

Syntax

unshaped-if-cir *cir-rate*

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no unshaped-if-cir

Context

config>port>ethernet>network>egress

Description

This command sets the CIR rate for the aggregate of all the unshaped VLANs (that is, network interfaces) on the port. The default *cir-rate* is 0 kb/s. When the *cir-rate* is set to **max**, the CIR rate adopts the maximum rate of the port. The actual rate of the port is dictated by the physical port speed, which can be overwritten by the egress-rate *sub-rate* command.

If the *cir-rate* is higher than the *sub-rate*, the *cir-rate* is stored in the configuration database but the *sub-rate* limit is used.

On Gen-3 hardware, the *cir-rate* for this command can be configured and is applied but has no effect on the network port, except for network traffic in hybrid mode, where the *cir-rate* value has an effect.

The **no** form of the command sets the **unshaped-if-cir** CIR rate to 0 kb/s.

Default

no unshaped-if-cir

Parameters

cir-rate

the CIR rate for the aggregate of all the unshaped VLANs on the port

Values 0 to 10000000 kb/s, or max

Default 0 kb/s

queue-policy

Syntax

queue-policy *name*

no queue-policy

Context

config>port>ethernet>network

config>port>sonet-sdh>path>network

config>port>tdm>ds1>channel-group>network

config>port>tdm>ds3>network

config>port>tdm>e1>channel-group>network

config>port>tdm>e3>network

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Description

This command specifies the network queue policy that defines queue parameters such as CBS-priority-only burst size, MBS, CIR, and PIR rates, as well as FC-to-queue mappings. The network queue policy is defined in the **config>qos>network-queue** context. See the 7705 SAR Quality of Service Guide, "Network Queue QoS Policies", for more information.

The **no** form of this command reverts to the default.

Default

"default"

Parameters

name

specifies an existing network queue policy name

scheduler-mode

Syntax

scheduler-mode {**16-priority**}

Context

config>port>ethernet>network

Description

This command selects the network-side scheduling option for the following:

- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card
- 2-port 10GigE (Ethernet) Adapter card
- 2-port 10GigE (Ethernet) module
- 4-port SAR-H Fast Ethernet module
- 6-port SAR-M Ethernet module
- Packet Microwave Adapter card
- Ethernet ports on the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-M, and 7705 SAR-Wx

On these Ethernet adapter cards, modules, and platforms, **scheduler-mode** can only be configured to 16-priority. On the 6-port Ethernet 10Gbps Adapter card and the 7705 SAR-X, **scheduler-mode** is permanently set to support 4-priority and is not user-configurable.

Default

16-priority – 8-port Gigabit Ethernet Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card, 2-port 10GigE (Ethernet) Adapter card, 2-port 10GigE (Ethernet) module, 4-port SAR-H Fast Ethernet Module, 6-port SAR-M Ethernet module, Packet Microwave Adapter card, 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-M, and 7705 SAR-Wx Ethernet ports (cannot be changed)

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Parameters

16-priority

sets the 16-priority scheduling option for the cards, modules, and platforms listed under **Default**

3.14.2.21 Multilink bundle and IMA group commands

Note: Unless otherwise specified, references to multilink bundles refer to both multilink (MLPPP) bundles and IMA groups.

multilink-bundle

Syntax

[**no**] **multilink-bundle**

Context

config>port

Description

This command enables the context to configure bundle properties for this bundle port.

Default

n/a

fragment-threshold

Syntax

fragment-threshold *fragment-threshold*

no fragment-threshold

Context

config>port>multilink-bundle

Description

This command sets the maximum length (in bytes) of a fragment transmitted across the specified MLPPP bundle or sets the length of a Tx frame across the specified IMA group bundle in ATM cells.

The **no** form of this command resets the fragment threshold back to the default value.

Default

128

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Parameters

fragment-threshold

specifies the maximum fragment length in bytes (for MLPPP bundles) or the Tx frame size (for IMA bundles)

Values 128 to 512 bytes (MLPPP)

128 bytes (IMA)

member

Syntax

[**no**] **member** *port-id*

Context

config>port>multilink-bundle

Description

This command binds a channel group to a multilink bundle.

To bind a channel group to a multilink bundle, all the timeslots on the channel group must be allocated.

When you configure a channel group on the network side with ppp-auto encapsulation, the system automatically allocates all timeslots to the channel group. When you configure a channel group on the access side with IPCP encapsulation, the system does not automatically allocate all timeslots to the channel group. In order to use the port or channel group as a member in an multilink bundle, you must manually allocate all the timeslots to the channel group before adding it to the bundle.

The following list specifies the cards, modules, and platforms that support multilink bundles and the number of channel groups on the network and/or access side that can be bound to an MLPPP bundle:

- T1/E1 ports on the 7705 SAR-A

  Network: 8 Access: 8
- T1/E1 ports on the 7705 SAR-M

  Network: 16 Access: 8
- T1/E1 ports on the 7705 SAR-X

  Network: 8 Access: 8

  The following must have all member links of an MLPPP bundle configured on the same card or module:
  - 16-port T1/E1 ASAP Adapter card

    Network: 16 Access: 8
  - 32-port T1/E1 ASAP Adapter card

    Network: 16 Access: 8
  - T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)

    Network: 2 Access: 2

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The following must have all member links of an MLPPP bundle configured on the same card or module, and on the same port:

– 2-port OC3/STM1 Channelized Adapter card

Network: 8 Access: 8

– 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card

Network: 8 Access: 8

The following list specifies the cards, modules, and platforms that support IMA groups and the number of channel groups on the network and/or access side that can be bound to an IMA group:

- T1/E1 ports on the 7705 SAR-M

  IMA: 16

  The following must have all member links of an IMA bundle configured on the same card or module:

  – 16-port T1/E1 ASAP Adapter card

    IMA: 16

  – 32-port T1/E1 ASAP Adapter card

    IMA: 16

  The following must have all member links of an IMA bundle configured on the same card or module, and on the same port:

  – 2-port OC3/STM1 Channelized Adapter card

    IMA: 8

The **no** form of this command removes the specified channel group from the multilink bundle.

Default

n/a

Parameters

port-id

the physical port ID in the format *slot*/*mda*/*port*.*channel*

minimum-links

Syntax

minimum-links *minimum-links*

no minimum-links

Context

config>port>multilink-bundle

Description

This command sets the minimum number of links that must be active for the bundle to be active.

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If the number of active links drops below the configured minimum, the multilink bundle will transition to an operationally down state.

The following table lists the minimum link limits for the supported adapter cards, modules, and platforms.

Table 44: Minimum link limit values

Port	MLPP bundles		IMA bundles
	Access	Network	Access
T1/E1 ports on the 7705 SAR-A	1 to 8	1 to 8	—
T1/E1 ports on the 7705 SAR-M	1 to 8	1 to 16	1 to 16
T1/E1 ports on the 7705 SAR-X	1 to 8	1 to 8	—
T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module (on 7705 SAR-H)	1 to 2	1 to 2	—
DS1/E1 channels on the 2-port OC3/STM1 Channelized Adapter card	1 to 8	1 to 8	1 to 8
4-port OC3/STM1 / 1-port OC12/STM4 Adapter card	—	1 to 8	—
16-port T1/E1 ASAP Adapter card	1 to 8	1 to 16	1 to 16
32-port T1/E1 ASAP Adapter card	1 to 8	1 to 16	1 to 16

The **no** form of this command removes the minimum link limit.

Default

1

Parameters

minimum-links

the minimum link limit, expressed as an integer

Values see Table 44: Minimum link limit values

mlppp

Syntax

mlppp

Context

config>port>multilink-bundle

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Description

This command enables the context to configure MLPPP bundle attributes.

endpoint-discriminator

Syntax

endpoint-discriminator class {**ip-address** | **global-mac-address** | **null**} [**discriminator-id** *discriminator-id*]

no endpoint-discriminator

Context

config>port>multilink-bundle>mlppp

Description

This command configures the endpoint-discriminator class and ID. The port must be shut down to modify the endpoint-discriminator parameters.

If the **null** option is configured, the 7705 SAR will advertise an endpoint-discriminator class value of NULL in link membership negotiations. If the far-end node rejects the NULL object, the 7705 SAR will remove the object from future requests. The **null** option should only be used if the far-end node cannot support the **ip-address** or **global-mac-address** endpoint-discriminator class options, as these options provide more protection from incorrectly adding a link to an MLPPP bundle.

The **no** form of this command removes the configured parameters.

Parameters

class

specifies the link control protocol endpoint-discriminator class field

Default global-mac-address (for physical MLPPP bundle)

ip-address (for physical MLPPP bundle protection group)

null (when the endpoint-discriminator option is not present in a received configure request)

discriminator-id

specifies the endpoint-discriminator identifier value within the specified endpoint-discriminator class

Values any valid IP address

magic-number

Syntax

[**no**] **magic-number**

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Context

config>port>multilink-bundle>mlppp

Description

This command allows loopback detection to be enabled and disabled for MLPPP bundles. The command is disabled by default. When the magic number option is disabled, the magic number option will not be requested when a member is trying to bring up the LCP layer on a member link; if the remote peer requests this option, it will be rejected. When transmitting echo-requests, a magic number of 0 is used. When responding to echo-requests, a magic number of 0 is sent.

If the magic-number option is enabled, the option is sent to the remote peer during protocol negotiation. If this option is rejected by the remote peer, the router will bring the link up but will be unable to detect loopbacks since the router will always send a magic number of 0 in the echo messages upon rejection. If this option is accepted by the remote peer, the router will send echo messages with randomly generated (non-zero) magic numbers. If the 7705 SAR receives a config-req with the same magic number that was sent out, the router will calculate a new magic number to use and send out another config-request. If the router persistently sees the randomly generated magic number in the received config-req, the router will declare a loopback.

The **no** form of the command disables the loopback detection.

Default

no magic-number

multiclass

Syntax

multiclass *count*

no multiclass

Context

config>port>multilink-bundle>mlppp

Description

This command enables multiclass MLPPP (MC-MLPPP) as defined by RFC 2686, *The Multi-Class Extension to Multi-Link PPP.* The 7705 SAR supports MC-MLPPP bundles with 2, 3 or 4 classes. To change the number of classes, all member links must be removed and then the bundle must be shut down.

The packets transmitted on the MC-MLPPP bundle are sent with class values from 0 to one less than the configured class size. For example, a 4-class MLPPP bundle has 4 classes and transmits packets with class numbers 0, 1, 2, and 3. A 4-class bundle transmits packets with class numbers 0, 1 and 2 and a 2-class bundle transmits packets with class numbers 0 and 1. A 0-class MLPPP bundle has the highest priority.

Entries are created and deleted by the system depending on the number of classes being used by a given MLPPP bundle. The **no** form of the command disables MC-MLPPP.

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Default

no multiclass

Parameters

count

specifies the number of classes in an MLPPP bundle

Values 2 to 4

mrru

Syntax

mrru *mrru*

no mrru

Context

config>port>multilink-bundle

Description

This command specifies the maximum received reconstructed unit (MRRU), which is similar to a maximum transmission unit (MTU) but applies only to MLPPP multilink bundles. The MRRU is the maximum frame size that can be reconstructed from multilink fragments. This command is only valid for MLPPP bundles.

The **no** form of this command resets the MRRU to the default.

Default

1524

Parameters

mrru

the maximum received reconstructed unit size, expressed as an integer

Values 1500 to 2088 bytes (for MLPPP)

1500 to 2090 bytes (for PPP)

red-differential-delay

Syntax

red-differential-delay *red-diff-delay* [**down**]

no red-differential-delay

Context

config>port>multilink-bundle

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Description

This command sets the maximum acceptable differential delay for individual circuits within a multilink bundle.

The **no** form of this command restores the red-differential-delay defaults.

Default

n/a

Parameters

red-diff-delay

the maximum red differential delay value, in milliseconds

Values 0 to 25 ms for MLPPP bundles

2 to 75 ms for IMA bundles on the 16-port T1/E1 ASAP Adapter card or 32-port T1/E1 ASAP Adapter card

2 to 75 ms for IMA bundles on the 2-port OC3/STM1 Channelized Adapter card

down

transition the circuit that exceeded the differential delay to a down state (for example, remove it from the multilink bundle from an operational perspective). To transition the circuit back to the up state, the user should shutdown, then no shutdown the channel group.

short-sequence

Syntax

[**no**] **short-sequence**

Context

config>port>multilink-bundle

Description

This command specifies that the MLPPP bundle should use short (12 bit) sequence numbers instead of the default 24-bit sequence number. This command is only valid for MLPPP bundles.

The **no** form of this command disables the short-sequence feature.

Default

no short-sequence

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yellow-differential-delay

Syntax

yellow-differential-delay *yellow-diff-delay*

no yellow-differential-delay

Context

config>port>multilink-bundle

Description

This command sets the yellow warning threshold for the differential delay for members within a multilink bundle. If circuit's delay exceeds the yellow-differential delay value, a log message and SNMP trap is sent. This command is only valid for MLPPP bundles.

The **no** form of this command removes the yellow-differential-delay.

Default

n/a

Parameters

yellow-diff-delay

the maximum yellow differential delay threshold value, in milliseconds

Values 1 to 25

ima

Syntax

ima

Context

config>port>multilink-bundle

Description

This command enables the context to configure parameters for an IMA group. An IMA group is a collection of physical links bundled together and assigned to an ATM port. IMA enables a high-speed channel that is composed of ATM cells to be transported as a number of lower-speed circuits. They are then reassembled as the original high-speed ATM channel.

This command is only valid for IMA bundles.

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link-delay

Syntax

link-delay {**activate** | **deactivate**} *milliseconds*

no link-delay {**activate** | **deactivate**}

Context

config>port>multilink-bundle>ima

Description

This command specifies the time delay between detection of a link activation/deactivation condition and acting upon it (going in/out of the Rx failure state on a link).

Parameters

activate *milliseconds*

the time, in milliseconds, used to clear an existing LIF, LODS, or FRI-IMA alarm. The time specified determines how long is needed for member links to stabilize before being activated.

Values 1 to 30000 ms

Default 1000

deactivate *milliseconds*

the time, in milliseconds, used to raise an LIF, LODS, or FRI-IMA alarm. The time specified determines how long before a member link is declared in error and is deactivated.

Values 1 to 30000 ms

Default 2000

test-pattern-procedure

Syntax

test-pattern-procedure

Context

config>port>multilink-bundle>ima

Description

This command enables the context to configure IMA test pattern procedures. This command and its sub-commands are not saved in the router configuration between reboots.

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test-link

Syntax

test-link *port-id*

no test-link

Context

config>port>multilink-bundle>ima>test-pattern-procedure

Description

This command specifies IMA members on which an IMA test pattern procedure is to be performed.

The **no** form of this command deletes the link from the test-pattern procedure. The test-pattern procedure must be shut down first.

Default

no test-link

Parameters

port-id

the port ID to be used to verify link connectivity within an IMA group

test-pattern

Syntax

test-pattern *pattern*

no test-pattern

Context

config>port>multilink-bundle>ima>test-pattern-procedure

Description

This command specifies the transmit test pattern in an IMA group loopback operation. This value can only be changed when the test-pattern-procedure command is shut down.

The **no** form of this command restores the test pattern to the default.

Default

0

Parameters

pattern

specifies an integer taking the following values:

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Values 0 to 255

shutdown

Syntax

[**no**] **shutdown**

Context

config>port>multilink-bundle>ima>test-pattern-procedure

Description

This command enables a configured IMA test pattern procedure.

The **no** form of this command disables the IMA test pattern procedure.

version

Syntax

version *IMA-version*

no version

Context

config>port>multilink-bundle>ima>

Description

This command configures the IMA version for the multilink bundle group. If there is a version mismatch between this IMA group and the far-end IMA group, the IMA group will go operationally down. To change the IMA version, you must first remove all member links from the group.

Only IMA version 1.1 is supported.

Default

1-1

Parameters

IMA-version

specifies the IMA version for this group

Values 1-1 – IMA version 1.1

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3.14.2.22 ATM interface commands

atm

Syntax

atm

Context

config>port>multilink-bundle>ima

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

config>port>tdm>ds3

config>port>tdm>e3

config>port>sonet-sdh>path

Description

This command enables the context to configure ATM interface properties.

cell-format

Syntax

cell-format *cell-format*

no cell-format

Context

config>port>multilink-bundle>ima>atm

config>port>tdm>ds1>channel-group>atm

config>port>tdm>e1>channel-group>atm

config>port>tdm>ds3>atm

config>port>tdm>e3>atm

config>port>sonet-sdh>path>atm

Description

This command configures the ATM cell format.

The **no** form of this command restores the default value.

Default

uni

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Parameters

cell-format

the ATM cell format, either UNI or NNI (SONET/SDH ports do not support the NNI format)

Values uni (user-to-network interface cell format)

nni (network-to-network interface cell format)

mapping

Syntax

mapping direct

no mapping

Context

config>port>tdm>ds3>atm

Description

This command specifies the ATM cell mapping to be used on this DS3 ATM interface.

The **no** form of this command restores the default value.

Note: For an E3 interface, the **mapping** command does not appear in the CLI; the interface is hard-coded for direct mapping.

Default

direct

Parameters

direct

specifies direct cell mapping

min-vp-vpi

Syntax

min-vp-vpi *value*

no min-vp-vpi

Context

config>port>multilink-bundle>ima>atm

config>port>tdm>ds1>channel-group>atm

config>port>tdm>e1>channel-group>atm

config>port>tdm>ds3>atm

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config>port>tdm>e3>atm

config>port>sonet-sdh>path>atm

Description

This command sets the minimum allowable virtual path identifier (VPI) value that can be used on the ATM interface for a virtual path connection (VPC).

The **no** form of this command restores the default value.

Default

0

Parameters

value

the minimum allowable VPI value that can be used on the ATM interface for a VPC

Values 0 to 4095 (NNI) (not supported on SDH/SONET ports)

0 to 255 (UNI)

3.14.2.23 TDM commands

tdm

Syntax

tdm

Context

config>port

Description

This command enables the context to configure:

- DS1/E1 parameters for a port on a channelized 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card (DS3 ports only)
- DS3 parameters for a port on a channelized 2-port OC3/STM1 Channelized Adapter card
- DS3/E3 parameters for a port on a 4-port DS3/E3 Adapter card
- codirectional and teleprotection interfaces (TPIF) parameters for a port on an 8-port Voice & Teleprotection card
- teleprotection interfaces (TPIF) parameters for a port on an 8-port C37.94 Teleprotection card

TDM is a mechanism that divides the bandwidth of a stream into separate channels or timeslots by assigning each stream a different timeslot in a set. TDM repeatedly transmits a fixed sequence of timeslots

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over a single transmission channel. Each individual data stream is reassembled at the receiving end based on the timing.

Default

n/a

buildout

Syntax

buildout {**long** | **short**}

Context

config>port>tdm

Description

This command specifies the line buildout (cable length) for physical DS1 ports on the 16-port T1/E1 ASAP Adapter card or 32-port T1/E1 ASAP Adapter card, or for physical DS3/E3 ports on the 4-port DS3/E3 Adapter card.

Default

short (this is the only option available for the 16-port T1/E1 ASAP Adapter card and 32-port T1/E1 ASAP Adapter card)

Parameters

long

sets the line buildout for length runs up to 450 ft (for the 4-port DS3/E3 Adapter card only)

short

sets the line buildout for length runs up to 225 ft (for the 4-port DS3/E3 Adapter card only) or up to 655 ft (for the 16-port T1/E1 ASAP Adapter card and 32-port T1/E1 ASAP Adapter card)

codir

Syntax

[**no**] **codir**

Context

config>port>tdm

Description

This command creates a 64 kb/s codirectional G.703 channel on a port on the 8-port Voice & Teleprotection card.

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The **no** form of this command deletes the port's codirectional channel.

Default

n/a

channel-group

Syntax

[**no**] **channel-group** *channel-group-id*

Context

config>port>tdm>codir

config>port>tdm>tpif

Description

This command creates a DS0 channel group on a TDM interface on the 8-port Voice & Teleprotection card or 8-port C37.94 Teleprotection card.

The **no** form of this command deletes the port's codirectional or TPIF channel group.

Default

n/a

Parameters

channel-group-id

specifies the channel group ID number

Values 1

encap-type

Syntax

encap-type cem

Context

config>port>tdm>codir>channel-group

config>port>tdm>tpif>channel-group

Description

This command specifies the encapsulation type. The channel group must be deleted before changing the encapsulation type.

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Default

no encap-type

Parameters

cem

circuit emulation (TDM)

mode

Syntax

mode access

Context

config>port>tdm>codir>channel-group

config>port>tdm>tpif>channel-group

Description

This command configures the interface for access mode. An access port or channel is used for customer-facing traffic. A SAP can only be configured on an access port or channel. When an interface is configured for access mode, the appropriate encapsulation type must be specified.

Default

access

Parameters

access

configures the port as service access

framing

Syntax

framing {**framed** | **unframed**}

no framing

Context

config>port>tdm>tpif

Description

This command configures framing on a C37.94 port in a TPIF VC.

If the VC is configured for unstructured circuit emulation (**satop-tpif**) (only supported on the odd-numbered ports on the 8-port C37.94 Teleprotection card), the framing mode must be set to **unframed**.

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The **no** form of this command removes the configuration.

Default

no framing

Parameters

framed

configures the port for framing

unframed

configures the port for unframed mode

loopback

Syntax

loopback {**internal** | **line**}

no loopback

Context

config>port>tdm>codir

config>port>tdm>tpif

Description

This command puts the specified interface into a loopback mode. The port must be shut down before loopback mode is enabled.

This command is not saved in the system configuration between boots.

The **no** form of this command disables the loopback on the interface.

Default

no loopback

Parameters

internal

places the port or channel into an internal loopback mode. An internal loopback loops the frames from the local router back to the framer.

line

places the port or channel into a line loopback mode. A line loopback loops data received on the port or channel back to the remote end.

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report-alarm

Syntax

report-alarm {**ais** | **los** | **rai**}

no report-alarm

Context

config>port>tdm>codir

config>port>tdm>tpif

Description

This command enables logging of codirectional and TPIF alarms for the specified interface or channel.

The **no** form of this command disables logging of the specified alarm.

Default

ais for codir

rai for tpif

Parameters

ais

reports alarm indication signal errors (configurable for codir only)

los

reports loss of signal errors

rai

reports remote alarm indication signal errors (configurable for tpif only)

timing-8k

Syntax

[**no**] **timing-8k**

Context

config>port>tdm>codir

Description

This command enables generation of an 8-kHz signal on a codirectional interface.

Default

disabled

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ds1

Syntax

[**no**] **ds1** *ds1-id*

Context

config>port>tdm

Description

This command enables the context to configure DS1 frame parameters on a channelized 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card (DS3 ports only).

T1 transmits DS1-formatted data at 1.544 Mb/s through the network.

Once a channel has been configured for DS1, all ports on the card can only be configured for DS1. There cannot be a mix of DS1 and E1 channels on the same card.

The **no** form of this command deletes the specified DS1 channel.

Default

n/a

Parameters

ds1-id

the identifier of the DS1 channel

Values DS1 number (1 to 28) | *ds1-sonet-sdh-index*

ds3

Syntax

[**no**] **ds3** [*sonet-sdh-index*]

Context

config>port>tdm

Description

This command enables the context to configure DS3 parameters on a 2-port OC3/STM1 Channelized Adapter card or a 4-port DS3/E3 Adapter card.

DS3 lines carry 28 DS1 signals and a 44.736 Mb/s data rate.

If DS3 links are provisioned on a channelized SONET/SDH Adapter card, you must provision the parent STS-1 SONET/STM0 SDH path first (this requirement does not apply to the 4-port DS3/E3 Adapter card).

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The **no** form of this command disables DS3 capabilities on the specified SONET/SDH path or DS3 port. The DS3 parameters must be disabled if a clear channel is enabled by default. A clear channel uses out-of-band signaling, not in-band signaling; therefore, the entire bit rate of the channel is available.

Default

n/a

Parameters

sonet-sdh-index

specifies the components making up the specified SONET/SDH path on the 2-port OC3/STM1 Channelized Adapter card

e1

Syntax

[**no**] **e1** *e1-id*

Context

config>port>tdm

Description

This command enables the context to configure E1 parameters on a channelized 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card (DS3 ports only). E1 is a standard WAN digital communication format designed to operate over copper facilities at a rate of 2.048 Mb/s.

Once a channel has been configured for E1, all ports on the card can only be configured for E1. There cannot be a mix of DS1 and E1 channels on the same card.

The **no** form of this command deletes the specified E1 channel.

Default

n/a

Parameters

e1-id

the identifier of the E1 channel

Values E1 number (1 to 21) | *e1-sonet-sdh-index*

e3

Syntax

[**no**] **e3** [*sonet-sdh-index*]

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Context

config>port>tdm

Description

This command enables the context to configure E3 parameters on a 4-port DS3/E3 Adapter card. E3 lines provide a speed of 34.368 Mb/s and are frequently used by service providers outside North America.

Default

n/a

Parameters

sonet-sdh-index

specifies the components making up the specified SONET/SDH path on the 2-port OC3/STM1 Channelized Adapter card

encoding

Syntax

encoding {**b8zs** | **ami**}

Context

config>port>tdm

Description

This command configures the encoding for the physical DS1 (T1) port. DS1 ports can be configured for either bipolar with eight-zero substitution (B8ZS) zero code suppression or alternate mark inversion (AMI). B8ZS and AMI are line coding techniques.

This command is supported on the following cards and platforms:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 7705 SAR-A (on the variant with T1/E1 ports)
- 7705 SAR-M (on the variants with T1/E1 ports)

Default

b8zs

length

Syntax

length {**133** | **266** | **399** | **533** | **655**}

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Context

config>port>tdm

Description

This command configures the line length for the physical DS1 port on the 16-port T1/E1 ASAP Adapter card or 32-port T1/E1 ASAP Adapter card.

Line buildout settings must be adjusted with line length in order to ensure nominal operating voltage levels for receivers. Ideal receiver voltage levels should be < 3Vp.

Default

133

line-impedance

Syntax

line-impedance {**75** | **100** | **120**}

Context

config>port>tdm

Description

This command configures the line impedance of a port. Line impedance is set on a per-port basis and ports on the same card can have different values. Before changing the line impedance of a port, the port must be shut down.

Default

100 for DS1

120 for E1

Parameters

75

75 Ω

100

100 Ω

120

120 Ω

tpif

Syntax

[**no**] **tpif**

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Context

config>port>tdm

Description

This command creates an IEEE C37.94 teleprotection interface (TPIF) channel.

The **no** form of this command deletes the port's TPIF channel.

Default

n/a

timeslots

Syntax

timeslots *timeslots*

Context

config>port>tdm>tpif>channel-group

Description

This command defines the list of DS0 timeslots to be used in the TPIF channel group.

Default

1

Parameters

timeslots

specifies the number of consecutive timeslots to be associated with the channel group. The value must start from the first timeslot. It represents line bandwidth of *n* x 64 kb/s, where *n* is the number of timeslots.

Values 1 to 12

3.14.2.24 DS1 and E1 commands

channelized

Syntax

channelized {**ds1** | **e1**}

no channelized

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Context

config>port>tdm>ds3

Description

This command configures the associated DS3 channel as a channelized DS3 with DS1/E1 sub-channels.

The **no** form of this command disables channelization. The sub-channels must be deleted first before the **no** command is executed.

Default

no channelized

Parameters

ds1

specifies that the channel is DS1

e1

specifies that the channel is E1

bert

Syntax

bert chngrp-id *chngrp-id*

no bert

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command enters the context to configure a bit error rate test (BERT) on a channel group.

The **no** form of this command removes the BERT configuration.

Parameters

chngrp-id

specifies the channel group on which to perform the BERT.

direction

Syntax

direction {**line** | **internal**}

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Context

config>port>tdm>ds1>bert

config>port>tdm>e1>bert

Description

This command configures the direction of the test data transmission for the BERT.

Default

line

Parameters

line

specifies that the test pattern is sent out the physical port. The BERT data from the receive port is analyzed for errors.

internal

specifies that the test pattern is sent away from the physical port, toward the switch fabric, and out to another TDM port in the system. The BERT test data coming from the internal switch fabric is analyzed for errors.

length

Syntax

length {**64k** | **56k**}

Context

config>port>tdm>ds1>bert

config>port>tdm>e1>bert

Description

This command configures the size the BERT pattern uses in a DS0.

Default

64k

Parameters

64k

specifies the BERT pattern size to be 8 bits

56k

specifies the BERT pattern size to be 7 bits

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pattern

Syntax

pattern *pattern*

Context

config>port>tdm>ds1>bert

config>port>tdm>e1>bert

Description

This command specifies the BERT pattern type to be generated on the specified channel group.

Default

2e20q

Parameters

pattern

the BERT pattern type

Values 2e11, 2e15, 2e20, 2e20q

clock-source

Syntax

clock-source {**loop-timed** | **node-timed** | **adaptive** | **differential**}

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command specifies the clock source to be used for the link transmit timing.

The following can be configured for loop timing and node timing:

- T1/E1 CES circuits on the 16-port T1/E1 ASAP Adapter card
- T1/E1 CES circuits on the 32-port T1/E1 ASAP Adapter card
- T1/E1 CES circuits on the 2-port OC3/STM1 Channelized Adapter card
- T1/E1 CES circuits on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- T1/E1 CES circuits on the 4-port DS3/E3 Adapter card

The following can be configured for adaptive timing:

- 16-port T1/E1 ASAP Adapter card

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- 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 7705 SAR-M on T1/E1 CES circuits used for TDM pseudowires
- T1/E1 ports on the 7705 SAR-X on T1/E1 CES circuits used for TDM pseudowires
- T1/E1 ports on the 7705 SAR-A on T1/E1 CES circuits used for TDM pseudowires
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

The following can be configured for differential timing:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- T1/E1 channels on the 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- T1/E1 channels on the DS3 ports on the 4-port DS3/E3 Adapter card (E3 ports cannot be channelized)
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X
- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

The clock source setting also determines the node sync reference if the port is configured as one of the node sync references **(config>system>sync-if-timing>{ref1 | ref2}> source-port** command). See the 7705 SAR Basic System Configuration Guide, "Node Timing", for more information.

Note: If a timing reference from an external BITS clock is used on a dedicated T1/E1 port, the port must be configured as loop-timed.

Default

node-timed

Parameters

loop-timed

the link recovers the clock from the received data stream

node-timed

the link uses the internal clock when transmitting data

adaptive

clocking is derived from the incoming pseudowire packets from the MPLS network

differential

clocking is derived from a common clock compared to differential clock recovery (DCR) data in the RTP header in the TDM PW overhead. DCR must also be enabled on the relevant card, module, or chassis with the clock-mode command.

framing (DS1)

Syntax

framing {**esf** | **sf** | **ds1-unframed**}

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Context

config>port>tdm>ds1

Description

This command specifies the DS1 framing to be used for the port.

The **ds1-unframed** parameter allows the configuration of an unstructured DS1 channel on the following:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 4-port DS3/E3 Adapter card (DS3 ports only)
- 4-port T1/E1 and RS-232 Combination module (T1/E1 ports only)
- 7705 SAR-M (T1/E1 ports only)
- 7705 SAR-X (T1/E1 ports only)
- 7705 SAR-A (T1/E1 ports only)

When an unframed DS1 channel is shut down, it sends the AIS pattern to the far-end DS1. The far end does not react to the AIS pattern if the far-end DS1 is configured as unframed. If the far-end DS1 is configured as framed, the far end declares AIS. The operational status remains up and no alarms are generated while the near end is operationally down. This is normal behavior for unframed G.703 mode.

Default

esf

Parameters

esf

configures the DS1 port for extended superframe framing

sf

configures the DS1 port for superframe framing

ds1-unframed

specifies DS1 unframed (G.703) mode for DS1 interfaces

framing (E1)

Syntax

framing {**no-crc-g704** | **g704** | **e1-unframed**}

Context

config>port>tdm>e1

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Description

This command specifies the E1 framing to be used for the port.

The **e1-unframed** parameter allows the configuration of an unstructured E1 channel on the following:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
- 4-port DS3/E3 Adapter card (DS3 ports only)
- 4-port T1/E1 and RS-232 Combination module (T1/E1 ports only)
- 7705 SAR-M (T1/E1 ports only)
- 7705 SAR-X (T1/E1 ports only)
- 7705 SAR-A (T1/E1 ports only)

When an unframed E1 channel is shut down, it sends the AIS pattern to the far-end E1. The far end does not react to the AIS pattern if the far-end E1 is configured as unframed. If the far-end E1 is configured as framed, the far end declares AIS. The operational status remains up and no alarms are generated while the near end is operationally down. This is normal behavior for unframed G.703 mode.

Default

g704

Parameters

g704

configures the E1 port for G.704 framing

no-crc-g704

configures the E1 port for G.704 framing with no CRC4

e1-unframed

specifies E1 unframed (G.703) mode for E1 interfaces

hold-time

Syntax

hold-time {[**up** *hold-time-up*] [**down** *hold-time-down*]}

no hold-time

Context

config>port>tdm>ds1

config>port>tdm>e1

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Description

This command configures the DS1/E1 link dampening timers in 100s of milliseconds, which guards against reporting excessive interface transitions. Once implemented, subsequent transitions of the interface from one state to another are not advertised to upper layer protocols until the configured timer has expired.

Default

no hold-time

Parameters

hold-time-up

the hold-timer for link-up event dampening. A value of zero (0) indicates that an up transition is reported immediately.

Values 0 to 100 (in 100 ms)

hold-time-down

the hold-timer for link-down event dampening. A value of zero (0) indicates that a down transition is reported immediately.

Values 0 to 100 (in 100 ms)

loopback (DS1)

Syntax

loopback {**line** | **internal** | **fdl-ansi** | **fdl-bellcore** | **payload-ansi**}

no loopback

Context

config>port>tdm>ds1

Description

This command puts the specified port or channel in a loopback mode.

A **line** loopback loops frames received on the corresponding port or channel back toward the transmit (egress) direction before reaching the framer. The bit stream is not reframed. The electrical signal is regenerated by the Tx line interface unit (LIU) and the timing is provided by the Rx LIU. On the 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card, the traffic is also passed through to the fabric.

An **internal** loopback loops the frames that are coming in an egress direction from the fabric toward the framer, back to the fabric. This is usually referred to as an equipment loopback. On the 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card, the frames are also transmitted on the line.

The **fdl-ansi** loopback command sends a repeating 16-bit ESF data link code word to the remote end requesting that it enter into a network line loopback. The **ansi** keyword enables the remote line FDL ANSI bit loopback on the T1 line, in accordance with the ANSI T1.403 specification.

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The **fdl-bellcore** loopback command sends a repeating 16-bit ESF data link code word to the remote end requesting that it enter into a network line loopback. The **bellcore** keyword enables the remote line FDL Bellcore bit loopback on the T1 line, in accordance with the Bellcore TR-TSY-000312 specification.

The **payload-ansi** loopback command sends a repeating 16-bit ESF data link code word to the remote end requesting that it enter into a network payload loopback. A payload loopback loops frames back toward the transmit (egress) direction after reaching the framer. The bit stream is reframed. The electrical signal is regenerated by the Tx LIU and the timing is provided by the Rx LIU.

The loopback command is not saved to the system configuration.

The **no** form of this command disables the specified type of loopback.

Note:

- The **fdl-ansi**, **fdl-bellcore** and **payload-ansi** options can only be configured if DS1 framing is set to ESF.
- The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card cannot initiate **fdl-ansi**, **fdl-bellcore**, or **payload-ansi** loopbacks.
- The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card supports up to 16 line loopbacks and 16 internal loopbacks at a time.

Default

no loopback

Parameters

line

places the associated port or channel into line loopback mode

internal

places the associated port or channel into internal loopback mode

fdl-ansi

requests an FDL line loopback in accordance with the ANSI T1.403 specification

fdl-bellcore

requests an FDL line loopback in accordance with the Bellcore TR-TSY-000312 specification

payload-ansi

requests a payload loopback using ANSI signaling

loopback (E1)

Syntax

loopback {**line** | **internal**}

no loopback

Context

config>port>tdm>e1

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Description

This command puts the specified port or channel in a loopback mode.

A **line** loopback loops frames received on the corresponding port or channel back toward the transmit (egress) direction before reaching the framer. The bit stream is not reframed. The electrical signal is regenerated by the Tx line interface unit (LIU) and the timing is provided by the Rx LIU. On the 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card, the traffic is also passed through to the fabric.

An **internal** loopback loops the frames that are coming in an egress direction from the fabric toward the framer, back to the fabric. This is usually referred to as an equipment loopback. On the 2-port OC3/STM1 Channelized Adapter card, 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card, or 4-port DS3/E3 Adapter card, the frames are also transmitted on the line.

The **no** form of this command disables the specified type of loopback.

Note: The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card supports up to 16 line loopbacks and 16 internal loopbacks at a time.

Default

no loopback

Parameters

line

places the associated port or channel into line loopback mode

internal

places the associated port or channel into internal loopback mode

remote-loop-respond

Syntax

[**no**] **remote-loop-respond**

Context

config>port>tdm>ds1

Description

This command configures the DS1 channel response to remote loopbacks. When enabled, the channel responds to remote loopbacks; when disabled, the channel does not respond.

Note: The 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card cannot respond to **fdl-ansi**, **fdl-bellcore**, or **payload-ansi** loopbacks.

Default

no remote-loop-respond

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report-alarm

Syntax

[**no**] **report-alarm** {**ais** | **los** | **oof** | **rai** | **looped** | **ber-sd** | **ber-sf**}

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command enables logging of DS1 or E1 alarms. When configured, logging is enabled for the raising and clearing of the specified alarms.

The **no** form of this command disables logging of the specified alarms.

Parameters

ais

reports alarm indication signal errors

Default ais alarms are issued

los

reports loss of signal errors

Default los alarms are issued

oof

reports out-of-frame errors

Default oof alarms are not issued

rai

reports remote alarm indication signal errors

Default rai alarms are not issued

looped

reports looped packets errors

Default looped alarms are not issued

ber-sd

reports BER line signal degradation errors on:

- the 16-port T1/E1 ASAP Adapter card
- the 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X

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- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

Default line signal degradation alarms are not issued

ber-sf

reports BER line signal failure errors on:

- the 16-port T1/E1 ASAP Adapter card
- the 32-port T1/E1 ASAP Adapter card
- T1/E1 ports on the 7705 SAR-M
- T1/E1 ports on the 7705 SAR-X
- T1/E1 ports on the 7705 SAR-A
- T1/E1 ports on the 4-port T1/E1 and RS-232 Combination module

Default line signal failure alarms are not issued

signal-mode

Syntax

signal-mode cas

no signal-mode

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command enables or disables channel associated signaling (CAS) at the port and circuit levels. When enabled, control signals (such as those for synchronizing and bounding frames) are carried in the same channels as voice and data signals.

If the signal mode for a DS1/E1 port or channel is configured for **no signal-mode**, all DS0/64 kb/s channels within the DS1 or E1 port will not be enabled for CAS. Individual channel groups within that DS1 or E1 port inherit this state and cannot be changed.

If the signal mode for a DS1/E1 port or channel is configured for **signal-mode cas**, any new channel groups default to **signal-mode cas**.

The signal mode must be configured for CAS before creating a Cpipe service that supports T1 or E1 with CAS. See the 7705 SAR Services Guide, "Creating a Cpipe Service", for information about configuring a Cpipe service.

This command is valid only on the following cards and platforms when DS1 framing is set to **esf** or **sf**, or E1 framing is set to **g704** or **no-crc-g704**:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card

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- 2-port OC3/STM1 Channelized Adapter card
- 4-port DS3/E3 Adapter card
- 4-port T1/E1 and RS-232 Combination module
- 7705 SAR-A
- 7705 SAR-M
- 7705 SAR-X

Parameters

cas

specifies channel associated signaling

signaling-insertion

Syntax

signaling-insertion chngrp-id *channel-group*

no signaling-insertion

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command enters the context to configure signaling insertion on a channel group.

Signaling insertion can only run on one channel group at a time, and signaling insertion cannot be configured while a test is running.

The **no** form of this command removes the signaling insertion configuration.

Parameters

channel-group

specifies the channel group on which to perform the signaling insertion.

direction

Syntax

direction {**line** | **internal**}

Context

config>port>tdm>ds1>signaling-insertion

config>port>tdm>e1>signaling-insertion

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Description

This command configures the direction of the test data transmission.

Default

line

Parameters

line

specifies that the test pattern is sent out the physical port

internal

specifies that the test pattern is sent away from the physical port, internally toward the switch fabric, and out to another TDM port in the system

pattern

Syntax

pattern *pattern*

Context

config>port>tdm>ds1>signaling-insertion

config>port>tdm>e1>signaling-insertion

Description

This command specifies the signaling insertion pattern type to be generated on the specified channel group.

Default

1010

Parameters

pattern

the signaling insertion pattern type

Values a 4-bits binary string

ssm

Syntax

ssm

Context

config>port>tdm>ds1

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config>port>tdm>e1

Description

This command accesses the context to configure DS1 or E1 Synchronization Status Messaging (SSM) parameters.

Note:

- Only **g704** framing mode should be used with E1 SSM. The **no-crc-g704** and **e1-unframed** framing modes are not compatible with E1 SSM. See the framing (E1) command for information about E1 framing.
- Only **esf** framing mode should be used with DS1 SSM. See the framing (DS1) command for information on DS1 framing.

ssm-bit

Syntax

ssm-bit *sa-bit*

no ssm-bit

Context

config>port>tdm>e1>ssm

Description

This command configures which Sa bit in the E1 frame to use for conveying the quality level SSM information.

Default

8

Parameters

sa-bit

identifies which Sa bit to use for SSM information

Values 4 to 8

tx-dus

Syntax

[**no**] **tx-dus**

Context

config>port>tdm>ds1>ssm

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config>port>tdm>e1>ssm

Description

This command enables or disables the transmission of 0xF (DUS) (do not use for synchronization) in the SSM channel. The code 0xF is transmitted but it is translated to DNU (do not use) for E1 or SDH and to DUS for SONET or T1.

Default

no tx-dus

threshold

Syntax

threshold {**ber-sd** | **ber-sf**} **rate** *threshold-rate*

no threshold {**ber-sd** | **ber-sf**}

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command configures the line signal degradation (SD) bit error rate (BER) and line signal failure (SF) thresholds.

PCV error rates are measured and when they cross either the degradation or failure threshold, alarms are raised.

The **no** form of this command disables the BER-SD or BER-SF feature.

Default

ber-sd - disabled

ber-sf - disabled

Parameters

threshold ber-sd

specifies the BER that specifies signal degradation

threshold ber-sf

specifies the BER that specifies signal failure

threshold-rate

specifies the number of errors, in millions

Values 1, 5, 10, 50, 100

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3.14.2.25 DS1 and E1 channel group commands

channel-group

Syntax

[**no**] **channel-group** *channel-group-id*

Context

config>port>tdm>ds1

config>port>tdm>e1

Description

This command creates n × DS0 (64 kb/s) channel groups in a channelized DS1 or E1 circuit. Channel groups cannot be further subdivided.

The **no** form of this command deletes the specified DS1 or E1 channel group.

Default

n/a

Parameters

channel-group-id

identifies the channel group ID number

Values DS1: 1 to 24

E1: 1 to 32

crc

Syntax

crc {**16** | **32**}

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command configures the precision of the cyclic redundancy check (CRC). Non-ATM channel groups configured under DS1 or E1 support 16-bit checksum. ATM channel groups support a 32-bit checksum.

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Default

16

Parameters

16

use 16-bit checksum for the associated port/channel

32

use 32-bit checksum for the associated port/channel

encap-type

Syntax

encap-type {**atm** | **cem** | **ipcp** | **ppp-auto** | **frame-relay** | **cisco-hdlc** | **hdlc**}

no encap-type

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command configures the encapsulation method used for a port. This parameter can be set on both access and network ports. The following table lists the adapter cards and platforms and the corresponding encapsulation types.

For access mode, the supported encapsulation types are **atm**, **cem**, **frame-relay**, **cisco-hdlc**, **hdlc, and ipcp**.

Table 45: Adapter cards and platforms and encapsulation types in access mode

Adapter cards and platforms	Encapsulation type					
	atm	cem	frame-relay	cisco-hdlc	hdlc	ipcp
16-port T1/E1 ASAP Adapter card	✓	✓	✓	✓	✓	✓
32-port T1/E1 ASAP Adapter card	✓	✓	✓	✓	✓	✓
2-port OC3/STM1 Channelized Adapter card	✓	✓				✓1
4-port OC3/STM1 / 1-port OC12/ STM4 Adapter card		✓				

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Adapter cards and platforms	Encapsulation type					
	atm	cem	frame-relay	cisco-hdlc	hdlc	ipcp
4-port DS3/E3 Adapter card (DS3 ports only)		✓	✓			
4-port T1/E1 and RS-232 Combination module		✓				✓
7705 SAR-X				✓		✓

Note:

1. Not supported on fractional T1/E1 channels

For network mode, only **ppp-auto** encapsulation is supported.

To change the **encap-type**, the channel group must first be deleted, then reconfigured with the new **encap-type**.

Default

no encap-type

Parameters

atm

specifies the encapsulation type as ATM for ATM pseudowires

cem

specifies the encapsulation type as circuit emulation mode (CEM) for TDM pseudowires

frame-relay

specifies the encapsulation type as frame relay

cisco-hdlc

specifies the encapsulation type as Cisco HDLC

hdlc

specifies the encapsulation type as HDLC

ipcp

specifies the encapsulation type as IPCP for a PPP/MLPPP channel group in access mode

ppp-auto

specifies the encapsulation type as PPP for PPP/MLPPP bundles in network mode

idle-cycle-flag

Syntax

idle-cycle-flag {**flags** | **ones**}

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no idle-cycle-flag

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command configures the value that the DS0, DS1, DS3, E1, or TDM interface transmits during idle cycles. This command is applicable only if the encapsulation type is ppp-auto.

The **no** form of this command changes the idle cycle flag to the default value.

Default

flags (0x7E)

Parameters

flags

use 0x7E as the idle cycle flag

ones

use 0xFF as the idle cycle flag

idle-payload-fill

Syntax

idle-payload-fill {**all-ones** | **pattern** *pattern*}

no idle-payload-fill

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command defines the data pattern to be transmitted (8-bit value) when the circuit emulation service is not operational or temporarily experiences underrun conditions. This command is only valid for CESoPSN services.

Note: See the 7705 SAR Services Guide for information about CESoPSN services.

Default

all-ones

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Parameters

all-ones

transmits 11111111

pattern

transmits the user-defined pattern

Values 0 to 255 (can be entered in decimal, binary, or hexadecimal format)

idle-signal-fill

Syntax

idle-signal-fill {**all-ones** | **pattern** *pattern*}

no idle-signal-fill

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command defines the signaling pattern to be transmitted (4-bit value) when the circuit emulation service is not operational or temporarily experiences underrun conditions. This command is only valid for CES with CAS.

Note: See the 7705 SAR Services Guide for information about CESoPSN services.

Default

all-ones

Parameters

all-ones

transmits 1111

pattern

transmits the user-defined pattern

Values 0 to 15 (can be entered in decimal, binary, or hexadecimal format)

loopback

Syntax

loopback {**line** | **internal**}

no loopback

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Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command puts the specified n × DS0 (64 kb/s) channel group in a loopback mode. For T1 ports, the channel group can have 1 to 24 channels. For E1 ports, the channel group can have 1 to 31 channels.

When a line loopback is enabled on the channel group:

- frames received on the channel group on the Rx port are looped back toward the Tx (egress) port before reaching the framer. However, if CAS is enabled on the interface, the Tx signaling bits will continue to be sourced from the far end of the Cpipe (not looped back).
- an all-ones pattern is inserted by the framer in the direction of the switch fabric and to the far end of the Cpipe

When an internal loopback (usually referred to as an equipment loopback) is enabled on the channel group:

- frames received on the channel group from the switch fabric toward the framer are looped back to the switch fabric and to the far end of the Cpipe. However, if CAS is enabled on the interface, the Rx signaling bits will continue to be sourced from the local access port (not looped back).
- traffic received on the channel group will continue to be sent out the Tx (egress) port as if no internal loopback was there

N × DS0 (64 kb/s) channel group loopbacks are only supported on the 16-port T1/E1 ASAP Adapter card and the 32-port T1/E1 ASAP Adapter card.

Default

no loopback

Parameters

line

puts the specified channel group in line loopback mode

internal

puts the specified channel group in internal loopback mode

mac

Syntax

mac *ieee-address*

no mac

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

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config>port>tdm>ds3

Description

This command assigns a specific MAC address to an APS port. When the command is issued while the port is operational, IP will issue an ARP, if appropriate, and BPDUs are sent with the new MAC address. Configuring a MAC address using the **mac** command is only supported for APS channel groups. Physical channel groups do not support the **mac** command.

The **no** form of this command removes the configured MAC address. The physical port MAC address will be used instead.

For TDM ports, configuring the MAC address allows the same MAC address to be assigned to ports across two routers in an MC-APS pair for MEF 8.

The **mac** command is only supported on the 2-port OC3/STM1 Channelized Adapter card and 4-port OC3/STM1 / 1-port OC12/STM4 Adapter card.

Default

no mac

Parameters

ieee-address

specifies the 48-bit MAC address in the form aa:bb:cc:dd:ee:ff or aa-bb-cc-dd-ee-ff where aa, bb, cc, dd, ee, and ff are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC, and non-IEEE reserved MAC addresses.

mode

Syntax

mode {**access** | **network**}

no mode

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command configures a TDM channel for access or network mode operation.

An **access** port or channel is used for customer-facing traffic on which services are configured. A service access point (SAP) can only be configured on an access port or channel.

When a port is configured for access mode, the appropriate **encap-type** must be specified to distinguish the services on the port. Once a TDM channel has been configured for access mode, multiple services can be configured on the TDM channel.

A **network** port or channel participates in the service provider transport or infrastructure network when a network mode is selected. When the network option is configured, only the ppp-auto **encap-type** can be configured for the port or channel.

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The **no** form of this command restores the default.

Default

access

Parameters

access

configures the port or channel as service access

network

configures the port or channel for transport network use

mtu

Syntax

mtu *mtu-bytes*

no mtu

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command configures the maximum payload MTU size for a port.

Packets received that are larger than the MTU will be fragmented or discarded, depending on whether the DF bit is set in the packet header. If the port mode or encapsulation type is changed, the MTU assumes the default values of the new mode or encapsulation type. The default and maximum values are shown in the table below.

Table 46: Default and maximum port MTU

Port type	Mode	Encap type	Default (bytes)	Max MTU (bytes)
TDM (PW)	Access	cem	1514	1514
TDM (ATM PW)	Access	atm	1524	1524
TDM (FR PW)	Access	frame-relay	1514	2090
TDM (HDLC PW)	Access	hdlc	1514	2090
TDM (IW PW)	Access	cisco-hdlc	1514	2090
TDM (PPP/MLPPP)	Access	ipcp	1502	2090
TDM (PPP/MLPPP)	Network	ppp-auto	1572	2090

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Port type	Mode	Encap type	Default (bytes)	Max MTU (bytes)
Serial V35 or X21 (FR PW)	Access	frame-relay	1514	2090
SONET/SDH	Access	atm	1524	1524
SONET/SDH	Network	ppp-auto	1572	2090

The **no** form of this command restores the default values.

Default

The default MTU value depends on the port type, mode, and encapsulation as listed in the table.

Parameters

mtu-bytes

sets the maximum allowable size of the MTU, expressed as an integer

Values 512 to 2090 bytes

ppp

Syntax

[**no**] **ppp**

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command enables access to the context to configure the LCP operational parameters for a DS1 or E1 channel or a DS0 channel.

The **no** form of the command removes the LCP operational parameters.

Default

no ppp

ber-sf-link-down

Syntax

ber-sf-link-down

no ber-sf-link-down

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Context

config>port>tdm>ds1>channel-group>ppp

config>port>tdm>e1>channel-group>ppp

Description

This command enables the channel-group down on BER-SF alarm. When enabled, the channel-group will be placed out of service once BER-SF is detected.

The **no** form of this command disables the feature.

Default

no ber-sf-link-down

keepalive

Syntax

keepalive *time-interval* [**dropcount** *drop-count*]

no keepalive

Context

config>port>tdm>ds1>channel-group>ppp

config>port>tdm>e1>channel-group>ppp

Description

This command sets the keepalive interval.

The **no** form of this command returns the interval to the default value.

Default

keepalive 10 dropcount 3

Parameters

time-interval

the time in seconds between keepalive messages, expressed as a decimal integer

Values 1 to 60

drop-count

the number of consecutive keepalive failed request attempts or remote replies that can be missed after which the port is operationally downed

Values 1 to 255

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scramble

Syntax

[**no**] **scramble**

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command enables payload scrambling on channel groups. The command is applicable only if the encapsulation type is **atm**.

signal-mode

Syntax

signal-mode cas

no signal-mode

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command enables or disables channel associated signaling (CAS) at the channel group level. When enabled, control signals (such as those for synchronizing and bounding frames) are carried in the same channels as voice and data signals.

If the signal mode at the DS1/E1 port level is configured for **signal-mode cas**, any new channel groups default to **signal-mode cas**. Any existing channel groups can be individually changed from **cas** to **no signal-mode**.

The signal mode must be configured for CAS before creating a Cpipe with CAS. See the 7705 SAR Services Guide, "Creating a Cpipe Service", for information about configuring a Cpipe service.

This command is valid only on the following cards and platforms when DS1 framing is set to **esf** or **sf**, or E1 framing is set to **g704** or **no-crc-g704**:

- 16-port T1/E1 ASAP Adapter card
- 32-port T1/E1 ASAP Adapter card
- 2-port OC3/STM1 Channelized Adapter card
- 4-port DS3/E3 Adapter card
- 7705 SAR-A
- 7705 SAR-M

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- 7705 SAR-X

Parameters

cas

specifies channel associated signaling

timeslots

Syntax

timeslots *timeslots*

no timeslots

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

Description

This command defines the list of DS0 timeslots to be used in the DS1 or E1 channel group. The timeslots do not need to be consecutive. If the encapsulation type is changed to or from **atm**, the timeslots are reset to the default. If the encapsulation type is set to **atm**, the timeslot ranges are automatically configured and cannot be changed.

If the port is configured for fractional T1/E1 (see Configuring fractional T1/E1 ports for PPP encapsulation), this command is used to specify the number of timeslots to be used on the port. Only the specified timeslots can be used.

The **no** form of this command removes DS0 timeslots from a channel group.

Default

no timeslots – non-ATM channel groups

1 to 24 – channel groups configured under DS1 with **atm** encapsulation

2 to 16, 18 to 32 – channel groups configured under E1 with **atm** encapsulation

2 to 32 – channel groups configured under E1 (ppp-auto)

Parameters

timeslots

specifies the timeslots to be associated with the channel group. The value can consist of a list of timeslots. Each member of the list can either be a single timeslot or a range of timeslots.

Values 1 to 24 for DS1 interfaces. The full range is automatically configured for ATM channel groups and cannot be changed.

2 to 32 for E1 interfaces. The 2 to 16 and 18 to 32 ranges are automatically configured for ATM channel groups and cannot be changed.

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3.14.2.26 DS3 and E3 commands

clock-source

Syntax

clock-source {**loop-timed** | **node-timed** | **differential** | **free-run**}

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command specifies the clock source to be used for the link transmit timing.

The clock source setting also determines the node sync reference if the port is configured as one of the node synchronization references (**config>system>sync-if-timing>**{**ref1** | **ref2**}> **source-port** command). See the 7705 SAR Basic System Configuration Guide, "Node Timing", for more information.

Default

node-timed (for the 4-port DS3/E3 Adapter card)

loop-timed (for all other applicable adapter cards)

Parameters

loop-timed

the link recovers the clock from the received data stream

node-timed

the link uses the internal clock when transmitting data (this parameter does not apply to the 2-port OC3/STM1 Channelized Adapter card)

differential

clocking is derived from a common clock compared to differential clock recovery (DCR) data in the RTP header in the TDM PW overhead. DCR must also be enabled on the relevant card, module, or chassis with the clock-mode command. This parameter applies only to DS3/E3 ports on the 4-port DS3/E3 Adapter card.

free-run

timing source is from its own clock, not an external timing source (this parameter does not apply to the 4-port DS3/E3 Adapter card)

crc

Syntax

crc {**16** | **32**}

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Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command configures the precision of the cyclic redundancy check (CRC). Non-ATM ports support a 16-bit checksum and ATM ports support a 32-bit checksum. CRC applies to PPP applications only on the 2-port OC3/STM1 Channelized Adapter card and 4-port DS3/E3 Adapter card.

Default

16 (non-ATM ports)

32 (ATM ports)

Parameters

16

use 16-bit checksum for the associated port

32

use 32-bit checksum for the associated port

encap-type

Syntax

encap-type {**atm** | **cem** | **ppp-auto** | **frame-relay**}

no encap-type

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command configures the encapsulation method used on the specified DS3/E3 port.

To change the **encap-type**, the port must first be deleted, then reconfigured with the new **encap-type**.

Default

no encap-type

Parameters

atm

specifies the encapsulation type as ATM

cem

specifies the encapsulation type as circuit emulation mode (CEM) for TDM pseudowires

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ppp-auto

specifies the encapsulation type as PPP. The activation of IPCP and MPLSCP is automatically enabled depending on the protocol configuration. This encapsulation type is only valid on DS3 and E3 ports or DS3 channels in network mode.

frame-relay

specifies the encapsulation type as frame relay

feac-loop-respond

Syntax

[**no**] **feac-loop-respond**

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command enables the DS3/E3 interface to respond to remote loop signals. The DS3/E3 far-end alarm and control (FEAC) signal is used to send alarm or status information from the far-end terminal back to the local terminal. DS3/E3 loopbacks at the far-end terminal from the local terminal are initiated.

The **no** form of this command prevents the DS3/E3 interface from responding to remote loop signals.

Default

no feac-loop-respond

framing (DS3)

Syntax

framing {**c-bit** | **m23**}

Context

config>port>tdm>ds3

Description

This command specifies DS3 framing for the associated DS3 port.

Default

c-bit

Parameters

c-bit

configures the DS3 port for C-bit framing

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m23

configures the DS3 port for M23 framing

framing (E3)

Syntax

framing g751

Context

config>port>tdm>e3

Description

This command specifies E3 framing for the associated E3 port.

Default

g751 (this default cannot be changed)

Parameters

g751

configures the E3 port for g751 framing

idle-cycle-flag

Syntax

idle-cycle-flag {**flags** | **ones**}

no idle-cycle-flag

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command configures the value that the DS3/E3 interface transmits during idle cycles. This command is applicable only if the encapsulation type is ppp-auto. For ATM ports, the configuration does not apply and only the **no** form is accepted.

The **no** form of this command resets the idle cycle flag to the default value.

Default

flags (0x7E)

no idle-cycle-flag (for ATM)

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Parameters

flags

use 0x7E as the idle cycle flag

ones

use 0xFF as the idle cycle flag

loopback

Syntax

loopback {**line** | **internal** | **remote**}

no loopback

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command puts the specified DS3/E3 port into a loopback mode.

A line loopback loops frames received on the corresponding port or channel back toward the transmit (egress) direction before reaching the framer.

An internal loopback loops the frames that are coming in an egress direction from the fabric toward the framer, back to the fabric. This is usually referred to as an equipment loopback.

A remote loopback sends a signal to the remote device to provide a line loopback. To configure a remote loopback, you must enable feac-loop-respond on the far-end DS3/E3 interface, then set the loopback to remote on the near-end DS3/E3 interface. Remote loopback sends a loopback code to the far-end DS3/E3 interface that results in the far end sending out a line loopback.

The loopback command is not saved to the system configuration.

The **no** form of this command disables loopback on the DS3/E3 port.

Default

no loopback

Parameters

line

places the associated DS3/E3 port into line loopback mode

internal

places the associated DS3/E3 port into internal loopback mode

remote

places the associated DS3/E3 port into remote loopback mode

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mdl

Syntax

mdl {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **gen**} *mdl-string*

no mdl

Context

config>port>tdm>ds3

Description

This command configures the maintenance data link (MDL) message for a DS3 port or channel. This command is only applicable if the DS3 port or channel is using C-bit framing, specified using the framing (DS3) command.

The **no** form of this command removes the mdl-string association and stops the transmission of MDL messages.

Default

no mdl

Parameters

mdl-string

specifies an MDL message up to 38 characters long

eic

specifies the equipment ID code up to 10 characters long

lic

specifies the line ID code up to 11 characters long

fic

specifies the frame ID code up to 10 characters long

unit

specifies the unit ID code up to 6 characters long

pfi

specifies the facility ID code up to 38 characters long

port

specifies the port ID code up to 38 characters long

gen

specifies the generator number to send in the MDL test signal message, up to 38 characters long

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mdl-transmit

Syntax

[**no**] **mdl-transmit** {**path** | **idle-signal** | **test-signal**}

Context

config>port>tdm>ds3

Description

This command enables the transmission of an MDL message on a DS3 port or channel. This command is only applicable if the DS3 port or channel is using C-bit framing, specified using the framing (DS3) command.

The **no** form of this command prevents the transmission of an MDL message on the DS3 port or channel.

Default

no mdl-transmit

Parameters

path

specifies the MDL path message

idle-signal

specifies the MDL idle signal message

test-signal

specifies the MDL test signal message

mode

Syntax

mode {**access** | **network**}

no mode

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command configures a DS3/E3 port for access or network mode of operation.

SAPs can only be configured on access ports. When a DS3/E3 port is configured for access mode, the **encap-type** can be set to **atm**, **cem**, or **frame-relay**.

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A network port is used as an uplink to connect to the packet network and transport the PPP services. Network mode applies to DS3 and E3 ports. When a DS3/E3 port is configured for network mode, the **encap-type** must be set to **ppp-auto**.

The mode can be changed between access and network provided that **encap-type** has not been configured yet. If **encap-type** has been configured, the DS3/E3 port must be first deleted and then reconfigured with the required **encap-type**.

The **no** form of this command reverts to the default.

Default

access

Parameters

access

configures the port as service access

network

configures the port as a network uplink

mtu

Syntax

mtu *mtu-bytes*

no mtu

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command configures the maximum payload MTU size for a DS3/E3 port configured for PPP. Packets that are received larger than the MTU are discarded. Packets that cannot be fragmented at egress and exceed the MTU are also discarded.

The **no** form of this command restores the default value.

Default

1572 (for ppp-auto)

Parameters

mtu-bytes

sets the maximum allowable size of the MTU, expressed as an integer

Values 512 to 2090 (in bytes)

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ppp

Syntax

ppp

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command enables access to the context to configure the LCP operational parameters for a DS3/E3 port.

keepalive

Syntax

keepalive *time-interval* [**dropcount** *drop-count*]

no keepalive

Context

config>port>tdm>ds3>ppp

config>port>tdm>e3>ppp

Description

This command sets the interval between keepalive messages.

The **no** form of this command returns the interval to the default value.

Default

keepalive 10 dropcount 3

Parameters

time-interval

the time in seconds between keepalive messages, expressed as a decimal integer

Values 1 to 60

drop-count

the number of consecutive keepalive failed request attempts or remote replies that can be missed before the port becomes operationally down

Values 1 to 255

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report-alarm

Syntax

[**no**] **report-alarm** {**ais** | **los** | **oof** | **rai** | **looped**}

Context

config>port>tdm>ds3

config>port>tdm>e3

Description

This command enables logging of DS3 and E3 alarms for a DS3/E3 port or channel. When configured, logging is enabled for the raising and clearing of the specified alarms.

The **no** form of this command disables logging of the specified alarms.

Parameters

ais

reports alarm indication signal errors

Default ais alarms are issued

los

reports loss of signal errors

Default los alarms are issued

oof

reports out-of-frame errors

Default oof alarms are not issued

rai

reports remote alarm indication signal errors

Default rai alarms are not issued

looped

reports looped packets errors

Default looped alarms are not issued

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3.14.2.27 Voice commands

voice

Syntax

voice

Context

config>port

Description

This command enables the context to configure voice port parameters. This context can only be accessed on the 6-port E&M Adapter card, 8-port Voice & Teleprotection card, 8-port FXO Adapter card, and 6-port FXS Adapter card.

Default

n/a

audio-wires

Syntax

audio-wires {**four-wires** | **two-wires**}

Context

config>port>voice

Description

This command configures the number of audio wires to be used for audio transmission for an E&M interface.

A change in the number of audio wires may also require a change in the tlp-rx and tlp-tx values.

Default

four-wires

Parameters

four-wires

four-wire operation

two-wires

two-wire operation. This parameter is not valid if the corresponding port or channel's signaling type is 4W transmission.

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em

Syntax

[**no**] **em**

Context

config>port>voice

Description

This command enables the context to configure channel group parameters for a channelized E&M voice interface.

The **no** form of this command deletes the E&M channel group.

Default

n/a

fault-signaling

Syntax

fault-signaling {**idle** | **seized**}

Context

config>port>voice>em

config>port>voice>fxo

config>port>voice>fxs

Description

This command configures a voice channel for idle or seized fault signaling.

On the 6-port E&M Adapter card, this command is valid only if signaling-mode is configured for E&M signaling. The 6-port E&M Adapter card also supports configuration of the idle and seized codes.

Configuration of the idle and seized codes is not supported on the FXO and FXS channels on the 8-port Voice & Teleprotection card, or on the 8-port FXO Adapter card or 6-port FXS Adapter card. The code transmitted depends on signaling type and companding law as shown in the following table.

Table 47: Idle and seized codes for FXO and FXS signaling types

Signaling type	Companding law		ABCD code	
	A-Law	Mu-Law	Idle	Seized
3600plar (FXS only)	✓		1101	0101
3600plar (FXS only)		✓	11	00

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Signaling type	Companding law		ABCD code	
	A-Law	Mu-Law	Idle	Seized
1511plar (FXS only)	✓		1101	0101
1511profile1 (FXO, FXS)	✓		1101	0101
3600ls (FXO, FXS)		✓	01	11
3600re (FXO, FXS)	✓		1101	0101
1511sn137 (FXO, FXS)	✓		1111	0111

Default

idle

Parameters

idle

specifies idle fault signaling

seized

specifies seized fault signaling

fxo

Syntax

[**no**] **fxo**

Context

config>port>voice

Description

This command creates a foreign exchange office (FXO) channel on a channelized voice interface. This command applies to the 8-port FXO Adapter card and the 8-port Voice & Teleprotection Card.

The **no** form of this command deletes the port's FXO channel.

Default

n/a

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fxs

Syntax

[**no**] **fxs**

Context

config>port>voice

Description

This command creates a foreign exchange subscriber (FXS) channel on a channelized voice interface. This command applies to the 8-port Voice & Teleprotection card and 6-port FXS Adapter card.The **no** form of this command deletes the port's FXS channel.

Default

n/a

idle-code

Syntax

idle-code *abcd-code*

no idle-code

Context

config>port>voice>em

Description

This command defines the ABCD signaling code to be transmitted when the voice channel is configured to transmit idle fault signaling. The command is also used for driving/scanning the E&M signaling leads.

This command is valid only on the 6-port E&M Adapter card and only if signaling-mode is configured for E&M signaling.

The **no** form of this command reverts to the default value.

Default

0 (for Mu-Law companding)

13 (for A-Law companding)

Parameters

abcd-code

the 4-bit ABCD value to be transmitted

Values 0 to 15 (can be entered in decimal, binary, or hexadecimal format)

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line-balance

Syntax

line-balance {**nominal** | **800**}

Context

config>port>voice

Description

This command configures the line balance for the FXO or FXS voice interface on the 8-port Voice & Teleprotection card, for the FXO voice interface on the 8-port FXO Adapter card, and for the FXS voice interface on the 6-port FXS Adapter card.

Default

nominal (for both FXS and FXO)

Parameters

nominal

600 Ω

800

800 Ω//(100 Ω+50 nF)

loopback

Syntax

loopback {**internal-analog** | **internal-digital**}

no loopback

Context

config>port>voice>em

config>port>voice>fxo

config>port>voice>fxs

Description

This command puts the specified port or channel in loopback mode. The internal-digital parameter is the only valid option for FXO and FXS.

The **loopback** command is not saved to the system configuration between boots.

The **no** form of this command disables the loopback.

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Default

no loopback

Parameters

internal-analog

places the associated port or channel into an internal analog loopback mode. The internal analog loopback resides in the CODEC, close to the line side. It loops the outgoing analog signals back toward the system. For E&M ports, the loopback analog signal may be looped back at a different signal level due to gain/loss circuits outside of the CODEC being bypassed.

internal-digital

places the associated port or channel into an internal digital loopback mode. The internal digital loopback resides in the CODEC, close to the system side. It loops the outgoing frames back toward the system.

ring-generation

Syntax

ring-generation {**16** | **20** | **25**}

no ring-generation

Context

config>port>voice

Description

This command configures the frequency of the generated ring signal for the specified FXS voice port.

This command does not apply to FXO or E&M ports.

The **no** form of this command reverts to the default value.

Default

16

Parameters

16

16 Hz ring signal

20

20 Hz ring signal

25

25 Hz ring signal

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seized-code

Syntax

seized-code *abcd-code*

no seized-code

Context

config>port>voice>em

Description

This command defines the ABCD signaling code to be transmitted when the channel is configured to transmit seized fault signaling. The command is also used for driving/scanning the E&M signaling leads.

This command is valid only on the 6-port E&M Adapter card and only if signaling-mode is configured for E&M signaling.

The **no** form of this command reverts to the default value.

Default

0 (for Mu-Law companding)

13 (for A-Law companding)

Parameters

abcd-code

the 4-bit ABCD value to be transmitted

signaling-type

Syntax

signaling-type {**3600plar** | **1511plar** | **3600ls** | **1511profile1** | **3600re** | **1511sn137**}

Context

config>port>voice

Description

This command configures how the signaling leads operate to establish a call. To change this parameter, the voice channel must be shut down first.

For FXO, **3600ls**, **1511profile1**, **3600re**, and **1511sn137** are the only valid options; **1511profile1**, **3600re**, and **1511sn137** support A-Law companding, and **3600ls** supports Mu-Law companding.

For FXS, all signaling types are supported; **3600plar** supports both A-Law and Mu-Law companding, **1511plar**, **1511profile1**, **3600re**, and **1511sn137** support A-Law companding, and **3600ls** supports Mu-Law companding.

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Default

3600ls (for Mu-Law companding)

3600re (for A-Law companding)

Parameters

3600plar

private line automatic ringdown

1511plar

private line automatic ringdown

3600ls

loop start

1511profile1

1511 loop start

3600re

remote extension

1511sn137

1511 profile 137

signaling-lead

Syntax

signaling-lead

Context

config>port>voice>em

Description

This command enables the context to configure the input and output leads, which carry call control signals.

Default

n/a

e

Syntax

e {**high** | **low** | **end-to-end**}

Context

config>port>voice>em>signaling-lead

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Description

This command configures the output signaling lead known as the E-lead (Ear, Earth, or Exchange).

This command is valid only if signaling-mode is configured for E&M signaling.

Default

end-to-end

Parameters

high

specifies that the output signaling lead is forced on

low

specifies that the output signaling lead is forced off

end-to-end

specifies that the output signaling lead follows that of the remote end

m

Syntax

m {**high** | **low** | **end-to-end**}

Context

config>port>voice>em>signaling-lead

Description

This command configures the input signaling lead known as the M-lead (Mouth, Magneto, or Multiplexer).

This command is valid only if signaling-mode is configured for E&M signaling.

Default

end-to-end

Parameters

high

specifies that the input signaling lead is forced on

low

specifies that the input signaling lead is forced off

end-to-end

specifies that the input signaling lead follows that of the connected equipment

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signaling-mode

Syntax

signaling-mode {**em** | **transmission-only**}

Context

config>port>voice>em

Description

This command configures the signaling mode for the specified port or channel. This configuration is done for groups of three ports (ports 1 to 3 and ports 4 to 6). The first port to be configured in the group sets the signaling mode for the other ports in the group. For example, if port 1 is set for transmission only, ports 2 and 3 must also be set for transmission only, and if port 4 is set for E&M signaling, ports 5 and 6 must also be set for E&M signaling. To change the signaling mode of a port, all ports in the group must first be deconfigured.

Default

em

Parameters

em

specifies E&M signaling mode

transmission-only

specifies transmission-only mode. This parameter is not valid if audio-wires is configured for two-wire operation.

tlp-rx

Syntax

tlp-rx *decibels*

Context

config>port>voice

Description

This command configures the analog-to-digital receive transmission level point (TLP) for the specified port.

Parameters

decibels

specifies the transmission level point expressed as an integer (in tenths)

Values –16.0 to +7.0 (for E&M four-wires)

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–10.0 to +6.0 (for E&M two-wires)

–7.0 to 0.0 (for FXO and FXS)

Default 0.0 (for E&M)

–3.0 (for FXO and FXS)

tlp-tx

Syntax

tlp-tx *decibels*

Context

config>port>voice

Description

This command configures the analog-to-digital transmit transmission level point (TLP) for the specified port.

Parameters

decibels

specifies the transmission level point expressed as an integer (in tenths)

Values –16.0 to +7.0 (for E&M four-wires)

–10.0 to +6.0 (for E&M two-wires)

–4.0 to +3.0 (for FXO and FXS)

Default 0.0 (for E&M)

0.0 (for FXO and FXS)

3.14.2.28 Voice channel group commands

channel-group

Syntax

[**no**] **channel-group** *channel-group-id*

Context

config>port>voice>em

config>port>voice>fxo

config>port>voice>fxs

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Description

This command creates a DS0 channel group for a channelized E&M, FXO, or FXS voice interface.

Channel groups cannot be further subdivided.

The **no** form of this command deletes the specified channel group.

Default

n/a

Parameters

channel-group-id

specifies the channel group ID number

Values 1 (only a single DS0 channel group, the first one, can be configured)

encap-type

Syntax

encap-type cem

Context

config>port>voice>em>channel-group

config>port>voice>fxo>channel-group

config>port>voice>fxs>channel-group

Description

This command configures the encapsulation method used by the channel group.

Default

no encap-type

Parameters

cem

specifies the encapsulation method as circuit emulation (TDM)

mode

Syntax

mode access

Context

config>port>voice>em>channel-group

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config>port>voice>fxo>channel-group

config>port>voice>fxs>channel-group

Description

This command configures a channelized voice interface for access mode operation. Network mode is not supported.

An access port or channel is used for customer-facing traffic on which services are configured. A SAP can only be configured on an access port or channel.

When a port or channel is configured for access mode, the **encap-type** must be specified (in this case, **cem**) to distinguish the services on the port.

Default

access

Parameters

access

specifies the channelized E&M, FXO, or FXS voice port as service access

3.14.2.29 LAG commands

lag

Syntax

[**no**] **lag** *lag-id*

Context

config

Description

This command enables the context in which link aggregation group (LAG) attributes are defined.

A LAG groups two or more Ethernet links (ports) into one logical link. The aggregation of multiple physical links adds redundancy and improves resiliency between two network devices, and allows for load sharing.

On access, network, and hybrid ports, a LAG supports active/standby and active/active operation.

For active/standby operation, the links must be in different subgroups. Links can be on the same platform or adapter card/module or distributed over multiple components. If an active link in a LAG fails, traffic gets redistributed to the standby link.

Load sharing is supported among the active links in a LAG group.

The **no** form of this command deletes the LAG from the configuration. A LAG can only be deleted while it is administratively shut down. Any dependencies, such as IP interface configurations, must be removed from the LAG before it can be shut down.

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Default

no lag

Parameters

lag-id

the LAG identifier, expressed as a decimal integer

Values 1 to 32

access

Syntax

access

Context

config>lag

Description

This command enables the context to configure access parameters.

Default

n/a

adapt-qos

Syntax

adapt-qos {**link** | **distribute**}

Context

config>lag>access

Description

This command specifies how active/active LAG SAP queue scheduler, SAP scheduler (H-QoS), and SAP MSS scheduler QoS rates (as specified by the SLA) are distributed to each of the active LAG ports. This command applies only to access LAGs.

Default

link

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Parameters

link

specifies that the full QoS rates are configured on each of the active LAG links for SAP queue schedulers, SAP schedulers (H-QoS), and SAP MSS schedulers

distribute

specifies that the QoS rates are divided equally among the active LAG links for SAP queue schedulers, SAP schedulers (H-QoS), and egress MSS schedulers. For ingress MSS shaper schedulers, the **distribute** parameter specifies that the QoS rates are divided proportionally among the active link MDAs based on the number of active links on each MDA.

bfd

Syntax

bfd

Context

config>lag

Description

This command creates the **bfd** context and enables a micro-BFD session over the associated LAG links.

Default

n/a

family

Syntax

family ipv4

Context

config>lag>bfd

Description

This command specifies the address family for the micro-BFD session over the associated LAG links.

Default

ipv4

Parameters

ipv4

specifies that IPv4 encapsulation be used for the micro-BFD session

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bfd-on-distributing-only

Syntax

[**no**] **bfd-on-distributing-only**

Context

config>lag>bfd>family

Description

This command enables standardized implementation for interworking with other vendors by restricting micro-BFD sessions to links in the LACP distributing state only.

The configuration must be the same for both the local and remote LAG nodes.

The **no** form of this command disables restricting micro-BFD sessions; this functionality is an enhanced proprietary solution.

Default

no bfd-on-distributing-only

local-ip-address

Syntax

local-ip-address *ip-address*

no local-ip-address

Context

config>lag>bfd>family

Description

This command is used to specify the IPv4 address of the BFD source.

The **no** form of this command removes the address from the configuration.

Default

no local-ip-address

Parameters

ip-address

specifies the IPv4 address

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max-admin-down-time

Syntax

max-admin-down-time [[*down-interval*] | **infinite**]

no max-admin-down-time

Context

config>lag>bfd>family

Description

This command specifies the maximum length of time the router continues to forward traffic over a link after the micro-BFD session has transitioned to a down state because it received an Admin Down state message from the far end. The configured time allows the administrator to disable or deprovision the micro-BFD session on the local node before forwarding is halted over the associated links.

The configured interval must be the same for both the local and remote LAG nodes.

The **no** form of this command removes the time interval from the configuration.

Default

0

Parameters

down-interval

specifies the time, in seconds, that the router continues to forward traffic

Values 0 to 3600

infinite

specifies no end time to forward traffic

max-setup-time

Syntax

max-setup-time [[*up-interval*] | **infinite**]

no max-setup-time

Context

config>lag>bfd>family

Description

This command specifies the maximum length of time the router forwards traffic over a link that has transitioned from standby to active before the micro-BFD session is fully established (up state).

The configured interval must be the same for both the local and remote LAG nodes.

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The **no** form of this command returns the timer value to the default (infinite), which indicates that the state of the micro-BFD session is ignored forever.

Note: If **bfd-on-distributing-only** is enabled, you cannot configure the **max-setup-time** to a value between 0 and 3000. Similarly, if **max-setup-time** is set to a value between 0 and 3000, you cannot enable **bfd-on-distributing-only**.

Default

infinite

Parameters

up-interval

specifies the time, in milliseconds, that the router forwards traffic

Values –1 | 0 to 60000

infinite

specifies no end time to forward traffic

multiplier

Syntax

multiplier *multiplier*

no multiplier

Context

config>lag>bfd>family

Description

This command specifies the detect multiplier used for a micro-BFD session over the associated LAG links. If a BFD control packet is not received within the period specified by the *multiplier x receive-interval* parameter of the receive-interval command, the session is declared down.

The **no** form of this command removes the multiplier from the configuration.

Default

3

Parameters

multiplier

specifies the multiplier value

Values 3 to 20

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receive-interval

Syntax

receive-interval *receive-interval*

no receive-interval

Context

config>lag>bfd>family

Description

This command specifies the receive timer used for micro-BFD sessions over the associated LAG links. The receive interval is the expected interval between received BFD control packets.

The **no** form of this command removes the receive timer from the configuration.

Default

100

Parameters

receive-interval

specifies the interval time, in milliseconds

Values 10 to 100000

remote-ip-address

Syntax

remote-ip-address *ip-address*

no remote-ip-address

Context

config>lag>bfd>family

Description

This command is used to specify the IPv4 address of the BFD destination.

The **no** form of this command removes the address from the configuration.

Default

no remote-ip-address

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Parameters

ip-address

specifies the IPv4 address

shutdown

Syntax

[**no**] **shutdown**

Context

config>lag>bfd>family

Description

This command disables micro-BFD sessions for this address family.

The **no** form of this command re-enables micro-BFD sessions for this address family.

Default

shutdown

transmit-interval

Syntax

transmit-interval *transmit-interval*

no transmit-interval

Context

config>lag>bfd>family

Description

This command specifies the transmit timer used for micro-BFD sessions over the associated LAG links. The transmit interval is the interval between transmitted BFD control packets.

The **no** form of this command removes the transmit timer from the configuration.

Default

100

Parameters

transmit-interval

specifies the interval time, in milliseconds

Values 10 to 100000

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dynamic-cost

Syntax

[**no**] **dynamic-cost**

Context

config>lag

Description

This command enables OSPF or IS-IS costing of a LAG based on the available aggregated, operational bandwidth.

The path cost is dynamically calculated based on the interface bandwidth. OSPF path cost can be changed through the interface metric or the reference bandwidth.

If dynamic cost is configured, costing is applied based on the total number of links configured and the cost advertised is inversely proportional to the number of links available at the time. This requires that the number of links that are up exceeds the configured LAG threshold value; if the number of links that are up falls below the threshold, the configured threshold action determines whether, and at what cost, this LAG will be advertised (see port-threshold).

For example, a physical link in OSPF has a cost associated with it of 100, and the LAG consists of four physical links. The cost associated with the logical link is 25. If one link fails, the cost is automatically adjusted to 33.

If dynamic cost is not configured and OSPF auto-cost is configured, costing is applied based on the total number of links configured. This cost will remain static provided that the number of links that are up exceeds the configured LAG threshold value; if the number of links that are up falls below the threshold, the configured threshold action determines whether, and at what cost, this LAG will be advertised.

If dynamic cost is configured and OSPF auto-cost is not configured, the cost is determined by the cost configured on the OSPF metric, provided that the number of links that are up exceeds the configured LAG threshold value; if the number of links that are up falls below the threshold, the configured threshold action determines whether this LAG will be advertised.

If neither dynamic cost nor OSPF auto-cost is configured, the cost advertised is determined by the cost configured on the OSPF metric, provided that the number of links that are up exceeds the configured LAG threshold value; if the number of links that are up falls below the threshold, the configured threshold action determines whether this LAG will be advertised.

The **no** form of this command removes dynamic costing from the LAG.

Default

no dynamic-cost

encap-type

Syntax

encap-type {**dot1q** | **null** | **qinq**}

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no encap-type

Context

config>lag

Description

This command configures the encapsulation method used to distinguish customer traffic on a LAG.

The encapsulation type of a LAG must match that of its member links. If the encapsulation type of the LAG is changed, the encapsulation type of all its member links also changes.

The encapsulation type can be changed on the LAG only if there is no interface or service associated with it. If the MTU is set to a non-default value, it will be reset to the default value when the encapsulation type is changed.

The **no** form of this command reverts to the default encapsulation type.

Default

null – all traffic on the link belongs to a single service or VLAN

Parameters

dot1q

ingress Ethernet frames carry IEEE 802.1Q tags, each tag signifying a different service

null

ingress Ethernet frames do not use any tags to indicate a service. As a result, only one service can be configured on a link with null encapsulation.

qinq

ingress frames carry two tags, where the outer tag is the service provider tag and the inner tag is the customer service tag as defined in 802.1ad

hold-time

Syntax

hold-time down *hold-down-time*

no hold-time

Context

config>lag

Description

This command specifies the delay between detecting that a LAG is down (all active ports are down) and reporting it to the upper layer protocols.

When a failure in a LAG is detected, it is immediately advertised to the rest of the system, but subsequent failures are not advertised to upper layers until the **hold-time down** interval has expired.

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Specifying a hold time is especially useful in a 1:1 active/standby configuration because the time between detecting that the active link in the LAG is down and the time needed to activate the standby link is very short. The hold time prevents the LAG from being operationally down when switching between the active and standby link.

The **no** form of this command removes any hold time configured.

Default

no hold-time

Parameters

hold-down-time

specifies, in tenths of seconds, the hold time before a failure is reported

Values 0 to 2000

lacp

Syntax

lacp [*mode*] [**administrative-key** *admin-key*] [**system-id** *system-id*] [**system-priority** *priority*]

no lacp

Context

config>lag

Description

This command specifies the LACP mode of the LAG. By default, the LACP mode is not set.

Per the IEEE 802.1AX-2008 (IEEE 802.3ad) standard, the Link Aggregation Control Protocol (LACP) provides a standardized means for exchanging information between network devices using LAGs. LACP operates in two modes: passive and active. At least one partner must operate in active mode. For example, if the mode on the CE end is passive, the LACP mode on the 7705 SAR end must be active.

The **no** form of this command disables LACP.

Default

no lacp

Parameters

mode

specifies the mode in which LACP operates

Values passive – starts transmitting LACP packets only after receiving packets

active – initiates the transmission of LACP packets

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admin-key

specifies an administrative key value to identify the aggregation group on each port configured to use LACP. This value should be configured only in exceptional cases. If it is not specified, a random key is assigned.

Values 1 to 65535

Default 32768

system-id

the 6-byte system identifier in hexadecimal format

Values xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx

priority

the system priority

Values 0 to 65535

lacp-xmit-interval

Syntax

lacp-xmit-interval {**slow** | **fast**}

no lacp-xmit-interval

Context

config>lag

Description

This command specifies the interval signaled to the peer and tells the peer at which rate it should transmit.

The **no** form of this command returns the value to the default.

Default

fast

Parameters

slow

transmits packets every 30 seconds

fast

transmits packets every second

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lacp-xmit-stdby

Syntax

[**no**] **lacp-xmit-stdby**

Context

config>lag

Description

This command enables LACP message transmission on the standby link.

The **no** form of this command disables LACP message transmission on the standby link. Disable LACP message transmission on the standby link if the peer does not properly follow the IEEE 802.3ax standard regarding the LACP sync bit.

Default

lacp-xmit-stdby

mac

Syntax

mac *ieee-address*

no mac

Context

config>lag

Description

This command assigns a specific MAC address to the LAG.

The **no** form of this command returns the MAC address to the default value.

Default

a default MAC address is assigned by the system

Parameters

ieee-address

specifies the 48-bit MAC address in the form aa:bb:cc:dd:ee:ff or aa-bb-cc-dd-ee-ff where aa, bb, cc, dd, ee, and ff are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC, and non-IEEE reserved MAC addresses.

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mode

Syntax

mode {**access** | **network** | **hybrid**}

no mode

Context

config>lag

Description

This command configures the LAG for access, network, or hybrid mode operation.

An **access** port is used for customer-facing traffic on which services are configured. A SAP can only be configured on an access port or channel.

A **network** port participates in the service provider transport or infrastructure network when network mode is selected.

A **hybrid** port allows a single port to operate in both access and network modes.

The **no** form of this command restores the default.

Default

network

Parameters

access

configures the LAG for access mode operation

network

configures the LAG for network mode operation

hybrid

configures the LAG for hybrid mode operation

port

Syntax

port *port-id* [*port-id*] [**priority** *priority*] [**sub-group** *sub-group-id*]

no port *port-id*

Context

config>lag

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Description

This command adds ports (links) to a LAG. Multiple ports can be added in one command as long as the maximum is not exceeded. The number of links in a LAG depends on the platform or adapter card/module and the Ethernet port type.

The port configuration of the first port added to the LAG is used to compare to subsequently added ports. All ports must share the same characteristics (MTU, speed, duplex, and so on) as those of the first port; otherwise, they will not be added to the LAG.

The **priority** parameter sets the priority of the port, which is used by LACP. The lower the value, the higher the priority. The port with the highest priority is the primary port. If two or more ports share the same priority value, the port with the lowest port ID becomes the primary port.

Any configuration changes made to the primary port apply to all member ports of a LAG. For example, port hold-time and MTU settings can be modified directly on the primary port and will be applied to all member ports. Any configuration changes made to non-primary ports are rejected.

Note: All ports in a LAG must have autonegotiation disabled or set to limited mode (recommended setting is **limited**). Autonegotiation can be disabled or set to limited mode using the autonegotiate command under the **config>port>ethernet** context.

The **no** form of this command removes ports from the LAG.

Default

n/a

Parameters

port-id

specifies the physical port ID in the *slot/mda/port* format

priority

specifies the priority of a port

Values 1 to 65535

sub-group-id

identifies a LAG subgroup. Each port in a LAG must be a member of a subgroup. If no subgroup is specified for an access port, the configuration will fail. If no subgroup is specified for a network port, the port is assigned to subgroup 1.

Subgroups should only be configured on one side of a LAG, not both. If you configure the 7705 SAR with subgroups to handle active/standby operation, the partner system should not be configured with subgroups. Only having one side perform active/standby selection guarantees a consistent selection and fast convergence. Active/standby selection is signaled through LACP from one side of the LAG to the other.

Values 1 to 4

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port-threshold

Syntax

port-threshold *value* [**action** {**dynamic-cost** | **down**}]

no port-threshold

Context

config>lag

Description

This command sets a threshold value and controls the behavior of the LAG if the number of operational links is equal to or below the threshold value.

The **no** form of this command returns the value to the default.

Default

0 action down

Parameters

value

the number of operational links at or below which the configured action will be invoked for the LAG. When the number of operational links exceeds the port threshold value, any action taken for being below the threshold value will cease.

Values 0 to 7

action dynamic-cost

specifies that dynamic costing will be activated if the number of operational links is equal to or below the configured threshold value. The LAG will remain operationally up with a cost relative to the number of operational links. The link will only be regarded as operationally down when all links in the LAG are down.

action down

specifies that the LAG will be brought operationally down if the number of operational links is equal to or below the configured threshold value. The LAG will only be regarded as up when the number of operational links exceeds the configured threshold value.

selection-criteria

Syntax

selection-criteria [**best-port** | **highest-count** | **highest-weight**] [**slave-to-partner**] [**subgroup-hold-time** *hold-time*]

no selection-criteria

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Context

config>lag

Description

This command specifies which criteria is used to select the active subgroup (link) of a LAG. Every time the configuration of a link changes, the selection algorithm is applied.

The **no** form of this command returns the value to the default.

Default

highest-count

Parameters

best-port

specifies that all standby ports will have their corresponding transmitters disabled. This parameter is used in static LAG configurations.

highest-count

specifies the subgroup with the highest number of eligible member links. An eligible member link of a LAG is a member that can potentially become active.

A subgroup can have a maximum of one eligible member link.

highest-weight

specifies the subgroup with the highest aggregate weight

slave-to-partner

selects, together with the selection criteria, the active subgroup. An eligible member link of a LAG is a member that can potentially become active. This means it is operationally up (not disabled) for use by the remote side. The **slave-to-partner** parameter can be used to control whether this latter condition is taken into account. The **slave-to-partner** parameter does not apply to static LAG configurations.

It is recommended that this parameter be set.

hold-time

specifies the delay time, in tenths of a second, before switching to a newly selected active subgroup from the existing active subgroup. The timer delay applies only if the existing subgroup remains operationally up. If a value of 0 or no value is specified, the switchover occurs immediately. If a value of **infinite** is specified, no switchover will occur as long as the subgroup remains up; this setting can be overridden with the **tools>perform>force>lag-id** command. LACP must be enabled on the LAG.

Values 0 to 2000 | infinite

standby-signaling

Syntax

standby-signaling [**lacp** | **power-off**]

no standby-signaling

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Context

config>lag

Description

This command specifies how the state of a member port is signaled to the remote side when the status corresponding to this member port has a standby value.

The **no** form of this command turns off standby signaling.

Parameters

lacp

specifies that lacp is active

power-off

specifies that the standby port transmitter is disabled

3.14.2.30 Frame relay commands

frame-relay

Syntax

frame-relay

Context

config>port>tdm>ds1>channel-group

config>port>tdm>ds3

config>port>tdm>e1>channel-group

config>port>tdm>e3

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command allows access to the context to configure the frame relay LMI operational parameters for a DS1/E1 channel group, a V.35 or X.21 SDI channel group, a DS-3/E-3 clear channel port, or a channelized DS3.

The **no** form of this command removes the frame relay LMI operational parameters.

lmi-type

Syntax

lmi-type {**ansi** | **itu** | **none** | **rev1**}

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no lmi-type

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the LMI type for frame relay interfaces. LMIs are sets of enhancements to the basic frame relay specification.

Default

itu

Parameters

ansi

specifies ANSI T1.617 Annex D

itu

specifies ITU-T Q933 Annex A

none

disable frame relay LMI on the port/channel

rev1

specifies Rev 1 version of ANSI T1.617 Annex D

mode

Syntax

mode {**dce** | **dte** | **bidir**}

no lmi-type

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

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Description

This command sets the frame relay interface to the DCE, DTE, or bidirectional mode of LMI operation. The DTE mode causes the router to send status enquiries over the interface. The DCE mode causes the router to respond to status enquiries. In bidirectional mode, the router performs both DTE and DCE operation over the FR interface. The bidirectional mode applies to the ANSI and ITU LMI types only.

This feature is used when two routers are connected back-to-back, running frame relay encapsulation.

Default

dce

Parameters

dce

specifies the DCE mode

dte

specifies the DTE mode

bidir

the bidirectional mode for LMI types ANSI and ITU

n391dte

Syntax

n391dte *intervals*

no n391dte

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DTE full status polling interval for the frame relay LMI. The number specifies the frequency at which inquiries expect a full status report.

The **no** form of this command returns the n391dte counter to the default value.

Default

6

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Parameters

intervals

sets the number of exchanges to be done before requesting a full-status report. A value of 1 specifies to receive full-status messages only.

Values 1 to 255

n392dce

Syntax

n392dce *threshold*

no n392dce

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DCE error threshold for the frame relay LMI. The threshold specifies the number of errors needed to bring down a link.

The **no** form of this command returns the n392dce counter to the default value.

Default

3

Parameters

threshold

sets the number of errors that will put the channel in an operationally down state

Values 1 to 10

n392dte

Syntax

n392dte *threshold*

no n392dte

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Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DTE error threshold for the frame relay LMI. The threshold specifies the number of errors needed to bring down a link.

The **no** form of this command returns the n392dte counter to the default value.

Default

3

Parameters

threshold

sets the number of errors that will put the channel in an operationally down state

Values 1 to 10

n393dce

Syntax

n393dce *count*

no n393dce

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DCE monitored event count for the frame relay LMI.

The **no** form of this command returns the n393dce counter to the default value.

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Default

4

Parameters

count

sets the diagnostic window used to verify link integrity on the DCE interface

Values 1 to 10

n393dte

Syntax

n393dte *count*

no n393dte

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DTE monitored event count for the frame relay LMI.

The **no** form of this command returns the n393dte counter to the default value.

Default

4

Parameters

count

sets the diagnostic window used to verify link integrity on the DTE interface

Values 1 to 10

t391dte

Syntax

t391dte *keepalive*

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no t391dte

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DTE keepalive timer for the frame relay LMI.

This number specifies the interval at which the DTE sends out a keepalive response request to the DCE.

The **no** form of this command returns the t391dte keepalive timer to the default value.

Default

10

Parameters

keepalive

sets the interval, in seconds, between status inquiries issued by the DTE

Values 5 to 30

t392dce

Syntax

t392dce *keepalive*

no t392dce

Context

config>port>tdm>ds1>channel-group>frame-relay

config>port>tdm>ds3>frame-relay

config>port>tdm>e1>channel-group>frame-relay

config>port>tdm>e3>frame-relay

config>port>serial>v35>channel-group>frame-relay

config>port>serial>x21>channel-group>frame-relay

Description

This command configures the DCE keepalive timer for the frame relay LMI.

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This number specifies the interval at which the DCE checks for keepalive responses from the DTE.

The **no** form of this command returns the t392dce keepalive timer to the default value.

Default

15

Parameters

keepalive

sets the expected interval, in seconds, between status inquiries issued by the DTE

Values 5 to 30

3.14.2.31 Cisco HDLC commands

cisco-hdlc

Syntax

cisco-hdlc

Context

config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group

config>port>serial>v35>channel-group

config>port>serial>x21>channel-group

Description

This command enables the context to configure Cisco HDLC parameters. Cisco HDLC is an encapsulation protocol that governs information transfer. The protocol specifies a data encapsulation method on synchronous serial links using frame characters and checksums.

down-count

Syntax

down-count *down-count*

no down-count

Context

config>port>tdm>ds1>channel-group>cisco-hdlc

config>port>tdm>e1>channel-group>cisco-hdlc

config>port>serial>v35>channel-group>cisco-hdlc

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config>port>serial>x21>channel-group>cisco-hdlc

Description

This command configures the number of keepalive intervals that must pass without receiving a keepalive packet before the link is declared down. The nodes at the two endpoints of the cHDLC link must be provisioned with the same values.

The **no** form of this command returns the down-count to the default value.

Default

3

Parameters

down-count

sets the number of keepalive intervals that must pass without receiving a keepalive packet before the link is declared down

Values 3 to 16

keepalive

Syntax

keepalive *time-interval*

no keepalive

Context

config>port>tdm>ds1>channel-group>cisco-hdlc

config>port>tdm>e1>channel-group>cisco-hdlc

config>port>serial>v35>channel-group>cisco-hdlc

config>port>serial>x21>channel-group>cisco-hdlc

Description

This command configures the interval, in seconds, used to send periodic keepalive packets. The receiver process expects to receive a keepalive packet every keepalive interval. The link is declared down if the receiver process does not receive a keepalive within the time-out interval. The link is declared up when the number of continual keepalive packets received equals the up-count. The nodes at the two endpoints of the cHDLC link must be provisioned with the same values.

The **no** form of this command returns the keepalive interval to the default value.

Default

10

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Parameters

time-interval

sets the interval, in seconds, used to send periodic keepalive packets

Values 0 to 300. A value of 0 means no keepalive packets are sent.

up-count

Syntax

up-count *up-count*

no up-count

Context

config>port>tdm>ds1>channel-group>cisco-hdlc

config>port>tdm>e1>channel-group>cisco-hdlc

config>port>serial>v35>channel-group>cisco-hdlc

config>port>serial>x21>channel-group>cisco-hdlc

Description

This command configures the number of continual keepalive packets that have to be received in order to declare the link up. The nodes at the two endpoints of the cHDLC link must be provisioned with the same values.

The **no** form of this command returns the up-count to the default value.

Default

1

Parameters

up-count

sets the number of continual keepalive packets that must be received in order to declare the link up

Values 1 to 3

3.14.2.32 SCADA commands

scada

Syntax

scada *bridge-id*

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Context

config

Description

This command configures a SCADA bridge on the Integrated Services card.

Parameters

bridge-id

specifies a SCADA bridge, in the format *slot/mda/bridge-id* where *bridge-id* is 1 to 16

branch

Syntax

[**no**] **branch** *branch-id*

Context

config>scada

Description

This command configures a branch that is used by the configured bridge.

The **no** form of the command deletes the specified branch.

Parameters

branch-id

the branch identifier

Values 1 to 32; branches 1 and 2 are dedicated as master branches, and branches 3 to 32 are slave branches (MDDB)

1 to 30; branches 1 and 2 are dedicated as master branches, and branches 3 to 30 are slave branches (PCM with A-Law encoding)

1 to 22; branches 1 and 2 are dedicated as master branches, and branches 3 to 22 are slave branches (PCM with Mu-Law encoding)

1 to 32; in broadcast mode, branch 1 is dedicated as the master branch (VCB with A-Law encoding)

1 to 24; in broadcast mode, branch 1 is dedicated as the master branch (VCB with Mu-Law encoding)

gain

Syntax

gain

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Context

config>scada>branch

Description

This command enables the context to set gain levels for a branch.

input

Syntax

input *decibels*

Context

config>scada>branch>gain

Description

This command sets the input gain for the branch. The input gain defines the magnitude of the increase or decrease of the signal transmitted into the bridge.

Default

0

Parameters

decibels

number of decibels by which the transmitted signal is increased or decreased

Values –16 to +9 dB (in 1-dB increments)

output

Syntax

output *decibels*

Context

config>scada>branch>gain

Description

This command sets the output gain for the branch. The output gain defines the magnitude of the increase or decrease of the signal received from the bridge.

Default

0

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Parameters

decibels

number of decibels by which the received signal is increased or decreased

Values –16 to +9 dB (in 1-dB increments)

squelch

Syntax

[**no**] **squelch**

Context

config>scada>branch

Description

This command administratively enables the squelching function for the branch. The squelching function can only be enabled on a branch if it is enabled at the bridge level (**config>scada>mddb**>squelch or **config>scada>pcm**>squelch).

The **no** form of this command administratively disables the squelching function on the branch.

The command does not apply to the VCB application.

Default

squelch (slave branches)

no squelch (master branches)

mddb

Syntax

mddb

Context

config>scada

Description

This command enables the context to configure MDDB parameters for a SCADA bridge.

pcm

Syntax

pcm

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Context

config>scada

Description

This command enables the context to configure PCM multidrop bridge parameters for a SCADA bridge.

force-active

Syntax

force-active master *branch-id*

Context

config>scada>mddb

config>scada>pcm

Description

This command forces a master branch to become active. The command applies only if **redundant-mode** is set to manual mode.

Default

1

Parameters

branch-id

the master branch that is forced to become active

Values 1 or 2

redundant-mode

Syntax

redundant-mode *redundant-mode*

Context

config>scada>mddb

config>scada>pcm

Description

This command configures the redundancy mode for the master inputs of the SCADA bridge.

In manual mode, the branch must be made active manually using the **force-active** command in order to receive data from the master input. The bridge always broadcasts to both master branches.

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In auto mode, both the master branch inputs are received simultaneously. This requires the master input behavior to be similar to an RTU, which transmits data when active and transmits either all 1s (MDDB) or no data (PCM) when inactive.

Default

manual

Parameters

redundant-mode

specifies the redundancy mode for the master inputs of the SCADA bridge

Values manual | auto

report-alarm

Syntax

[**no**] **report-alarm** [**hcmOof**] [**hcmRai**]

Context

config>scada>mddb

Description

This command enables the logging of alarms.

The **no** form of the command disables the logging of alarms.

Default

no report-alarm

Parameters

hcmOof

specifies HCM out-of-frame errors

hcmRai

specifies HCM remote alarm indications

speed

Syntax

speed {**600** | **1200** | **2400** | **4800** | **9600** | **19200** | **38400** | **56000**}

Context

config>scada>mddb

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Description

This command configures the SCADA MDDB speed for RS-232 and X.21 interfaces. SCADA MDDB is supported only at subrate speeds (less than 64 kb/s) on X.21 interfaces.

Default

2400

Parameters

600

sets the SCADA MDDB speed at 600 (supported on RS-232 interfaces only)

1200

sets the SCADA MDDB speed at 1200

2400

sets the SCADA MDDB speed at 2400

4800

sets the SCADA MDDB speed at 4800

9600

sets the SCADA MDDB speed at 9600

19200

sets the SCADA MDDB speed at 19200

38400

sets the SCADA MDDB speed at 38400

56000

sets the SCADA MDDB speed at 56000

squelch

Syntax

squelch timeout *timeout*

squelch reset

no squelch

Context

config>scada>mddb

config>scada>pcm

Description

This command enables the squelching function for all branches configured on a bridge. This setting takes priority over the setting at the branch level; that is, if squelch is disabled with this command, it cannot be enabled for individual branches.

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The **no** form of this command disables the squelching function on a bridge.

Default

no squelch

Parameters

timeout

the interval between when an alarm is raised indicating that a branch has locked up and is continuing to send data to the master, and squelching is triggered

Values 1 to 120 s

reset

puts the bridge back into the normal state

squelch-recovery

Syntax

squelch-recovery [*mode*] [**time** *time*]

Context

config>scada>mddb

config>scada>pcm

Description

This command configures squelch recovery attributes. When the **squelch-recovery** mode is configured as auto, the branch will automatically be put back into the normal state after the configured time. If the branch remains locked up, the branch will automatically be squelched again.

Configuring the **squelch-recovery** mode as manual disables automatic squelch recovery. To put the bridge back into the normal state, use the **squelch reset** command.

Default

squelch-recovery manual

Parameters

mode

specifies the squelch recovery mode

Values manual | auto

time

the interval after which the branch will automatically be put back into the normal state

Values 1 to 120 s

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vcb

Syntax

vcb

Context

config>scada

Description

This command enables the context to configure voice conference bridge parameters for a SCADA bridge.

idle-code

Syntax

idle-code *abcd-code*

no idle-code

Context

config>scada>vcb

Description

This command defines the ABCD signaling code to be transmitted when the E&M interface is configured to transmit idle fault signaling (see fault-signaling).

The **no** form of the command reverts to the default value.

This command is supported only when VCB is operating in **vcb-branch-initiate** mode.

Default

0 (for Mu-Law companding)

13 (for A-Law companding)

Parameters

abcd-code

the 4-bit ABCD value to be transmitted

Values 0 to 15 (can be entered in decimal, binary, or hexadecimal format)

seized-code

Syntax

seized-code *abcd-code*

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no seized-code

Context

config>scada>vcb

Description

This command defines the ABCD signaling code to be transmitted when the E&M interface is configured to transmit seized fault signaling (see fault-signaling).

The **no** form of the command reverts to the default value.

This command is supported only when VCB is operating in **vcb-branch-initiate** mode.

Default

0 (for Mu-Law companding)

13 (for A-Law companding)

Parameters

abcd-code

the 4-bit ABCD value to be transmitted

Values 0 to 15 (can be entered in decimal, binary, or hexadecimal format)

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3.15 Show, monitor, clear, and debug command reference

3.15.1 Command hierarchies

- Show commands
- Monitor commands
- Clear commands
- Debug commands

3.15.1.1 Show commands

```
show
    - aps [aps-id] [detail]
    - card [slot-number] [detail]
    - card state
    - mda [slot [/mda]] [detail]
    - mda [slot/mda] statistics [source-mda | dest-mda | ip-transport | cflowd | mirror |
 security [encryption | firewall]]
    - mda aggregate-statistics
    - mda with-fabric-stats
    - mda [slot [/mda]] ring mda
        - fdb [mac ieee-address] [port port-id] [all]
    - external-alarms alarm [alarm-id]
    - external-alarms input [alarm-input] [detail]
    - external-alarms name [name-string] [detail]
    - external-alarms output [alarm-output] [detail]
    - lcr [lcr-id] [detail]
    - mw link [mw-link-id] [detail]
    - mw radio port-id detail] [power]
    - mw radio port-id perfmon [all | g826 | acm | power]
    - mw radio software
    - lag [lag-id] [detail] [statistics]
    - lag lag-id associations
    - lag lag-id bfd
    - lag [lag-id] description
    - lag lag-id [detail] lacp-partner
    - lag [lag-id] port
    -  macsec
            - connectivity-association [ca-name] [detail]
            - mka-session [port port-id] [sub-port sub-port]
            - mka-session [port port-id] [sub-port sub-port] detail
            - mka-session [port port-id] [sub-port sub-port] statistics
    - multilink-bundle [bundle-id | slot/mda | type {mlppp | ima-grp}] [detail]
    - multilink-bundle [bundle-id | slot/mda | [ppp [multiclass] | ima]]
    - multilink-bundle bundle-id
        - ima
            - atm [detail]
                - connections
                - pvc [vpi/vci] [detail]
                - pvp [vpi] [detail]
    - port [port-id] [statistics] [detail]
    - port port-id acr [detail]
    - port port-id cisco-hdlc
    - port port-id description
    - port port-id dot1x [detail]
```


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```
    - port port-id associations
    - port port-id ppp [detail]
    - port port-id ethernet [efm-oam | detail]
        - lldp [nearest-bridge | nearest-non-tpmr | nearest-customer] [remote-info] [detail]
    - port port-id frame-relay [detail | dlci dlci]
    - port port-id ima-link
    - port port-id macsec [sub-port-id] [detail] [statistics]
    - port port-id atm
    - port port-id atm connections
    - port port-id atm pvc [vpi/vci] [detail]
    - port port-id atm pvp [vpi] [detail]
    - port aps[-group-id][.channel]
    - port lcr[-group-id/port][.channel]
    - port-tree port-id
    - scada [bridge-id] [detail]
    - scada [bridge-id] description
    - scada [bridge-id] [detail] statistics
```

3.15.1.2 Monitor commands

```
monitor
    - fabric-profile  mda {mda-id | with-stats-enabled} {dest-mda | source-mda}
 [interval seconds] [repeat repeat] [absolute | rate]
    - lag lag-id [lag-id...(up to 5 max)] [interval seconds] [repeat repeat] [absolute | rate]
    - port port-id [port-id...(up to 5 total)] [interval seconds] [repeat repeat] [absolute |
 rate] [multiclass]
    - port port-id [port-id...(up to 5 total)] atm [interval seconds] [repeat repeat] [absolute
 | rate]
    - port port-id atm aal-5 [interval seconds] [repeat repeat] [absolute | rate]
    - port port-id atm pvc vpi/vci [interval seconds] [repeat repeat] [absolute | rate]
    - port port-id atm pvc vpi/vci aal-5 [interval seconds] [repeat repeat] [absolute | rate]
    - port port-id atm pvc vpi/vci oam [interval seconds] [repeat repeat] [absolute | rate]
    - port port-id atm pvp vpi [interval seconds] [repeat repeat] [absolute | rate]
    - port port-id atm pvp vpi oam [interval seconds] [repeat repeat] [absolute | rate]
    - scada scada-id [scada-id...(up to 5 total)] [interval seconds] [repeat repeat] [absolute
 | rate]
```

3.15.1.3 Clear commands

```
clear
    - external-alarms alarm [all | alarm-id]
    - lag lag-id statistics
    - macsec mka-session [port-id]
    - mda mda-id
    - mda mda-id statistics {source-mda | destination-mda | fabric-port | fabric-global | all}
    - mda mda-id statistics ip-transport
    - mda mda-id statistics security [encryption | firewall]
    - mda mda-id statistics mirror
    - mda mda-id statistics cflowd
    - mda mda-id ring {all | mac ieee-address | port port-id}
    - mda all
    - mw
        - link mw-link-id statistics
        - radio port-id
        - radio radio perfmon [all | g826 | acm | power]
        - rsl-history port-id
    - port port-id statistics
    - port port-id statistics bert
```


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```
    - port port-id atm pvc [vpi[/vci]] statistics
    - port port-id atm pvp [vpi] statistics
    - port port-id frame-relay dlci dlci
    - port port-id macsec sub-port-id statistics
    - scada bridge-id statistics
```

3.15.1.4 Debug commands

```
debug
    - lag [lag-id lag-id [port port-id]] [all]
    - lag [lag-id lag-id [port port-id]] [sm] [pkt] [cfg] [red] [iom-upd] [port-state] [timers]
 [sel-logic] [mc] [mc-pkt]
    - no lag [lag-id lag-id]
```


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3.15.2 Command descriptions

- Show commands
- Monitor commands
- Clear commands
- Debug commands

3.15.2.1 Show commands

- Show APS commands
- Show card commands
- Show external alarms commands
- Show T1/E1 LCR commands
- Show microwave link commands
- Show port commands
- Show ATM port commands
- Show port-tree commands
- Show LAG commands
- Show MACsec commands
- Show multilink bundle and IMA group commands
- Show ATM IMA group commands
- Show SCADA commands

Note: The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

3.15.2.1.1 Show APS commands

aps

Syntax

aps [*aps-id*] [**detail**]

Context

show

Description

This command displays automatic protection switching (APS) information.

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Parameters

aps-id

displays information for the specified APS group ID

Values 1 to 128

detail

displays detailed APS information

Output

The following outputs are examples of APS information, and Table 48: APS field descriptions describes the fields.

Output example

```
*A:7705:Dut-A>config>port# show aps
===============================================================================
APS Group Info
===============================================================================
Interface Admin  Oper   MC-Ctl  Work      Prot      Active    Tx/Rx
          State  State  State   Circuit   Circuit   Circuit   K1 Byte
-------------------------------------------------------------------------------
aps-1     Up     Up     N/A     1/5/1     1/6/1     1/5/1     PC-Tx: No-Req
===============================================================================


*A:7705:Dut-A>config>port# show aps detail
===============================================================================
APS Group: aps-1
===============================================================================
Description        : APS Group
Group Id           : 1                       Active Circuit       : 1/5/1
Admin Status       : Up                      Oper Status          : Up
Working Circuit    : 1/5/1                   Protection Circuit   : 1/6/1
Switching-mode     : Bi-directional          Switching-arch       : 1+1(sig,data)
Revertive-mode     : Non-revertive           Revert-time (min)    :
Rx K1/K2 byte      : 0x00/0x05 (No-Req on Protect)
Tx K1/K2 byte      : 0x00/0x05 (No-Req on Protect)
Current APS Status : OK
Multi-Chassis APS  : No
Neighbor           : 0.0.0.0
Control link state : N/A
Mode mismatch Cnt  : 0                       Channel mismatch Cnt : 0
PSB failure Cnt    : 1                       FEPL failure Cnt     : 1
-------------------------------------------------------------------------------
 APS Working Circuit - 1/5/1
-------------------------------------------------------------------------------
Admin Status       : Up                      Oper Status          : Up
Current APS Status : OK                      No. of Switchovers   : 0
Last Switchover    : None                    Switchover seconds   : 0
Signal Degrade Cnt : 1                       Signal Failure Cnt   : 0
Last Switch Cmd    : No Cmd                  Last Exercise Result : Unknown
Tx L-AIS           : None
-------------------------------------------------------------------------------
 APS Protection Circuit - 1/6/1
-------------------------------------------------------------------------------
Admin Status       : Up                      Oper Status          : Up
Current APS Status : OK                      No. of Switchovers   : 0
Last Switchover    : None                    Switchover seconds   : 0
Signal Degrade Cnt : 1                       Signal Failure Cnt   : 0
```


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```
Last Switch Cmd    : No Cmd                Last Exercise Result : Unknown
Tx L-AIS           : None
===============================================================================
```

Table 48: APS field descriptions

Label	Description
Interface	Specifies the APS interface name (the APS group port)
Admin State	Specifies whether the APS interface is administratively up or down
Oper State	Specifies whether the APS interface is operationally up or down
MC-Ctl state	Specifies the multi-chassis state
Work Circuit	Specifies the physical port that is acting as the working circuit for this APS group
Prot Circuit	Specifies the physical port that is acting as the protection circuit for this APS group
Active Circuit	Specifies the active circuit
Tx/Rx K1 Byte	Displays the value of the SONET/SDH K1 byte received or transmitted on the protection circuit
APS Group	Displays the APS group name
Description	Displays the APS group description
Group ID	Displays the APS group ID number
Active Circuit	Specifies the physical port that is acting as the active circuit for this APS group
Admin Status	Specifies whether the APS circuit is administratively up or down
Oper Status	Specifies whether the APS circuit is operationally up or down
Working Circuit	Displays the physical port that is acting as the working circuit for this APS group
Protection Circuit	Displays the physical port that is acting as the protection circuit for this APS group
Switching-mode	Displays the switching mode of the APS group

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Label	Description
Switching-arch	Displays the architecture of the APS group
Revertive-mode	Displays the revertive mode of the APS group: non-revertive – traffic remains on the protection line until another switch request is received revertive – when the condition that caused a switch to the protection line has been cleared, the signal is switched back to the working line
Revert-time	Displays the configured time, in minutes, to wait after the working circuit has become functional again before making the working circuit active again. If the revertive mode is non-revertive, then this field is empty.
Rx K1/K2 byte	Displays the value of the SONET/SDH K1/K2 byte received on the interface
Tx K1/K2 byte	Displays the value of the SONET/SDH K1/K2 byte transmitted on the interface
Current APS Status	Displays the current APS status
Multi-Chassis APS	Indicates whether MC-APS is configured
Neighbor	Displays the neighbor IP address. All zeros indicates the APS group is an SC-APS.
Control link state	Displays the current control link status
Mode mismatch Cnt	Indicates the number of times a conflict occurs between the current local mode and the received K2 mode information
Channel mismatch Cnt	Indicates the number of mismatches between the transmitted K1 channel and the received K2 channel that have been detected
PSB failure Cnt	Displays a count of Protection Switch Byte (PSB) failure conditions. This condition occurs when either an inconsistent APS byte or an invalid code is detected.
FEPL failure Cnt	Displays a count of far-end protection-line (FEPL) failure conditions. This condition is declared based on receiving SF on the protection line in the K1 byte.

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Label	Description
No. of Switchovers	Displays the number of times a switchover has occurred
Last Switchover	Displays the timestamp of the last switchover
Switchover seconds	Displays the cumulative Protection Switching Duration (PSD) time in seconds For a working channel, this is the cumulative number of seconds that service was carried on the protection line For the protection line, this is the cumulative number of seconds that the protection line has been used to carry any working channel traffic. This information is only valid if revertive switching is enabled.
Signal Degrade Cnt	Displays the number of times the signal was degraded
Signal Failure Cnt	Displays the number of times the signal failed
Last Switch Cmd	Reports the last switch command that was performed on a circuit
Last Exercise Result	Displays the result of the last exercise request on a circuit
Advertise Interval	Displays the advertise interval
Hold time	Displays the hold time

3.15.2.1.2 Show card commands

card

Syntax

card [*slot-number*] [**detail**]

card state

Context

show

Description

This command displays IOM and CSM information for the chassis.

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Default

displays summary information only

Parameters

slot-number

displays information for the specified card slot (always 1)

Values 1

state

displays provisioned and equipped card, adapter card, and module information

detail

displays detailed IOM information if used with the **card** *slot-number* option and displays detailed IOM and CSM card information if used without the *slot-number* option

Output

The following outputs are examples of card information:

- Card (Output example, Table 49: Card field descriptions)
- Card State (Output example, Table 50: Card state field descriptions)
- Card Detailed (Output example, Table 51: Card (IOM) detailed field descriptions)
- CSM Card (Output example, Table 52: CSM card field descriptions)

Output example

```
ALU-1# show card
===============================================================================
Card Summary
===============================================================================
Slot   Provisioned Type                          Admin Operational   Comments
           Equipped Type (if different)          State State
-------------------------------------------------------------------------------
1      iom-sar                                   up    up
A      csmv2-10g                                 up    up/active
B      csmv2-10g                                 up    down/standby
===============================================================================
```

Table 49: Card field descriptions

Label	Description
Slot	The slot number of the card in the chassis
Provisioned Type	The card type that is configured for the slot
Equipped Type (if different)	The card type that is actually populated in the slot if different from the provisioned type
Admin State	up: the card is administratively up down: the card is administratively down

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Label	Description
Operational State	up: the card is operationally up down: the card is operationally down active: the CSM is in active mode (for redundancy) standby: the CSM is in standby mode (for redundancy)
Comments	Provides other information about the card

Output example
The following examples display the card states for a 7705 SAR-8 Shelf V2, 7705 SAR-18, 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-Wx, and 7705 SAR-X.

Note:

- The **show card state** command output for the 7705 SAR-Hc, 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-Wx, and 7705 SAR-X will always appear as shown because these platforms have a fixed physical configuration.
- The **show card state** command output for the 7705 SAR-M will always appear as shown, with the exception of slot 1/3 where the provisioned type depends on the module installed in the slot.
- The **show card state** command output for the 7705 SAR-H will always appear as shown, with the exception of slots 1/2 and 1/3 where the provisioned type depends on the module installed in those slots.

For the 7705 SAR-8 Shelf V2:

```
*A:NOK-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  6
1/1    a12-sdiv2                        up    provisioned   12
1/2    a4-oc3                           up    provisioned   4
1/3    a16-chds1v2                      up    provisioned   16
1/4    a4-chds3v2                       up    provisioned   4
1/5    a8-1gb-sfp                       up    provisioned   8
1/6    a2-choc3                         up    provisioned   2
A      csmv2-10g                        up    up                        Active
B      csmv2-10g                        up    down                      Standby
===============================================================================
```

For the 7705 SAR-18:

```
*A:NOK-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                  12
```


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```
1/1    aux-alarm                       up    up
1/2    a8-1gb-sfp                      up    up
1/3    a8-1gb-sfp                      up    up            8
1/4    a8-1gb-sfp                      up    provisioned   8
1/5    a8-1gb-sfp                      up    provisioned   8
1/6    a32-chds1v2                     up    up            32
1/7    a32-chds1v2                     up    up            32
1/8    a32-chds1v2                     up    provisioned   8
1/9    a32-chds1v2                     up    provisioned   8
1/10   a4-oc3                          up    provisioned   4
1/11   a4-chds3v2                      up    provisioned   4
1/12   a2-choc3                        up    provisioned   2
1/X1   x-10GigE-v2                     up    provisioned   1
1/X2   x-10GigE-v2                     up    provisioned   10
1/X3   x-10GigE-v2                     up    provisioned   1
1/X4   x-10GigE-v2                     up    provisioned   10
A      csm-10g                         up    up                    Active
B      csm-10g                         up    down                  Standby
===============================================================================
*A:NOK-1>#
```

For the 7705 SAR-M:

```
*A:ALU-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                         up     up                3
1/1    i7-1gb                          up     up            7
1/2    i16-chds1                       up     up            16
1/3    p6-eth                          up     up            6
A      csm-2.5g                        up     up                     Active
===============================================================================
*A:ALU-1>#
```

For the 7705 SAR-H:

```
*A:ALU-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                         up     up                3
1/1    i8-1gb                          up     up            8
1/2    p4-combo                        up     up            4
1/3    p4-combo         p4-combo       up     up            4
A      csm-2.5g         csm-2.5g       up     up                    Active
===============================================================================
*A:ALU-1>#
```

For the 7705 SAR-Hc:

```
*A:ALU-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                Admin Operational   Num   Num Comments
```


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```
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up     up                2
1/1    i6-1gb                           up     up             6
1/2    i2-sdi                           up     up             2
A      csm-2.5g                         up     up                       Active
===============================================================================
*A:ALU-1>#
```

For the 7705 SAR-A:

```
*A:ALU-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                2
1/1    i12-eth-xor                      up    up             12
1/2    i8-chds1                         up    up             8
A      csm-2.5g                         up    up                    Active
===============================================================================
*A:ALU-1>#
```

For the 7705 SAR-Ax:

```
*A:sar-Ax# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                  Admin Operational   Num   Num Comments
Id         Equipped Type (if different)  State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                           up    up                2
1/1    i12-1gb-xor                       up    up             12
1/2    i1-gnss                           up    up             1
A      csm-2.5g                          up    up                      Active
===============================================================================
```

For the 7705 SAR-Wx:

```
*A:ALU-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                 Admin Operational   Num   Num Comments
Id         Equipped Type (if different) State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                          up    up                1
1/1    i5-1gb-b                         up    up             5
A      csm-2.5g                         up    up                    Active
===============================================================================
```

For the 7705 SAR-X:

```
*A:ALU-1># show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned Type                  Admin Operational   Num   Num Comments
```


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```
Id         Equipped Type (if different)  State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sar                           up    up                  3
1/1    i8-chds1-x                        up    up            8
1/2    i7-mix-eth                        up    up            7
1/3    i7-mix-eth                        up    up            7
A      csm-2.5g                          up    up                      Active
===============================================================================
*A:ALU-1>#
```

Table 50: Card state field descriptions

Label	Description
Slot/Id	The slot number of the card in the chassis
Provisioned Type	The card type that is configured for the slot
Equipped Type (if different)	The card type that is actually populated in the slot if different from the provisioned type
Admin State	up: the card is administratively up down: the card is administratively down
Operational State	up: the card is operationally up down: the card is operationally down provisioned: there is no card in the slot but it has been preconfigured failed: the installed card has operationally failed
Num Ports	The number of ports available on the provisioned card
Num MDA	The number of adapter cards installed
Comments	Indicates which CSM is the active card and which is in standby mode (for redundancy)

Output example
The following example displays detailed card (IOM) information for the 7705 SAR-8 Shelf V2.

```
*A:ALU-1># show card 1 detail
===============================================================================
Card 1
===============================================================================
Slot   Provisioned Type                          Admin Operational   Comments
           Equipped Type (if different)          State State
-------------------------------------------------------------------------------
1      iom-sar                                   up    up

IOM Card Specific Data
    Clock source                : none
    Named Pool Mode             : Disabled
    Available MDA slots         : 6
    Installed MDAs              : 2
Hardware Data
    Part number                 : Sim Part#
```


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```
    CLEI code                     : Sim CLEI
    Serial number                 : card-1
    Manufacture date              : 01012003
    Manufacturing string          : Sim MfgString card-1
    Manufacturing deviations      : Sim MfgDeviation card-1
    Administrative state          : up
    Operational state             : up
    Temperature                   : 36C
    Temperature threshold         : 75C
    Software boot (rom) version   : simulated
    Software version              : TiMOS-B-8.0.I1070 both/i386 NOKIA SAR 7705 *
    Time of last boot             : 2016/08/05 20:57:10
    Current alarm state           : alarm cleared
    Base MAC address              : a4:58:01:00:00:00
    Last bootup reason            : hard boot
    Memory capacity               : 2,031 MB
===============================================================================
```

```
A:7705:Dut-B# show card "a" detail

===============================================================================
Card A
===============================================================================
Slot      Provisioned Type                        Admin Operational   Comments
              Equipped Type (if different)        State State
-------------------------------------------------------------------------------
A         csm-2.5g                                up    up/active
BOF last modified               : N/A
Config file version             : FRI MAY 30 13:18:41 2025 UTC
Config file last modified       : N/A
Config file last saved          : N/A
M/S clocking ref state          : primary

Flash - cf3:
    Administrative State        : up
    Operational state           : up
    Serial number               : N/A
    Firmware revision           : v2.0
    Model number                : Flash
    Size                        : 249,968 KB
    Free space                  : 221,580 KB

Hardware Data
    Platform type               : 7705
    Part number                 : 3HE07353AAAA0113
    CLEI code                   : IPMZY00CRA
    Serial number               : NS132410004
    Manufacture date            : 06272013
    Administrative state        : up
    Operational state           : up
    Temperature                 : 47C
    Temperature threshold       : 95C
    Software boot (rom) version : X-0.0.private on Thu Apr 2 15:45:44 EDT
                                  2026 by jlm17
    Software version            : TiMOS-B-0.0.I5287 both/hops Nokia 7705 SAR
                                  Copyright (c) 2000-2026 Nokia.
                                  All rights reserved. All use subject to
                                  applicable license agreements.
                                  Built on Wed Apr 15 16:00:52 PDT 2026 by
                                  builder in /builds/F00/I5287/panos/main/
                                  sros
    Time of last boot           : 2000/01/01 00:00:13
    Current alarm state         : alarm cleared
```


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```
    Base MAC address              : 34:aa:99:91:6c:0b
    Firmware revision status      : acceptable
    Memory capacity               : 1,024 MB
    System timing oscillator type : TCXO
    Secure boot status            : enabled
    UEFI variables status         : ok
===============================================================================
A:7705:Dut-B#
```

Table 51: Card (IOM) detailed field descriptions

Label	Description
Slot	The slot number of the IOM (always 1)
Provisioned Type	The card type that is configured for the slot (iom-sar)
Equipped Type (if different)	The card type that is actually populated in the slot if different from the provisioned type
Admin State	up: the card is administratively up down: the card is administratively down
Operational State	up: the card is operationally up down: the card is operationally down
Comments	Provides other information about the card
Clock source	The system's clock source
Available MDA slots	The number of card slots available
Installed MDAs	The number of cards installed
Part number	The chassis part number
CLEI code	The Common Language Equipment Identifier (CLEI) code string for the router
Serial number	The chassis serial number
Manufacture date	The chassis manufacture date
Manufacturing string	A factory-inputted manufacturing text string
Manufacturing deviations	A record of changes done to the hardware or software that is outside the normal revision control process
Administrative state	up: the card is administratively up
	down: the card is administratively down
Operational State	up: the card is operationally up down: the card is operationally down

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Label	Description
	provisioned: there is no card in the slot but it has been preconfigured failed: the provisioned card has operationally failed
Temperature	The internal chassis temperature
Temperature threshold	The value above which the internal temperature must rise in order to indicate that the temperature is critical
Software boot (rom) version	The version of the boot ROM image
Software boot version	The version of the boot image
Software version	The software version number
Time of last boot	The date and time the most recent boot occurred
Current alarm state	The alarm conditions for the adapter card
Base MAC address	The base MAC address of the hardware component
Memory capacity	The memory capacity of the adapter card
Secure boot status	Indicates whether Secure Boot is enabled or disabled
UEFI variables status	The status of Secure Boot UEFI variables: • ok - the variables are up to date • update-reqd - the variables need to be updated

Output example
The following example displays detailed CSMv2 information for the 7705 SAR-8 Shelf V2.

```
*A:ALU-1># show card "a" detail
===============================================================================
Card A
===============================================================================
Slot   Provisioned Type                          Admin Operational   Comments
           Equipped Type (if different)          State State
-------------------------------------------------------------------------------
A      csmv2-10g                                 up    up/active

BOF last modified                : N/A
Config file version              : WED SEP 01 15:49:15 2015 UTC
Config file last modified        : 2016/01/12 21:08:27
Config file last saved           : 2016/07/14 18:14:07
M/S clocking ref state           : primary
Flash - cf3:
    Administrative State         : up
    Operational state            : up
    Serial number                : serial-3
    Firmware revision            : v1.0
    Model number                 : SMART CF
    Size                         : 1,953 MB
    Free space                   : 1,948 MB
Hardware Data
```


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```
    Part number                  : Sim Part#
    CLEI code                    : Sim CLEI
    Serial number                : card-2
    Manufacture date             : 01012003
    Manufacturing string         : Sim MfgString card-2
    Manufacturing deviations     : Sim MfgDeviation card-2
    Administrative state         : up
    Operational state            : up
    Temperature                  : 35C
    Temperature threshold        : 75C
    Software boot (rom) version  : simulated
    Software version             : TiMOS-B-8.0.I536 both/i386 NOKIA SAR 7705 *
    Time of last boot            : 2016/08/05 20:57:10
    Current alarm state          : alarm cleared
    Base MAC address             : a4:58:02:00:00:00
    Memory capacity              : 2,048 MB
===============================================================================
```

Table 52: CSM card field descriptions

Label	Description
Slot	The slot number of the card in the chassis
Provisioned Type	The card type that is configured for the slot
Equipped Type (if different)	The card type that is actually populated in the slot if different from the provisioned type
Admin State	up: the CSM is administratively up down: the CSM is administratively down
Operational State	up: the CSM is operationally up down: the CSM is operationally down active: the CSM is in active mode (for redundancy) standby: the CSM is in standby mode (for redundancy)
Comments	Provides other information about the card
BOF last modified	The date and time of the most recent BOF modification
Config file version	The configuration file version
Config file last modified	The date and time of the most recent config file modification
Config file last saved	The date and time of the most recent config file save
M/S clocking ref state	primary: the card is acting as the primary (active) CSM in a redundant system
	secondary: the card is acting as the standby (secondary) CSM in a redundant system
Admin State	up: the compact flash is administratively up

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Label	Description
	down: the compact flash is administratively down
Operational State	up: the compact flash is operationally up
	down: the compact flash is operationally down
Serial number	The compact flash serial number
Firmware revision	The compact flash firmware version number
Model number	The compact flash model number
Size	The memory capacity on the compact flash
Free space	The amount of free space on the compact flash
Part number	The CSM part number
CLEI code	The code used to identify the router
Serial number	The CSM serial number
Manufacture date	The chassis manufacture date
Manufacturing string	A factory-inputted manufacturing text string
Manufacturing deviations	A record of changes done to the hardware or software that is outside the normal revision control process
Administrative state	up: the CSM is administratively up
	down: the CSM is administratively down
Operational state	up: the CSM is operationally up
	down: the CSM is operationally down
Temperature	The internal chassis temperature
Temperature threshold	The value above which the internal temperature must rise in order to indicate that the temperature is critical
Software boot (rom) version	The version of the boot image
Software version	The software version number
Time of last boot	The date and time the most recent boot occurred
Current alarm state	The alarm conditions for the specific card
Base MAC address	The base MAC address of the hardware component
Memory capacity	The total amount of memory on the CSM

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mda

Syntax

mda [*slot* [*lmda*]] [**detail**]

mda *slot*/*mda* **statistics** [**source-mda** | **dest-mda** | **ip-transport** | **cflowd** | **mirror** | **security** [**encryption** | **firewall**]]

mda aggregate-statistics

mda with-fabric-stats

mda [*slot* [*lmda*]] **ring**

Context

show

Description

This command displays adapter card information and statistics collected from a specified adapter card and associated fabric ports.

The **mda** *slot*/*mda* **statistics** command applies only to the 7705 SAR-8 Shelf V2, 7705 SAR-18, and 7705 SAR-X. For the 7705 SAR-X, only the **cflowd** and **mirror** parameters apply.

The **mda aggregate-statistics** command applies only to the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-Wx. Additionally, on the 7705 SAR-Ax, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-Wx, the displays include IPSec security statistics. On the 7705 SAR-Ax, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-Wx, the displays also include firewall queue statistics. On the 7705 SAR-H and 7705 SAR-Hc, the displays also include IP transport statistics.

The **mda with-fabric-stats** command applies only to 7705 SAR-8 Shelf V2 and 7705 SAR-18.

The **mda** *slot*/*mda* **ring** command applies only to the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module

If no command line options are specified, a summary output of all adapter cards is displayed.

Parameters

slot

the slot number of the IOM

Values 1

mda

the slot number of the adapter card or the fixed platform MDA. If this parameter is omitted, information for all MDAs is displayed

source-mda

displays network and access ingress traffic statistics from the specified adapter card going toward the fabric and toward a destination adapter card. The sum of traffic forwarded or dropped is also displayed.

Statistics from the fabric are not displayed when this keyword is used.

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dest-mda

displays network and access ingress statistics for all adapter cards going toward the fabric and destined for the specified destination adapter card. The following are also collected: global fabric statistics, fabric firewall statistics, and fabric port statistics if the destination adapter card has the collection of fabric statistics enabled.

The sum of traffic forwarded or dropped is also displayed.

ip-transport

displays IP transport queue forward and drop statistics

cflowd

displays cflowd queue statistics

security encryption

displays IPSec encryption statistics for the 7705 SAR-8 Shelf V2 and 7705 SAR-18 only

security firewall

displays firewall security statistics for the 7705 SAR-8 Shelf V2 and 7705 SAR-18 only

aggregate-statistics

displays all applicable statistics aggregated over all MDAs in the system. This command applies only to the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-Wx.

with-fabric-stats

displays all adapter cards that have been configured to collect fabric port statistics. For the 7705 SAR-8 Shelf V2, only one adapter card can have fabric statistics enabled. For the 7705 SAR-18, multiple adapter cards can have fabric statistics enabled.

ring

accesses the commands to show the FDB and statistics on a ring adapter card. See the fdb command for more information.

Output

The following outputs are examples of MDA information:

- MDA (Output example, Table 53: MDA field descriptions)
- MDA Detailed (Output example, Table 54: MDA detail field descriptions)
- MDA Fabric Statistics (Output example (source-mda and dest-mda), Table 55: MDA fabric statistics field descriptions)
- MDA Fabric Statistics (Output example (ip-transport statistics), Table 56: MDA fabric IP-transport statistics field descriptions)
- MDA Fabric Statistics (Output example (cflowd statistics), Table 57: MDA fabric cflowd statistics field descriptions)
- MDA Fabric Statistics (Output example (mirror statistics), Table 58: MDA fabric mirror statistics field descriptions)
- MDA Fabric Security Encryption Statistics (Output example (security encryption), Table 59: MDA fabric security encryption statistics field descriptions)
- MDA Fabric Security Firewall Statistics (Output example (security firewall), Table 60: MDA fabric security firewall statistics field descriptions)

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- MDA With Fabric Statistics (Output example, Table 61: MDA with fabric statistics field descriptions)
- MDA Aggregate-Statistics (Output example, Table 62: MDA aggregate statistics field descriptions)

Output example

```
*A:ALU-1># show mda 1/1
===============================================================================
MDA 1/1
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)          State     State
-------------------------------------------------------------------------------
1     1     a6-em                                     up        provisioned
===============================================================================
*A:ALU-1>


*A:ALU-1># show mda 1/2
===============================================================================
MDA 1/2
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)          State     State
-------------------------------------------------------------------------------
1     2     a4-oc3                                    up        provisioned
===============================================================================
*A:ALU-1>#

*A:ALU-1># show mda 1/3
===============================================================================
MDA 1/3
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)          State     State
-------------------------------------------------------------------------------
1     3     a16-chds1v2                               up        provisioned
===============================================================================
*A:ALU-1>#

*A:ALU-1># show mda 1/4
===============================================================================
MDA 1/4
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)          State     State
-------------------------------------------------------------------------------
1     4     a4-chds3v2                                up        provisioned
===============================================================================
*A:NOK-1>#

*A:NOK-1># show mda 1/6
===============================================================================
MDA 1/6
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)          State     State
-------------------------------------------------------------------------------
1     6     a2-choc3              Unknown             up        failed
===============================================================================
*A:NOK-1>#
```


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Table 53: MDA field descriptions

Label	Description
Slot	The card slot number (always 1)
Mda	The adapter card slot number
Provisioned Type	The provisioned adapter card type
Equipped Type (if different)	The adapter card type actually installed in the slot if different from the provisioned type
Admin State	up: the adapter card is administratively up down: the adapter card is administratively down
Operational State	up: the adapter card is operationally up down: the adapter card is operationally down provisioned: there is no adapter card in the slot but it has been preconfigured failed: the provisioned adapter card has operationally failed

Output example
The following example shows the details of a 12-port Serial Data Interface card in slot 1.

```
*A:ALU-1># show mda 1/1 detail
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)           State     State
-------------------------------------------------------------------------------
1     1     a12-sdiv2                                 up        provisioned

MDA Specific Data
    Maximum port count            : 12
    Number of ports equipped      : 12
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Serial, PPP, FR, HDLC, cHDLC, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : Serial RS-232
    Max number of channels        : 12
    Channels in use               : 2
CEM MDA Specific Data
    Clock Mode                    : n/a
Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
```


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```
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : provisioned
    Software version              : N/A
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
    Base MAC address              :
===============================================================================
*A:ALU-1>#
```

The following example shows the details of a 6-port E&M Adapter card in slot 1.

```
*A:ALU-1># show mda 1/1 detail
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
               Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
1     1     a6-em                                        up        provisioned

MDA Specific Data
    Maximum port count            : 6
    Number of ports equipped      : 6
    Network ingress queue policy  : default
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Voice, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : Voice E&M
    Max number of channels        : 6
    Channels in use               : 6
CEM MDA Specific Data
    Clock Mode                    : n/a

Voice MDA Specific Data
    Companding Law                : a-law
    Signaling Type                : type-v
Hardware Data
    Part number                   : 3HE03126AAAA0101
    CLEI code                     : IPUCAXU1AA
    Serial number                 : NS000L00065
    Manufacture date              : 10142009
    Manufacturing string          : E&M Init
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 31C
    Temperature threshold         : 75C
    Software version              : N/A
    Time of last boot             : 2010/01/08 14:08:17
    Current alarm state           : alarm cleared
    Base MAC address              : 00:25:ba:c2:cb:fe
===============================================================================
*A:ALU-1>#
```


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The following example shows the details of a 4-port OC3/STM1 Clear Channel Adapter card in slot 2.

```
*A:ALU-1># show mda 1/2 detail
===============================================================================
MDA 1/2 detail
===============================================================================
Slot  Mda   Provisioned Type                            Admin     Operational
              Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
1     2     a4-oc3                                      up        provisioned

MDA Specific Data
    Maximum port count            : 4
    Number of ports equipped      : 4
    Network ingress queue policy  : default
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Sonet, PPP, ATM
    Min channel size              : Sonet STS-3
    Max channel size              : Sonet STS-3
    Max number of channels        : 4
    Channels in use               : 3
Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : provisioned
    Software version              : N/A
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
    Base MAC address              :
===============================================================================
A:ALU-1>#
```

The following example shows the details of a 16-port T1/E1 ASAP Adapter card in slot 6.

```
*A:NOK-1># show mda 1/6 detail
===============================================================================
MDA 1/6 detail
===============================================================================
Slot  Mda   Provisioned Type                            Admin     Operational
              Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
      6     a16-chds1v2                                 up        provisioned
              (not equipped)
MDA Specific Data
    Maximum port count            : 16
    Number of ports equipped      : 16
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Fabric Port Speed-Hardware    : 1000000 kbps
    Fabric Port Speed-In-Use      : 1000000 kbps
```


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```
    Network security queue policy : 1
    Access security queue policy  : 1
    Security aggregate rate       : 50000
    Access ingress shaper policy  : N/A
    Capabilities                  : TDM, PPP, ATM, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS1
    Max number of channels        : 256
    Channels in use               : 0
    Capability mode               : cem-atm-ppp
CEM MDA Specific Data
    Clock Mode                    : dcr-acr
    Timestamp Frequency           : 77760
ATM MDA Specific Data
    ATM Mode                      : max8k-vc
Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Administrative state          : up
    Operational state             : provisioned
    Software version              : (Not Specified)
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
    Base MAC address              :
===============================================================================
A:NOK-1>#
```

The following example shows the details of a 4-port DS3/E3 Adapter card in slot 4.

```
*A:NOK-1># show mda 1/4 detail
===============================================================================
MDA 1/4 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
               Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
1     4     a4-chds3v2                                   up        up

MDA Specific Data
    Maximum port count            : 4
    Number of ports equipped      : 4
    Network ingress queue policy  : default
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : TDM, PPP, ATM
    Min channel size              : PDH DS3
    Max channel size              : PDH DS3
    Max number of channels        : 2048
    Channels in use               : 4
Hardware Data
    Part number                   : 3HE04962AAAA0101
    CLEI code                     : IPUIBFXDAA
    Serial number                 : NS000L0007N
    Manufacture date              : 10272009
    Manufacturing string          : Initial release
    Manufacturing deviations      :
    Administrative state          : up
```


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```
    Operational state             : up
    Temperature                   : 28C
    Temperature threshold         : 75C
    Software version              : N/A
    Time of last boot             : 2009/11/23 12:59:45
    Current alarm state           : alarm cleared
    Base MAC address              : 00:25:ba:33:2d:7c
===============================================================================
```

The following example shows the details of a 2-port OC3/STM1 Channelized Adapter card in slot 6.

```
A:ALU-1># show mda 1/6 detail
===============================================================================
MDA 1/6 detail
===============================================================================
Slot  Mda   Provisioned Type                            Admin     Operational
               Equipped Type (if different)            State     State
-------------------------------------------------------------------------------
1     6     a2-choc3                                   up        failed

MDA Specific Data
    Maximum port count            : 2
    Number of ports equipped      : 2
    Network ingress queue policy  : default
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Sonet, TDM, PPP, ATM, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS3
    Max number of channels        : 512
    Channels in use               : 1
CEM MDA Specific Data
    Clock Mode                    : adaptive
Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : failed
    Failure Reason                : MDA type unknown in this build
    Software version              : N/A
    Time of last boot             : N/A
    Current alarm state           : alarm active
    Base MAC address              :
===============================================================================
A:ALU-1>#
```

The following example shows the details of an 8-port Voice & Teleprotection card in slot 6.

```
*A:ALU-1> show mda 1/6 detail
===============================================================================
MDA 1/6 detail
===============================================================================
Slot  Mda   Provisioned Type                            Admin     Operational
               Equipped Type (if different)            State     State
```


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```
-------------------------------------------------------------------------------
1     6     a8-vt                                       up        up

MDA Specific Data
    Maximum port count            : 8
    Number of ports equipped      : 8
    Network ingress queue policy  : default
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : TDM, Voice, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : Voice FXO
    Max number of channels        : 8
    Channels in use               : 2

CEM MDA Specific Data
    Clock Mode                    : n/a

Voice MDA Specific Data
    Companding Law                : mu-law
    Signaling Type                : n/a

Hardware Data
    Part number                   : Sim Part#
    CLEI code                     : Sim CLEI
    Serial number                 : mda-6
    Manufacture date              : 01012003
    Manufacturing variant         : ch1: 1471 ch2: 1491
    Manufacturing string          : Sim MfgString mda-6
    Manufacturing deviations      : Sim MfgDeviation mda-6
    Administrative state          : down
    Operational state             : down
    Temperature                   : 36C
    Temperature threshold         : 75C
    Software version              : N/A
    Time of last boot             : 2011/07/18 14:39:12
    Current alarm state           : alarm cleared
    Base MAC address              : a4:8d:01:06:00:01
===============================================================================
*A:ALU-1>#
```

The following example shows the details of an 8-port C37.94 Teleprotection card in slot 12 on a 7705 SAR-18.

```
*A:Sar18> show mda 1/12 detail
===============================================================================
MDA 1/12 detail
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
              Equipped Type (if different)           State     State
-------------------------------------------------------------------------------
1     12    a8-c3794                                 up        provisioned
              (not equipped)
MDA Specific Data
    Maximum port count            : 8
    Number of ports equipped      : 8
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
```


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```
    Fabric Stats Enabled          : FALSE
    Fabric Port Speed-Hardware    : 1000000 kbps
    Fabric Port Speed-In-Use      : 1000000 kbps
    Network security queue policy : 1
    Access security queue policy  : 1
    Security aggregate rate       : 50000
    Access ingress shaper policy  : N/A
    Capabilities                  : TDM, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : Data TPIF
    Max number of channels        : 8
    Channels in use               : 0
CEM MDA Specific Data
    Clock Mode                    : n/a
Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Administrative state          : up
    Operational state             : provisioned
    Software version              : (Not Specified)
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
    Base MAC address              :
===============================================================================
A:Sar18 Dut-B#
```

The following example shows the details of an 8-port FXO Adapter card in slot 6.

```
*A:ALU-1> show mda 1/6 detail
===============================================================================
MDA 1/6 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
               Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
1     6     a8-fxo                                       up        up

MDA Specific Data
    Maximum port count            : 8
    Number of ports equipped      : 8
    Network ingress queue policy  : default
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Voice, CEM
    Min channel size              : PDH DS0 Group
    Max channel size              : Voice FXO
    Max number of channels        : 8
    Channels in use               : 1

CEM MDA Specific Data
    Clock Mode                    : n/a

Voice MDA Specific Data
    Companding Law                : mu-law
    Signaling Type                : n/a

Hardware Data
    Part number                   : Sim Part#
    CLEI code                     : Sim CLEI
```


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```
    Serial number                : mda-6
    Manufacture date             : 01012003
    Manufacturing variant        : ch1: 1471 ch2: 1491
    Manufacturing string         : Sim MfgString mda-6
    Manufacturing deviations     : Sim MfgDeviation mda-6
    Administrative state         : down
    Operational state            : down
    Temperature                  : 36C
    Temperature threshold        : 75C
    Software version             : N/A
    Time of last boot            : 2011/07/18 14:39:12
    Current alarm state          : alarm cleared
    Base MAC address             : a4:8d:01:06:00:01
===============================================================================
*A:ALU-1>#
```

The following example shows the details of a 10-port 1GigE/1-port 10GigE X-Adapter card in x10-1gb-sfp mode in slot X1 on a 7705 SAR-18.

```
*A:ALU-1> show mda 1/X1 detail
===============================================================================
MDA 1/X1 detail
===============================================================================
Slot  Mda   Provisioned Type                           Admin     Operational
               Equipped Type (if different)           State     State
-------------------------------------------------------------------------------
1     X1     x-10GigE-v2                             up        up

MDA Specific Data
    Maximum port count           : 10
    Number of ports equipped     : 10
    Network ingress queue policy : default
    Network ingress fabric policy : 1
    Access ingress fabric policy : 1
    Fabric Stats Enabled         : FALSE
    Capabilities                 : Ethernet
    Min channel size             : Sonet STS-192
    Max channel size             : Sonet STS-192
    Max number of channels       : 10
    Channels in use              : 2
    Capability mode              : x10-1gb-sfp

Hardware Data
    Part number                  : Sim Part#
    CLEI code                    : Sim CLEI
    Serial number                : mda-X1
    Manufacture date             : 01012011
    Manufacturing variant        : ch1: 1471 ch2: 1491
    Manufacturing string         : Sim MfgString mda-X1
    Manufacturing deviations     : Sim MfgDeviation mda-X1
    Administrative state         : down
    Operational state            : down
    Software version             : N/A
    Time of last boot            : 2011/07/18 14:39:12
    Current alarm state          : alarm cleared
    Base MAC address             : a4:8d:01:06:00:01
===============================================================================
*A:ALU-1>#
```


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The following example shows the details of a 2-port 10GigE (Ethernet) Adapter card in slot 11 on a 7705 SAR-18.

```
*A:ALU-1> show mda 1/11 detail
===============================================================================
MDA 1/11 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
               Equipped Type (if different)              State     State
-------------------------------------------------------------------------------
1     11    a2-10gb-xfp                                  up        failed

MDA Specific Data
    Maximum port count            : 3
    Number of ports equipped      : 3
    Sync-E Capable                : TRUE
    Network ingress queue policy  : r.nw.q3
    Network Ring queue policy     : r.nw.q2
    Network Ring qos policy       : 1
    Network ingress fabric policy : 1
    Access ingress fabric policy  : 1
    Fabric Stats Enabled          : FALSE
    Capabilities                  : Ethernet
    Min channel size              : Sonet STS-192
    Max channel size              : Sonet STS-192
    Max number of channels        : 3
    Channels in use               : 0
Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : failed
    Failure Reason                : MDA type unknown in this build
    Software version              : N/A
    Time of last boot             : N/A
    Current alarm state           : alarm active
    Base MAC address              :
-------------------------------------------------------------------------------
QOS Settings
-------------------------------------------------------------------------------
===============================================================================
*A:ALU-1>#
```

Table 54: MDA detail field descriptions

Label	Description
Slot	The card slot number (always 1)
Mda	The adapter card slot number
Provisioned Type	The provisioned adapter card type
Equipped Type (if different)	The adapter card type actually installed in the slot if different from the provisioned type

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Label	Description
Admin State	up: the adapter card is administratively up down: the adapter card is administratively down
Operational State	up: the adapter card is operationally up down: the adapter card is operationally down provisioned: there is no adapter card in the slot but it has been preconfigured failed: the provisioned adapter card has operationally failed
MDA Specific Data	
Maximum port count	The maximum number of ports that can be equipped on the adapter card
Number of ports equipped	The number of ports that are actually equipped on the adapter card
Transmit timing selected	The CSM clock used for the transmit clock. It should be the active CSM except during a system or MDA initialization or during an activity switch.
Sync-E Capable	TRUE: the adapter card supports synchronous Ethernet timing
	FALSE: the adapter card does not support synchronous Ethernet timing
Sync interface timing status	The status of synchronization interface timing; it should be qualified except during a system or MDA initialization or during an activity switch
Network Ring queue policy	The network queue policy applied to the ring port on the adapter card to define the queuing structure for this object
Network Ring qos policy	The network QoS policy applied to the ring port on this adapter card
Network ingress queue policy	The network ingress queue policy applied to the adapter card to define the queuing structure for this object
Network ingress fabric policy	The network ingress fabric policy applied to the adapter card
Access ingress fabric policy	The access ingress fabric policy applied to the adapter card
Fabric Stats Enabled	TRUE: the collection of fabric statistics is enabled on the adapter card

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Label	Description
	FALSE: the collection of fabric statistics is disabled on the adapter card
Capabilities	The protocols that can be run on the adapter card
Min channel size	The minimum channel size on the adapter card
Max channel size	The maximum channel size on the adapter card
Max number of channels	The maximum number of channels supported on the adapter card
Channels in use	The number of channels being used on the adapter card
Capability mode	The adapter card mode (**mda-mode**) for cards that support mda-mode
CEM MDA Specific Data	
Clock Mode	The clocking mode used on the adapter card
Voice MDA Specific Data	
Companding Law	The companding law used on the adapter card
Signaling Type	The signaling type used on the adapter card
Hardware Data	
Part number	The hardware part number
CLEI code	The code used to identify the adapter card
Serial number	The adapter card part number
Manufacture date	The adapter card manufacture date
Manufacturing variant	The adapter card manufacture variant
Manufacturing string	A factory-inputted manufacturing text string
Manufacturing deviations	A record of changes done to the hardware or software that is outside the normal revision control process
Administrative state	up: the adapter card is administratively up
	down: the adapter card is administratively down
Operational state	up: the adapter card is operationally up
	down: the adapter card is operationally down
	provisioned: there is no adapter card in the slot but it has been preconfigured

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Label	Description
	failed: the provisioned adapter card has operationally failed
Temperature	The internal chassis temperature
Temperature threshold	The value above which the internal temperature must rise in order to indicate that the temperature is critical
Software version	The software version number
Time of last boot	The date and time the most recent boot occurred
Current alarm state	The alarm conditions for the specific adapter card
Base MAC address	The base MAC address of the hardware component

Output example (source-mda and dest-mda)
The following example shows an MDA fabric statistics display if the **source-mda** keyword is used.

```
*A:ALU-1># show mda 1/5 statistics source-mda
===============================================================================
Statistic of Source MDA 1/5
===============================================================================
-------------------------------------------------------------------------------
Unicast to Destination MDA  1/1     Packets              Octets
    Network In Profile forwarded :  4203305              311044570
    Network In Profile dropped   :  933497               69078778
    Network Out Profile forwarded:  934317               69139458
    Network Out Profile dropped  :  700120               51808880
    Access In Profile forwarded  :  4246150              314215100
    Access Out Profile forwarded :  708419               52423006
    Access dropped               :  1885052              139493848
Unicast to Destination MDA  1/2     Packets              Octets
    Network In Profile forwarded :  187130               13847620
    Network In Profile dropped   :  41164                3046136
    Network Out Profile forwarded:  41766                3090684
    Network Out Profile dropped  :  30873                2284602
    Access In Profile forwarded  :  640974               47432076
    Access Out Profile forwarded :  108549               8032626
    Access dropped               :  279832               20707568
Unicast to Destination MDA  1/3     Packets              Octets
    Network In Profile forwarded :  229693               16997282
    Network In Profile dropped   :  50499                3736926
    Network Out Profile forwarded:  51280                3794720
    Network Out Profile dropped  :  37872                2802528
    Access In Profile forwarded  :  140170               10372580
    Access Out Profile forwarded :  24595                1820030
    Access dropped               :  58680                4342320
Unicast to Destination MDA  1/4     Packets              Octets
    Network In Profile forwarded :  403805               29881570
    Network In Profile dropped   :  89105                6593770
    Network Out Profile forwarded:  90008                6660592
    Network Out Profile dropped  :  66827                4945198
    Access In Profile forwarded  :  256362               18970788
    Access Out Profile forwarded :  44097                3263178
    Access dropped               :  109920               8134080
Unicast to Destination MDA  1/5     Packets              Octets
```


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```
    Network In Profile forwarded :  396270               403402860
    Network In Profile dropped   :  87752                89331536
    Network Out Profile forwarded:  88190                89777420
    Network Out Profile dropped  :  65817                67001706
    Access In Profile forwarded  :  2719693              201257282
    Access Out Profile forwarded :  455549               33710626
    Access dropped               :  1202105              88955770
Unicast to Destination MDA  1/6     Packets              Octets
    Network In Profile forwarded :  585296               595831328
    Network In Profile dropped   :  129704               132038672
    Network Out Profile forwarded:  130222               132565996
    Network Out Profile dropped  :  97278                99029004
    Access In Profile forwarded  :  5948753              440207722
    Access Out Profile forwarded :  995919               73698006
    Access dropped               :  2630809              194679866
Multipoint                          Packets              Octets
    Network In Profile forwarded :  585296               595831328
    Network In Profile dropped   :  129704               132038672
    Network Out Profile forwarded:  130222               132565996
    Network Out Profile dropped  :  97278                99029004
    Access In Profile forwarded  :  5948753              440207722
    Access Out Profile forwarded :  995919               73698006
    Access dropped               :  2630809              194679866
-------------------------------------------------------------------------------
    Total Network forwarded :       7341282              1676034100
    Total Network dropped   :       2330508              531697736
    Total Access forwarded  :       16289230             1205403020
    Total Access dropped    :       6166398              456313452
```

The following example shows an MDA fabric statistics display if the **dest-mda** keyword is used.

```
*A:ALU-1># show mda 1/5 statistics dest-mda
===============================================================================
Statistic of Destination MDA 1/5
===============================================================================

-------------------------------------------------------------------------------
Drop Events: 0
-------------------------------------------------------------------------------
Unicast from Source MDA  1/1        Packets              Octets
    Network In Profile forwarded :  520148               529510664
    Network In Profile dropped   :  64852                66019336
    Network Out Profile forwarded:  65075                66246350
    Network Out Profile dropped  :  32425                33008650
    Access In Profile forwarded  :  5614550              415476700
    Access Out Profile forwarded :  661714               48966836
    Access dropped               :  657705               48670170
Unicast from Source MDA  1/2        Packets              Octets
    Network In Profile forwarded :  4146                 1733028
    Network In Profile dropped   :  480                  200640
    Network Out Profile forwarded:  531                  221958
    Network Out Profile dropped  :  240                  100320
    Access In Profile forwarded  :  204744               15151056
    Access Out Profile forwarded :  15318                1133532
    Access dropped               :  25565                1891810
Unicast from Source MDA  1/3        Packets              Octets
    Network In Profile forwarded :  32470                30617292
    Network In Profile dropped   :  3890                 3664068
    Network Out Profile forwarded:  4127                 3894682
    Network Out Profile dropped  :  1933                 1818878
    Access In Profile forwarded  :  510301               37762274
    Access Out Profile forwarded :  34691                2567134
```


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```
    Access dropped               :  66951                4954374
Unicast from Source MDA  1/4       Packets               Octets
    Network In Profile forwarded :  0                    0
    Network In Profile dropped   :  0                    0
    Network Out Profile forwarded:  0                    0
    Network Out Profile dropped  :  0                    0
    Access In Profile forwarded  :  491695               126976722
    Access Out Profile forwarded :  24867                7435050
    Access dropped               :  23790                2271932
Unicast from Source MDA  1/5       Packets               Octets
    Network In Profile forwarded :  950101               967202818
    Network In Profile dropped   :  118649               120784682
    Network Out Profile forwarded:  118803               120941454
    Network Out Profile dropped  :  59322                60389796
    Access In Profile forwarded  :  187631               191008358
    Access Out Profile forwarded :  12594                12820692
    Access dropped               :  24894                25342092
Unicast from Source MDA  1/6       Packets               Octets
    Network In Profile forwarded :  1494108              1521001944
    Network In Profile dropped   :  186642               190001556
    Network Out Profile forwarded:  186811               190173598
    Network Out Profile dropped  :  93314                94993652
    Access In Profile forwarded  :  1473381              1499873582
    Access Out Profile forwarded :  173421               176539142
    Access dropped               :  173142               176255492
-------------------------------------------------------------------------------
Total Unicast Network forwarded  :  3376320              3431543788
Total Unicast Network dropped    :  561747               570981578
Total Unicast Access forwarded   :  9404907              2535711078
Total Unicast Access dropped     :  972047               259385870

Fabric Firewall Stats              Packets               Octets
    Unicast Forwarded   :          1929191               N/A
    Multicast Forwarded :          1046297               N/A
    Total Forwarded     :          2975488               0
    Total Dropped       :          0                     0

Fabric Global Stats                Packets               Octets
    Unicast Forwarded   :          1929191               N/A
    Multicast Forwarded :          1046297               N/A
    Total Forwarded     :          2975488               N/A
    Total Dropped       :          0                     N/A
===============================================================================
*A:ALU-1>#
```

Table 55: MDA fabric statistics field descriptions

Label	Description
Statistic of Source MDA	If the source-mda keyword is specified in the show statistics command, displays the network and access ingress traffic statistics from the specified adapter card toward the fabric and toward a destination adapter card. The sum of traffic forwarded or dropped is also displayed.
Unicast to Destination MDA Packets/Octets [1]	Network In Profile forwarded: the number of unicast network in-profile packets/octets forwarded from the adapter card specified in the show mda command

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Label	Description
	toward the fabric, then to the output destination adapter card
	Network In Profile dropped: the number of unicast network in-profile packets/octets dropped from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Network Out Profile forwarded: the number of unicast network out-of-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Network Out Profile dropped: the number of unicast network out-of-profile packets/octets dropped from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Access In Profile forwarded: the number of unicast access in-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Access Out Profile forwarded: the number of unicast access out-of-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Access dropped: the number of unicast access out-of-profile packets/octets and access in-profile packets/octets dropped from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
Multipoint (for source-mda) [1]	Network In Profile forwarded: the number of multipoint network in-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Network In Profile dropped: the number of multipoint network in-profile packets/octets dropped from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card

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Label	Description
	Network Out Profile forwarded: the number of multipoint network out-of-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Network Out Profile dropped: the number of multipoint network out-of-profile packets/octets dropped from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Access In Profile forwarded: the number of multipoint access in-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Access Out Profile forwarded: the number of multipoint access out-of-profile packets/octets forwarded from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
	Access dropped: the number of multipoint access out-of-profile packets/octets and access in-profile packets/octets dropped from the adapter card specified in the show mda command toward the fabric, then to the output destination adapter card
Total Network forwarded Packets/ Octets	The number of network in-profile and out-of-profile packets/octets forwarded
Total Network dropped Packets/ Octets	The number of network in-profile and out-of-profile packets/octets dropped
Total Access forwarded Packets/ Octets	The number of access in-profile and out-of-profile packets/octets forwarded
Total Access dropped Packets/ Octets	The number of access in-profile and out-of-profile packets/octets dropped
Statistic of Destination MDA	If the dest-mda keyword is specified in the show statistics command, displays the network and access ingress statistics from all source adapter cards going toward the fabric and destined for the specified adapter card. Global fabric statistics are also displayed, as well as the fabric port statistics if the destination adapter card has the collection of fabric statistics enabled. The sum of traffic forwarded or dropped is also displayed.

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Label	Description
Drop Events	The number of packets that are dropped from the buffer at the 7705 SAR-8 Shelf V2 or 7705 SAR-18 adapter card port instead of being transferred to the fabric. Drop events only occur if an excessive amount of traffic is flowing through the ports, which causes the buffers to fill up; under normal circumstances, this statistic should always be 0.
Unicast from Source MDA Packets/Octets [2]	Network In Profile forwarded: the number of network in-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network In Profile dropped: the number of network in-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network Out Profile forwarded: the number of network out-of-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network Out Profile dropped: the number of network out-of-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access In Profile forwarded: the number of access in-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access Out Profile forwarded: the number of access out-of-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access dropped: the number of access in-profile packets/octets and out-of-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
Total Unicast Network forwarded Packets/Octets	The number of unicast network in-profile and out-of-profile packets/octets forwarded
Total Unicast Network dropped Packets/Octets	The number of unicast network in-profile and out-of-profile packets/octets dropped

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Label	Description
Total Unicast Access forwarded Packets/Octets	The number of unicast access in-profile and out-of-profile packets/octets forwarded
Total Unicast Access dropped Packets/Octets	The number of unicast access in-profile and out-of-profile packets/octets dropped
Fabric Global Stats Packets/ Octets [3]	If the dest-mda keyword is specified in the show mda statistics command, displays the global fabric statistics collected from the fabric. The statistics include all traffic switched over the fabric, which includes traffic to all adapter cards and all internal traffic such as traffic destined for the CSM.
	Unicast Forwarded: the number of forwarded unicast packets/octets switched over the fabric
	Multicast Forwarded: the number of forwarded multicast packets/octets switched over the fabric
	Total Forwarded: the total number of forwarded packets/octets switched over the fabric
	Total Dropped: the total number of dropped packets/ octets switched over the fabric

Notes:

1. Destination MDA 1/x in the output field, where x = 1 to 6 on the 7705 SAR-8 Shelf V2 and 1 to 12 and X1 to X4 on the 7705 SAR-18.
2. Source MDA 1/*x* in the output field, where *x* = 1 to 6 on the 7705 SAR-8 Shelf V2 and 1 to 12 and X1 to X4 on the 7705 SAR-18.
3. Fabric Global Stats octet counts are supported only on the 7705 SAR-18. For other 7705 SAR products, "N/A" is displayed in these fields.

Output example (ip-transport statistics)
The following example shows an MDA fabric statistics display when the **ip-transport** keyword is used. The keyword applies only to the 7705 SAR-8 Shelf V2 and 7705 SAR-18.

```
*A:ALU-1># show mda 1/1 statistics ip-transport
===============================================================================
IP Transport Statistics
===============================================================================
-------------------------------------------------------------------------------
IP Transport Queue Statistics
-------------------------------------------------------------------------------
Network Ingress Queue               Packets               Bytes
    Forwarded              :        99                    34238
    Dropped                :        0                     0
Access Ingress Queue                Packets               Bytes
    Forwarded              :        50                    29250
    Dropped                :        0                     0
-------------------------------------------------------------------------------
```


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```
Serial Socket Queue Statistics
-------------------------------------------------------------------------------
Access Ingress Queue               Packets              Bytes
    Forwarded             :        0                    0
    Dropped               :        0                    0
===============================================================================
```

Table 56: MDA fabric IP-transport statistics field descriptions

Label	Description
IP Transport Statistics	
IP Transport Queue Statistics	
Network Ingress Queue Forwarded Dropped	The number of IP-Transport subservice network ingress queued packets and bytes that were forwarded and dropped
Access Ingress Queue Forwarded Dropped	The number of IP-Transport subservice access ingress queued packets and bytes that were forwarded and dropped
Serial Socket Queue Statistics	
Access Ingress Queue Forwarded Dropped	The number of serial raw socket access ingress queued packets and bytes that were forwarded and dropped

Output example (cflowd statistics)
The following example shows an MDA fabric statistics display when the **cflowd** keyword is used.

```
*A:ALU-1# show mda 1/1 statistics cflowd
===============================================================================
Cflowd Queue Statistics
===============================================================================
Cflowd Queue                       Packets              Bytes
    forwarded   :                  0                    0
    dropped     :                  0                    0
===============================================================================
```

Table 57: MDA fabric cflowd statistics field descriptions

Label	Description
Cflowd Queue Statistics	
Cflowd Queue Forwarded Dropped	The number of forwarded and dropped cflowd packets and bytes

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Output example (mirror statistics)
The following example shows an MDA fabric statistics display when the **mirror** keyword is used. The **statistics mirror** keywords apply only to the 7705 SAR-8 Shelf V2, 7705 SAR-18, and 7705 SAR-X. The **aggregate-statistics mirror** keywords apply only to the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-Wx. See the "Mirroring" chapter in the 7705 SAR OAM and Diagnostics Guide for more information about mirroring.

```
*A:ALU-1# show mda 1/1 statistics mirror
===============================================================================
mirror Statistics
===============================================================================
-------------------------------------------------------------------------------
mirror Queue Statistics
-------------------------------------------------------------------------------
Mirror Queue 1 Best-effort       Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 2 Best-effort       Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 3 Best-effort       Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 4 Best-effort       Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 5 Expedited         Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 6 Expedited         Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 7 Expedited         Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
Mirror Queue 8 Expedited         Packets               Bytes
    In Profile forwarded   :        0                   0
    In Profile dropped     :        0                   0
    Out Profile forwarded  :        0                   0
    Out Profile dropped    :        0                   0
===============================================================================
```


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Table 58: MDA fabric mirror statistics field descriptions

Label	Description
Mirror Queue Statistics for Mirror Queue 1 to 4	
In Profile forwarded	The number of packets and octets forwarded by the mirror queue for in-profile and best-effort traffic
In Profile dropped	The number of packets and octets dropped by the mirror queue for in-profile and best-effort traffic
Out Profile forwarded	The number of packets and octets forwarded by the mirror queue for out-of-profile and best-effort traffic
Out Profile dropped	The number of packets and octets dropped by the mirror queue for out-of-profile and best-effort traffic
Mirror Queue Statistics for Mirror Queue 5 to 8	
In Profile forwarded	The number of packets and octets forwarded by the mirror queue for in-profile and expedited traffic
In Profile dropped	The number of packets and octets dropped by the mirror queue for in-profile and expedited traffic
Out Profile forwarded	The number of packets and octets forwarded by the mirror queue for out-of-profile and expedited traffic
Out Profile dropped	The number of packets and octets dropped by the mirror queue for out-of-profile and expedited traffic

Output example (security encryption)
The following example shows an MDA fabric statistics display when the **security encryption** keywords are used. The **security encryption** keywords apply only to the 7705 SAR-8 Shelf V2 and the 7705 SAR-18. See the "IPSec" section in the 7705 SAR Services Guide for more information about IPSec security.

```
*A:ALU-1# show mda 1/1 statistics security encryption
===============================================================================
MDA 1/1 Security Statistics
===============================================================================
-------------------------------------------------------------------------------
IPsec Datapath Statistics
-------------------------------------------------------------------------------
    Encrypted packets             : 382893273
    Encrypted bytes               : 187617703770
    Outbound dropped packets      : 130532
    Outbound SA misses            : 130532
    Outbound policy entry misses  : 0
    Decrypted packets             : 382878423
    Decrypted bytes               : 187610427270
    Inbound dropped packets       : 0
    Inbound SA misses             : 0
    Inbound IP dst/src mismatches : 0
    Transmit packet errors        : 0
```


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```
    Drop Too Big/Df-set Pkts      : 0
-------------------------------------------------------------------------------
IPsec Control Statistics (System Wide)
-------------------------------------------------------------------------------
    Static IPsec Tunnels          : 1
    Dynamic IPsec Tunnels         : 0
-------------------------------------------------------------------------------
IPsec Queue Statistics
-------------------------------------------------------------------------------
Decryption Queue Best-effort     Packets               Bytes
    Hi Priority forwarded  :        0                    0
    Hi Priority dropped    :        0                    0
    Low Priority forwarded :        383236465            2018336468
    Low Priority dropped   :        0                    0
Decryption Queue Expedited       Packets               Bytes
    Hi Priority forwarded  :        0                    0
    Hi Priority dropped    :        0                    0
    Low Priority forwarded :        0                    0
    Low Priority dropped   :        0                    0
Encryption Queue Best-effort     Packets               Bytes
    In Profile forwarded   :        0                    0
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        383494130            3228529972
    Out Profile dropped     :       0                    0
Encryption Queue Expedited       Packets               Bytes
    In Profile forwarded   :        0                    0
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        0                    0
    Out Profile dropped     :       0                    0
Encryption Queue CTL             Packets               Bytes
    Forwarded :                     0                    0
    Dropped   :                     0                    0
===============================================================================
```

Table 59: MDA fabric security encryption statistics field descriptions

Label	Description
IPsec Datapath Statistics	
Encrypted packets	The total number of packets encrypted by the adapter card to be sent out IPSec tunnels
Encrypted bytes	The total number of bytes encrypted by the adapter card to be sent out IPSec tunnels
Outbound dropped packets	The total number of outbound packets dropped instead of encrypted and sent out IPSec tunnels
Outbound SA misses	The number of Security Association-related mismatches in the outbound direction
Outbound policy entry misses	The number of security policy entry mismatches in the outbound direction
Decrypted packets	The total number of decrypted packets
Decrypted bytes	The total number of decrypted bytes

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Label	Description
Inbound dropped packets	The total number packets dropped instead of forwarded
Inbound SA misses	The number of inbound Security Association-related misses (that is, having mismatched security parameter index (SPI) on manual keyed tunnel)
Inbound IP dst/src mismatches	The number of security policy entry mismatches in the inbound direction due to IP destination or source address mismatches
Transmit packet errors	The number of generic packet transmit errors
Drop Too Big/Df-set Pkts	The number of packets dropped because the packet is too big and the do-not-fragment flag is set
IPsec Control Statistics (System Wide)	
Static IPsec Tunnels	The number of static IPSec tunnels configured on the 7705 SAR
Dynamic IPsec Tunnels	Not applicable (always 0)
Encryption/Decryption Queue Statistics	
Decryption Queue Best-effort	
Hi Priority forwarded	The number of packets and octets forwarded by the decryption queue for high priority and best effort traffic
Hi Priority dropped	The number of packets and octets dropped by the decryption queue for high priority and best effort traffic
Low Priority forwarded	The number of packets and octets forwarded by the decryption queue for low priority and best effort traffic
Low Priority dropped	The number of packets and octets dropped by the decryption queue for low priority and best effort traffic
Decryption Queue Expedited	
Hi Priority forwarded	The number of packets and octets forwarded by the decryption queue for high priority and expedited traffic
Hi Priority dropped	The number of packets and octets dropped by the decryption queue for high priority and expedited traffic
Low Priority forwarded	The number of packets and octets forwarded by the decryption queue for low priority and expedited traffic
Low Priority dropped	The number of packets and octets dropped by the decryption queue for low priority and expedited traffic
Encryption Queue Best-effort	

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Label	Description
In Profile forwarded	The number of packets and octets forwarded by the encryption queue for in-profile and best effort traffic
In Profile dropped	The number of packets and octets dropped by the encryption queue for in-profile and best effort traffic
Out Profile forwarded	The number of packets and octets forwarded by the encryption queue for out-of-profile and best effort traffic
Out Profile dropped	The number of packets and octets dropped by the encryption queue for out-of-profile and best effort traffic
Encryption Queue Expedited	
In Profile forwarded	The number of packets and octets forwarded by the encryption queue for in-profile and expedited traffic
In Profile dropped	The number of packets and octets dropped by the encryption queue for in-profile and expedited traffic
Out Profile forwarded	The number of packets and octets forwarded by the encryption queue for out-of-profile and expedited traffic
Out Profile dropped	The number of packets and octets dropped by the encryption queue for out-of-profile and expedited traffic
Encryption Queue CTL	
Forwarded	The number of packets and octets forwarded by the encryption queue for control path traffic
Dropped	The number of packets and octets dropped by the encryption queue for control path traffic

Output example (security firewall)
The following example shows an MDA fabric statistics display when the **security firewall** keywords are used. The **security firewall** keywords apply only to the 7705 SAR-8 Shelf V2 and 7705 SAR-18. See the "Security Parameters" section in the 7705 SAR Router Configuration Guide for more information about firewall security.

```
*A:ALU-1# show mda 1/6 statistics security firewall
===============================================================================
Firewall Statistics
===============================================================================
-------------------------------------------------------------------------------
Firewall Queue Statistics
-------------------------------------------------------------------------------
Network Queue 1 Best-effort         Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Network Queue 2 Expedited           Packets               Bytes
```


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```
    In Profile forwarded   :        0                    0
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        0                    0
    Out Profile dropped    :        0                    0
Access Queue 1 Best-effort           Packets              Bytes
    In Profile forwarded   :        0                    0
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        0                    0
    Out Profile dropped    :        0                    0
Access Queue 2 Expedited             Packets              Bytes
    In Profile forwarded   :        0                    0
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        0                    0
    Out Profile dropped    :        0                    0
===============================================================================
```

Table 60: MDA fabric security firewall statistics field descriptions

Label	Description
Network Queue 1 Best-effort	The statistics for the best-effort network queue; queue 1 is always for best-effort traffic
Network Queue 2 Expedited	The statistics for the expedited network queue; queue 2 is always for expedited traffic
Access Queue 1 Best-effort	The statistics for the best-effort access queue; queue 1 is always for best-effort traffic
Access Queue 2 Best-effort	The statistics for the expedited access queue; queue 2 is always for expedited traffic
In Profile forwarded	The number of packets and bytes forwarded by the security queue for in-profile best-effort or expedited traffic
In Profile dropped	The number of packets and bytes dropped by the security queue for in-profile best-effort or expedited traffic
Out Profile forwarded	The number of packets and bytes forwarded by the security queue for out-of-profile best-effort or expedited traffic
Out Profile dropped	The number of packets and bytes dropped by the security queue for out-of-profile best-effort or expedited traffic

Output example

The following example shows an MDA fabric statistics display if the **with-fabric-stats** keyword is used.

```
*A:ALU-1# show mda with-fabric-stats
===============================================================================
Summary of MDA's With Fabric Stats Enabled
===============================================================================
Slot  Mda   Provisioned Type                          Admin     Operational
               Equipped Type (if different)          State     State
-------------------------------------------------------------------------------
1     1     a12-sdiv2                                 down      provisioned
===============================================================================
```


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```
*A:ALU-1>#
```

Table 61: MDA with fabric statistics field descriptions

Label	Description
Slot	The card slot number (always 1)
Mda	The adapter card slot number
Provisioned Type	The provisioned adapter card type
Equipped Type (if different)	The adapter card type actually installed in the slot if different from the provisioned type
Admin State	up: the adapter card is administratively up down: the adapter card is administratively down
Operational State	up: the adapter card is operationally up down: the adapter card is operationally down provisioned: there is no adapter card in the slot but it has been preconfigured failed: the provisioned adapter card has operationally failed

Output example

The following example shows aggregate statistics for access and network ingress fabric traffic on the 7705 SAR-M when the **aggregate-statistics** keyword is used. The displays on the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-Wx, 7705 SAR-H, and 7705 SAR-Hc look similar. Additionally, on the 7705 SAR-Ax, 7705 SAR-Wx, 7705 SAR-H, and 7705 SAR-Hc, the displays include IPSec security statistics. See the "IPSec" section in the 7705 SAR Services Guide for more information about IPSec security. On the 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Ax and 7705 SAR-Wx, the displays include the aggregated firewall security statistics. On the 7705 SAR-H and 7705 SAR-Hc, the displays include IP transport statistics.

```
*A:ALU-1># show mda aggregate-statistics
===============================================================================
Drop Events: 0
===============================================================================

-------------------------------------------------------------------------------
Unicast from All MDA's to MDA  1/1  Packets          Octets
    Network In Profile forwarded :  0                0
    Network In Profile dropped   :  0                0
    Network Out Profile forwarded:  0                0
    Network Out Profile dropped  :  0                0
    Access In Profile forwarded  :  0                0
    Access Out Profile forwarded :  6592860          6724717200
    Access dropped               :  1070278          1093824116
Unicast from All MDA's to MDA  1/2  Packets          Octets
-------------------------------------------------------------------------------
    Network In Profile forwarded :  0                0
    Network In Profile dropped   :  0                0
    Network Out Profile forwarded:  0                0
```


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```
    Network Out Profile dropped  :  0               0
    Access In Profile forwarded  :  0               0
    Access Out Profile forwarded :  0               0
    Access dropped               :  0               0
-------------------------------------------------------------------------------
Unicast from All MDA's to MDA  1/3  Packets          Octets
    Network In Profile forwarded :  0               0
    Network In Profile dropped   :  0               0
    Network Out Profile forwarded:  0               0
    Network Out Profile dropped  :  0               0
    Access In Profile forwarded  :  0               0
    Access Out Profile forwarded :  0               0
    Access dropped               :  0               0
-------------------------------------------------------------------------------
Multicast from All MDA's           Packets          Octets
    Network In Profile forwarded :  0               0
    Network In Profile dropped   :  0               0
    Network Out Profile forwarded:  0               0
    Network Out Profile dropped  :  0               0
    Access In Profile forwarded  :  0               0
    Access Out Profile forwarded :  0               0
    Access dropped               :  0               0
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Total Network forwarded  :  0               0
Total Network dropped    :  0               0
Total Access forwarded   :  6592860         6724717200
Total Access dropped     :  1070278         1093824116
===============================================================================

===============================================================================
Aggregated Cflowd Queue Statistics
===============================================================================
Cflowd Queue                        Packets              Bytes
    forwarded   :                   0                    0
    dropped     :                   0                    0
===============================================================================

*A:ALU-1>#
```

The following example shows the inclusion of IPSec security statistics on 7705 SAR-Ax, 7705 SAR-Wx, 7705 SAR-H, and 7705 SAR-Hc displays.

```
*A:ALU-1# show mda aggregate-statistics
===============================================================================
Aggregated Statistics
===============================================================================
-------------------------------------------------------------------------------
Drop Events :                       0
-------------------------------------------------------------------------------
Unicast from All MDA's to MDA 1/1  Packets              Octets
    Network In Profile forwarded :  0                   0
    Network In Profile dropped   :  0                   0
    Network Out Profile forwarded:  0                   0
    Network Out Profile dropped  :  0                   0
    Access In Profile forwarded  :  0                   0
    Access Out Profile forwarded :  0                   0
    Access dropped               :  0                   0
Multicast from All MDA's          Packets              Octets
    Network In Profile forwarded :  0                   0
    Network In Profile dropped   :  0                   0
    Network Out Profile forwarded:  0                   0
```


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```
    Network Out Profile dropped  :  0                    0
    Access In Profile forwarded  :  0                    0
    Access Out Profile forwarded :  0                    0
    Access dropped               :  0                    0
-------------------------------------------------------------------------------
Total Network forwarded  :          0                    0
Total Network dropped    :          0                    0
Total Access forwarded   :          0                    0
Total Access dropped     :          0                    0
===============================================================================
Aggregated Security Statistics
===============================================================================
-------------------------------------------------------------------------------
IPsec Datapath Statistics
-------------------------------------------------------------------------------
    Encrypted packets             : 2114116
    Encrypted bytes               : 2997816488
    Outbound dropped packets      : 1928
    Outbound SA misses            : 1928
    Outbound policy entry misses  : 0
    Decrypted packets             : 2104241
    Decrypted bytes               : 2983813738
    Inbound dropped packets       : 207
    Inbound SA misses             : 207
    Inbound IP dst/src mismatches : 0
    Inbound IP fragmented packets : 0
    Transmit packet errors        : 0
    Drop Too Big/Df-set Pkts      : 0
-------------------------------------------------------------------------------
IPsec Control Statistics (System Wide)
-------------------------------------------------------------------------------
    Static IPsec Tunnels          : 4
    Dynamic IPsec Tunnels         : 0

-------------------------------------------------------------------------------
IPsec Queue Statistics
-------------------------------------------------------------------------------
Decryption Queue Best-effort     Packets               Bytes
    Hi Priority forwarded  :        0                    0
    Hi Priority dropped    :        0                    0
    Low Priority forwarded :        2105076              3056570352
    Low Priority dropped   :        0                    0

Decryption Queue Expedited       Packets               Bytes
    Hi Priority forwarded  :        0                    0
    Hi Priority dropped    :        0                    0
    Low Priority forwarded :        0                    0
    Low Priority dropped   :        0                    0

Encryption Queue Best-effort     Packets               Bytes
    In Profile forwarded   :        893166               1266509388
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        1221786              1732492548
    Out Profile dropped     :       0                    0

Encryption Queue Expedited       Packets               Bytes
    In Profile forwarded   :        0                    0
    In Profile dropped     :        0                    0
    Out Profile forwarded  :        0                    0
    Out Profile dropped     :       0                    0

Encryption Queue CTL             Packets               Bytes
    Forwarded :                     0                    0
    Dropped   :                     0                    0
```


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```
===============================================================================
*A:ALU-1#
```

The following example shows the inclusion of aggregated firewall security statistics on the 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-Ax and 7705 SAR-Wx displays.

```
*A:ALU-1# show mda aggregate-statistics
===============================================================================
Aggregated Statistics
===============================================================================
-------------------------------------------------------------------------------
Drop Events :                       0
-------------------------------------------------------------------------------
Unicast from All MDA's to MDA 1/1  Packets               Octets
    Network In Profile forwarded :  0                     0
    Network In Profile dropped   :  0                     0
    Network Out Profile forwarded:  0                     0
    Network Out Profile dropped  :  0                     0
    Access In Profile forwarded  :  0                     0
    Access Out Profile forwarded :  0                     0
    Access dropped               :  0                     0
Multicast from All MDA's          Packets               Octets
    Network In Profile forwarded :  0                     0
    Network In Profile dropped   :  0                     0
    Network Out Profile forwarded:  0                     0
    Network Out Profile dropped  :  0                     0
    Access In Profile forwarded  :  0                     0
    Access Out Profile forwarded :  0                     0
    Access dropped               :  0                     0
-------------------------------------------------------------------------------
Total Network forwarded  :          0                     0
Total Network dropped    :          0                     0
Total Access forwarded   :          0                     0
Total Access dropped     :          0                     0
===============================================================================
===============================================================================
Aggregated Security Statistics
===============================================================================
-------------------------------------------------------------------------------
Group Encryption Datapath Statistics
-------------------------------------------------------------------------------
    Encrypted packets             : 0
    Encrypted bytes               : 0
    Outbound dropped packets      : 0
    Outbound unsupported uplink   : 0
    Outbound enqueue error        : 0
    Decrypted packets             : 0
    Decrypted bytes               : 0
    Inbound dropped packets       : 0
    Inbound invalid spi           : 0
    Inbound authentication failure: 0
    Inbound padding error         : 0
    Inbound control word mismatch : 0
    Inbound enqueue error         : 0
-------------------------------------------------------------------------------
Encryption/Decryption Queue Statistics
-------------------------------------------------------------------------------
Decryption Queue Best-effort        Packets               Bytes
    Hi Priority forwarded  :        0                     0
    Hi Priority dropped    :        0                     0
    Low Priority forwarded :        0                     0
    Low Priority dropped   :        0                     0
```


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```
Decryption Queue Expedited          Packets               Bytes
    Hi Priority forwarded  :        0                     0
    Hi Priority dropped    :        0                     0
    Low Priority forwarded :        0                     0
    Low Priority dropped   :        0                     0
Encryption Queue Best-effort        Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Encryption Queue Expedited          Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Encryption Queue CTL             Packets               Bytes
    Forwarded :                     0                     0
    Dropped   :                     0                     0
===============================================================================
===============================================================================
Aggregated Firewall Statistics
===============================================================================
-------------------------------------------------------------------------------
Firewall Queue Statistics
-------------------------------------------------------------------------------
Network Queue 1 Best-effort         Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Network Queue 2 Expedited           Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Access Queue 1 Best-effort          Packets               Bytes
    Hi Priority forwarded  :        0                     0
    Hi Priority dropped    :        0                     0
    Low Priority forwarded :        0                     0
    Low Priority dropped   :        0                     0
Access Queue 2 Expedited            Packets               Bytes
    Hi Priority forwarded  :        0                     0
    Hi Priority dropped    :        0                     0
    Low Priority forwarded :        0                     0
    Low Priority dropped   :        0                     0
===============================================================================
===============================================================================
Aggregated Mirror Queue Statistics
===============================================================================
Mirror Queue 1                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        5600                  4481226
    Out Profile dropped    :        0                     0
Mirror Queue 2                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Mirror Queue 3                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
```


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```
Mirror Queue 4                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Mirror Queue 5                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Mirror Queue 6                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Mirror Queue 7                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
Mirror Queue 8                      Packets               Bytes
    In Profile forwarded   :        0                     0
    In Profile dropped     :        0                     0
    Out Profile forwarded  :        0                     0
    Out Profile dropped    :        0                     0
===============================================================================
```

The following example shows the inclusion of IP transport statistics on the 7705 SAR-H and 7705 SAR-Hc displays.

```
===============================================================================
Aggregated IP Transport Statistics
===============================================================================
-------------------------------------------------------------------------------
IP Transport Queue Statistics
-------------------------------------------------------------------------------
Network Ingress Queue               Packets               Bytes
    Forwarded              :        101                   35450
    Dropped                :        0                     0
Access Ingress Queue                Packets               Bytes
    Forwarded              :        48                    28080
    Dropped                :        0                     0
-------------------------------------------------------------------------------
Serial Socket Queue Statistics
-------------------------------------------------------------------------------
Access Ingress Queue                Packets               Bytes
    Forwarded              :        98                    54586
    Dropped                :        0                     0
===============================================================================
```

Table 62: MDA aggregate statistics field descriptions

Label	Description
Drop Events	The number of packets that are dropped from the buffer at the port instead of being transferred to the fabric. Drop events only occur if an excessive amount of traffic is flowing through the ports, which causes the buffers to fill up; under normal circumstances, this statistic should always be 0.

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Label	Description
Unicast from all MDA's to Destination MDA Packets/ Octets	Network In Profile forwarded: number of network in-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network In Profile dropped: number of network in-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network Out Profile forwarded: number of network out-of-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network Out Profile dropped: the number of network out-of-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access In Profile forwarded: number of access in-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access Out Profile forwarded: the number of access out-of-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access dropped: the number of access packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
Multicast from All MDA's Packets/Octets	Network In Profile forwarded: number of multicast network in-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network In Profile dropped: number of multicast network in-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Network Out Profile forwarded: number of multicast network out-of-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command

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Label	Description
	Network Out Profile dropped: the number of multicast network out-of-profile packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access In Profile forwarded: number of multicast access in-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access Out Profile forwarded: the number of multicast access out-of-profile packets/octets forwarded from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
	Access dropped: the number of multicast access packets/octets dropped from any source adapter card toward the fabric, then to the destination adapter card specified in the show mda command
Total Network forwarded Packets/Octets	The number of network in-profile and out-of-profile packets/octets forwarded
Total Network dropped Packets/Octets	The number of network in-profile and out-of-profile packets/octets dropped
Total Access forwarded Packets/Octets	The number of access in-profile and out-of-profile packets/octets forwarded
Total Access dropped Packets/ Octets	The number of access in-profile and out-of-profile packets/octets dropped
Aggregated Cflowd Queue Statistics	
Cflowd Queue Forwarded Dropped	The number of forwarded and dropped cflowd packets and bytes
Aggregated Security Statistics See Table 58: MDA fabric mirror statistics field descriptions and Table 59: MDA fabric security encryption statistics field descriptions	
Aggregated IP Transport Statistics	
IP Transport Queue Statistics	
Network Ingress Queue Forwarded Dropped	The number of IP-Transport subservice network ingress queued packets and bytes that were forwarded and dropped

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Label	Description
Access Ingress Queue Forwarded Dropped	The number of IP-Transport subservice access ingress queued packets and bytes that were forwarded and dropped
Serial Socket Queue Statistics	
Access Ingress Queue Forwarded Dropped	The number of serial raw socket access ingress queued packets and bytes that were forwarded and dropped

fdb

Syntax

fdb [**mac** *ieee-address*] [**port** *port-id*] [**all**]

Context

show>mda>ring

Description

This command displays the forwarding database (FDB) for the specified MAC address or ring port, or all FDBs associated with the specified ring adapter card.

Parameters

ieee-address

displays the FDB associated with the specified MAC address

port-id

displays the FDB associated with the specified port, where the port is a ring port or the v-port

all

displays all FDBs associated with the ring adapter card

Output

The following output is an example of FDB information, and Table 63: MDA ring FDB field descriptions describes the fields.

Output example

```
*A:7705:Dut-A# show mda 1/2 ring fdb port 1/11/1
=====================================
Ring MDA Forwarding Database for 1/11/1
=====================================
MAC                 Port        Type
-------------------------------------
38:52:1a:f4:1f:cd   1/11/1      Host
```


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```
---------------------------------------
No. of Entries: 1
---------------------------------------
Learning Enabled.
---------------------------------------
Ageing Enabled.
---------------------------------------
Remote age time = 900
---------------------------------------
Discard unknown source Disabled.
---------------------------------------
Table Size = 512
---------------------------------------
High water Mark = 95
---------------------------------------
1/2/1, Mac pinning Disabled.
1/2/2, Mac pinning Disabled.
=======================================
```

```
*A:7705:Dut-A# show mda 1/2 ring fdb port 1/11/v-port
=======================================
Ring MDA Forwarding Database for 1/11/v-port
=======================================
MAC                 Port        Type
---------------------------------------
38:52:1a:f4:1f:cf   1/11/v-port Host
---------------------------------------
No. of Entries: 1
---------------------------------------
Learning Enabled.
---------------------------------------
Ageing Enabled.
---------------------------------------
Remote age time = 900
---------------------------------------
Discard unknown source Disabled.
---------------------------------------
Table Size = 512
---------------------------------------
High water Mark = 95
---------------------------------------
1/2/1, Mac pinning Disabled.
1/2/2, Mac pinning Disabled.
=======================================
```

```
*A:7705:Dut-A# show mda 1/11 ring fdb all
=======================================
Ring MDA Forwarding Database
=======================================
MAC                 Port        Type
---------------------------------------
38:52:1a:f4:1f:cd   1/11/1      Host
38:52:1a:f4:1f:ce   1/11/2      Host
38:52:1a:f4:1f:cf   1/11/v-port Host
38:52:1a:f4:20:e9   1/11/2      Dynamic
---------------------------------------
No. of Entries: 4
---------------------------------------
Learning Enabled.
---------------------------------------
Ageing Enabled.
---------------------------------------
```


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```
Remote age time = 900
-------------------------------------
Discard unknown source Disabled.
-------------------------------------
Table Size = 512
-------------------------------------
High water Mark = 95
-------------------------------------
1/2/1, Mac pinning Disabled.
1/2/2, Mac pinning Disabled.
=====================================
```

Table 63: MDA ring FDB field descriptions

Label	Description
Ring MDA Forwarding Database	
MAC	The MAC address of any matching entry
Port	The port identifier of any matching entry
Type	The type of matching entry
No. of Entries:	The total number of MAC addresses currently in all FDBs on the adapter card, which includes host, static, and dynamic addresses
Learning	The configured state of the learning capabilities: Enabled or Disabled
Ageing	The configured state of the aging capabilities: Enabled or Disabled
Remote age time	The age time setting of the remote device, in seconds
Discard unknown source	The configured state of the discard capability for packets arriving from an unknown source: Enabled or Disabled
Table Size	The table size of the dynamic FDB table
High water Mark	The high-water mark setting for the FDB table, in percentage of table-size
1/*mda*/*port*, Mac pinning	The configured state of the MAC pinning capability: Enabled or Disabled

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3.15.2.1.3 Show external alarms commands

external-alarms

Syntax

external-alarms alarm [*alarm-id*]

external-alarms input [*alarm-input*] [**detail**]

external-alarms name [*name-string*] [**detail**]

external-alarms output [*alarm-output*] [**detail**]

Context

show

Description

This command displays external alarm information for 7705 SAR Ethernet ports, for the Auxiliary Alarm card, or the External Alarms connector on the Fan module of the 7705 SAR-8 Shelf V2, the Alarm module of the 7705 SAR-18, or the faceplate of the 7705 SAR-M, 7705 SAR-X, 7705 SAR-H, or 7705 SAR-Hc chassis.

Parameters

alarm-id

the alarm identifier

Values 1 to 2147483647

alarm-input

identifies the alarm input

- for Ethernet ports, the format is:

  port-*slot*/*mda*/*port* [*name*]

- for the Auxiliary Alarm card, the format is:

  alarm-*slot*/*mda*.{**d** | **a**}-*alarm-num* [*name*]

- for the four alarm inputs on an External Alarms connector, the format is:

  alarm.**d**-*alarm-num* [*name*]

where:

slot = card slot number for IOM (always 1 on the 7705 SAR)

mda = Ethernet adapter card or Auxiliary Alarm card slot number (for Ethernet modules or ports on platforms with no card slots, the mda slot number is preconfigured)

port = port number for Ethernet ports

d = digital input

a = analog input

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alarm-num = alarm port number (1 to 24 for digital on the Auxiliary Alarm card, 1 to 4 for digital on the four chassis alarm inputs, 1 or 2 for analog)

name = optional name assigned to the input

Note: If you configured a name for the alarm-input using the name option (see input command), you can use the configured name instead of the alarm-input identifier in the show command.

name-string

the name for the input port or output relay (maximum of 15 characters)

alarm-output

the output relay identifier, in the following format:

relay-*slot*/*mda*.**d**-*relay-num*

where:

slot = slot number of the card in the chassis (always 1 on the 7705 SAR)

mda = Auxiliary Alarm card slot number

d = digital output

relay-num = output relay number (1 to 8)

Note: If you configured a name for the alarm-output using the name option (see output command), you can use the configured name instead of the alarm-output identifier in the show command.

detail

displays detailed information for the external alarms

Output

The following outputs are examples of external alarm information:

- Specific Alarm (Output example, Table 64: Specific alarm field descriptions)
- External Alarm Input (Output example, Table 65: External alarm input field descriptions)
- External Alarm Input Detail (Output example, Table 66: External alarm input detail field descriptions)
- External Alarm Output (Output example, Table 67: External alarm output field descriptions)
- External Alarm Output Detail (Output example, Table 68: External alarm output detail field descriptions)
- External Alarm Name (Output example, Table 69: External alarm name field descriptions)

Output example

```
*A:ALU-1>#  show>external-alarms# alarm 1
===============================================================================
Alarm 1 Detail
===============================================================================
Admin Status       : up                State             : ok
Severity           : critical
Description        : N/A

Thresholds
  Analog Voltage   :  0.000 V          Operation         : gt
```


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```
Actions
  Log Alarm        : yes
  Chassis Alarming : yes

-------------------------------------------------------------------
Trigger             Type        Admin  Value     Threshold State
-------------------------------------------------------------------
alarm-1/1.a-2       analog-in   up      0.0 V    ok
-------------------------------------------------------------------
Triggers Req'd     : any
===================================================================================
*A:ALU-1># show>#
```

Table 64: Specific alarm field descriptions

Label	Description
Admin Status	The administrative state of the alarm
State	The current state of the alarm: ghost: no trigger equipment presently installed
	ok: no triggers are detected
	alarm detected: alarm is outstanding
	not monitored: alarm or all triggers are administratively disabled
Severity	The severity level for the specified alarm
Description	An optional description of the alarm
Thresholds	
Analog Voltage	The analog voltage level threshold value for the specified alarm, in millivolts (0.000V)
Operation	The analog voltage level threshold operational value: lt: a less-than value
	gt: a greater-than value
Actions	
Log Alarm	Indicates whether raise/clear log events and SNMP traps are generated for the specified alarm
Chassis Alarming	Indicates whether output to chassis alarm relays and LEDs are generated for the specified alarm
Trigger	The inputs that will trigger the alarm
Type	The type of trigger (a digital input or analog input, or, for Ethernet ports, the operational state)

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Label	Description
Admin	The administrative state of the trigger
Value	The current value of the alarm input: • for a digital input – the state of the digital circuit associated with the trigger (open or closed). A value of open indicates that the external equipment has not shorted this digital input to one of the four common ground pins. If no external equipment is connected to a digital input on an Auxiliary Alarm card faceplate or External Alarm connector, all digital input ports read open. A value of closed indicates that the external equipment has shorted this digital input to one of the four common ground pins. • for an analog input – the current voltage level of an analog trigger, in volts. If no external equipment is connected to the Auxiliary Alarm card faceplate or External Alarm connector, both analog inputs show no applied voltage (0.0V). • for an Ethernet port – a value of down indicates an alarm event; a value of up indicates no alarm
Threshold State	The threshold state: ghost: no threshold is present
	not monitored: the threshold is administratively disabled
	ok: the threshold is enabled
	detected: the threshold has been crossed
Triggers Req'd	The trigger condition that is required to raise an alarm: any: any configured input trigger is required to raise an alarm
	all: all configured input triggers are required to raise an alarm

Output example

```
*A:ALU-1># show external-alarms input
===============================================================================
External Alarm Input Summary
===============================================================================
Input Id        Name            Type        Admin  Value     Alarm State
-------------------------------------------------------------------------------
alarm.d-1                       digital-in  up     open      ok
alarm.d-2                       digital-in  up     open      ok
alarm.d-3                       digital-in  up     open      ok
```


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```
alarm.d-4                       digital-in  up     open      ok
port-1/2/1                      oper-state  up     down      alarm-detected
alarm-1/1.d-1   dd3             digital-in  up     open      ok
alarm-1/1.d-2                   digital-in  up     open      ok
alarm-1/1.d-3                   digital-in  up     open      ok
alarm-1/1.d-4                   digital-in  up     open      ok
alarm-1/1.d-5                   digital-in  up     open      ok
alarm-1/1.d-6                   digital-in  up     open      ok
alarm-1/1.d-7                   digital-in  up     open      ok
alarm-1/1.d-8                   digital-in  up     open      ok
alarm-1/1.d-9                   digital-in  up     open      ok
alarm-1/1.d-10                  digital-in  up     open      ok
alarm-1/1.d-11                  digital-in  up     open      ok
alarm-1/1.d-12                  digital-in  up     open      ok
alarm-1/1.d-13                  digital-in  up     open      ok
alarm-1/1.d-14                  digital-in  up     open      ok
alarm-1/1.d-15                  digital-in  up     open      ok
alarm-1/1.d-16                  digital-in  up     open      ok
alarm-1/1.d-17                  digital-in  up     open      ok
alarm-1/1.d-18                  digital-in  up     open      ok
alarm-1/1.d-19                  digital-in  up     open      ok
alarm-1/1.d-20                  digital-in  up     open      ok
alarm-1/1.d-21                  digital-in  up     open      ok
alarm-1/1.d-22                  digital-in  up     open      ok
alarm-1/1.d-23                  digital-in  up     open      ok
alarm-1/1.d-24                  digital-in  up     open      ok
alarm-1/1.a-1                   analog-in   up      0.0 V    ok
alarm-1/1.a-2                   analog-in   up      0.0 V    ok
===============================================================================
*A:ALU-1># show>#
```

Table 65: External alarm input field descriptions

Label	Description
External Alarm Input Summary	
Input Id	The alarm input identifier
Name	The name of the alarm input
Type	The type of input: digital, analog, or oper-state (for Ethernet ports)
Admin	The administrative state of the alarm input
Value	The current value of the alarm input: • for a digital input – the state of the digital circuit associated with the trigger (open or closed). A value of open indicates that the external equipment has not shorted this digital input to one of the four common ground pins. If no external equipment is connected to a digital input on an Auxiliary Alarm card faceplate or External Alarm connector, all digital input ports read open.

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Label	Description
	A value of closed indicates that the external equipment has shorted this digital input to one of the four common ground pins. • for an analog input – the current voltage level of an analog trigger, in volts. If no external equipment is connected to the Auxiliary Alarm card faceplate or External Alarm connector, both analog inputs show no applied voltage (0.0V). • for an Ethernet port – a value of down indicates an alarm event; a value of up indicates no alarm
Alarm State	The current state of the alarm input: ghost: no trigger equipment presently installed
	ok: no triggers are detected
	alarm detected: alarm is outstanding
	not monitored: alarm or all triggers are administratively disabled

Output example

```
*A:ALU-1># show external-alarms input alarm-1/1.d-1 detail
===============================================================================
Input alarm-1/1.d-3 Detail
===============================================================================
Name               : dinput3
Admin Status       : up                Alarm State        : ok
Detect Debounce    : 2 secs            Clear Debounce     : 2 secs
Value              : open

Description        : Discrete Digital Input

-------------------------------------------------------------
# Threshold         Severity  Alarm Id       Threshold State
-------------------------------------------------------------
1    closed         major     3              ok
-------------------------------------------------------------
```

Table 66: External alarm input detail field descriptions

Label	Description
Input *alarm input* **Detail**	
Name	The name of the alarm input
Admin Status	The administrative state of the alarm input
Alarm State	The current state of the alarm input:

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Label	Description
	ghost: no trigger equipment is presently installed
	ok: no triggers are detected
	alarm detected: alarm is outstanding
	not monitored: alarm or all triggers are administratively disabled
Detect Debounce	The debounce time associated with the detection of the specified alarm input (not applicable to Ethernet ports)
Clear Debounce	The debounce time associated with the clearance of the specified alarm input (not applicable to Ethernet ports)
Port State	The value of the alarm input for Ethernet ports, either up or down
Value	The current value of the alarm input: • for a digital input – the state of the digital circuit associated with the trigger (open or closed). A value of open indicates that the external equipment has not shorted this digital input to one of the four common ground pins. If no external equipment is connected to a digital input on an Auxiliary Alarm card faceplate or External Alarm connector, all digital input ports read open. A value of closed indicates that the external equipment has shorted this digital input to one of the four common ground pins. • for an analog input – the current voltage level of an analog trigger, in volts. If no external equipment is connected to the Auxiliary Alarm card faceplate or External Alarm connector, both analog inputs show no applied voltage (0.0V).
Description	A description of the alarm input
#	A summary of the alarms that are using this input as a trigger. Each input can be used for up to four alarms.
Threshold	The threshold value: • for a digital input – all digital inputs are considered normally open; therefore, the threshold for each alarm is monitoring the input closing • for an analog input – the voltage threshold for the alarm • for Ethernet ports – the operational state threshold

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Label	Description
Severity	The severity level for the specified alarm input: critical, major, minor, or warning
Alarm Id	The alarm identifier (1 to 2147483647)
Threshold State	The threshold state indicates whether the input state contributes to the alarm: detected: this input triggers the alarm into an alarm-detected state
	ok: this input does not trigger the alarm into an alarm-detected state

Output example

```
*A:ALU-1># show external-alarms output
===============================================================
Output Relay Summary
===============================================================
Output Id       Name            Type        Admin  State
---------------------------------------------------------------
relay-1/1.d-1   output1         digital-out down   off
relay-1/1.d-2   output2         digital-out down   off
relay-1/1.d-3   output3         digital-out down   off
relay-1/1.d-4   output4         digital-out down   off
relay-1/1.d-5   output5         digital-out down   off
relay-1/1.d-6                   digital-out down   off
relay-1/1.d-7                   digital-out down   off
relay-1/1.d-8                   digital-out down   off
===============================================================
*A:ALU-1>#
```

Table 67: External alarm output field descriptions

Label	Description
Output Relay Summary	
Output Id	The output relay identification
Name	The name of the output relay
Type	The output type is digital
Admin	The administrative state of the alarm output relay When the digital output relay output state is set to no shutdown, the normally closed contacts open and the normally open contacts close. The digital output displays a digital output administrative status of up and the state of active (the output relay is energized). When the digital output relay output state is set to shutdown, the normally closed contacts close and the

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Label	Description
	normally open contacts open. The digital output displays a digital output administrative status of down and the state of off (the output relay is not energized).
State	The current state of the alarm output relay: ghost: no equipment is installed
	off: the output relay is not energized (it is administratively disabled)
	active: the output relay is energized (active)

Output example

```
*A:ALU-1># show external-alarms output relay-1/1.d-1 detail
===============================================================================
Output relay-1/1.d-1 Detail
===============================================================================
Name               : output1
Admin Status       : down               State              : off
Description        : Digital Output Relay
===============================================================================
*A:ALU-1>#
```

Table 68: External alarm output detail field descriptions

Label	Description
Output relay-x/x.d-x Detail	
Name	The name of the output relay
Admin	The administrative state of the alarm output relay When the digital output relay output state is set to no shutdown, the normally closed contacts open and the normally open contacts close. The digital output displays a digital output administrative status of up and the state of active (the output relay is energized). When the digital output relay output state is set to shutdown, the normally closed contacts close and the normally open contacts open. The digital output displays a digital output administrative status of down and the state of off (the output relay is not energized).
State	The current state of the alarm output relay: ghost: no equipment is installed
	off: the output relay is not energized (it is administratively disabled)

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Label	Description
	active: the output relay is energized (active)
Description	The description for the output relay

Output example

```
*A:ALU-1># show external-alarms name
===============================================================================
External Alarm Names
===============================================================================
Name            Alarm/Relay     Type        Admin Value     State
-------------------------------------------------------------------------------
ainput1         alarm-1/1.a-1   analog-in   up     0.0 V    ok
ainput2         alarm-1/1.a-2   analog-in   up     0.0 V    ok
dinput1         alarm-1/1.d-1   digital-in  up    open      ok
dinput2         alarm-1/1.d-2   digital-in  up    open      ok
dinput23        alarm-1/1.d-23  digital-in  up    open      ok
dinput24        alarm-1/1.d-24  digital-in  up    open      ok
dinput3         alarm-1/1.d-3   digital-in  up    open      ok
dinput4         alarm-1/1.d-4   digital-in  up    open      ok
output1         relay-1/1.d-1   digital-out down            off
output2         relay-1/1.d-2   digital-out down            off
output3         relay-1/1.d-3   digital-out down            off
output4         relay-1/1.d-4   digital-out down            off
output5         relay-1/1.d-5   digital-out down            off
===============================================================================
*A:ALU-1>#
```

Table 69: External alarm name field descriptions

Label	Description
External Alarm Names	
Name	The alarm name
Alarm/Relay	The name of the alarm input or output relay
Type	The alarm input type (digital input, analog input, or oper-state) or output relay type (digital output)
Admin	The administrative state of the alarm input or output relay
State	The current state of the alarm input or output relay. For an alarm input: ghost: no trigger equipment is presently installed
	ok: no triggers are detected
	alarm detected: alarm is outstanding
	not monitored: alarm or all triggers are administratively disabled

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Label	Description
	For an alarm output relay: ghost: no equipment is installed
	off: the output relay is not energized (it is administratively disabled)
	active: the output relay is energized (active)
Value	The current value of the alarm input (this field is not applicable to outputs because the value is based on how the Auxiliary Alarm card or External Alarm connector is wired to the external equipment): • for a digital input – the state of the digital circuit associated with the trigger (open or closed). A value of open indicates that the external equipment has not shorted this digital input to one of the four common ground pins. If no external equipment is connected to a digital input on an Auxiliary Alarm card faceplate or External Alarm connector, all digital input ports read open. A value of closed indicates that the external equipment has shorted this digital input to one of the four common ground pins. • for an analog input – the current voltage level of an analog trigger, in volts. If no external equipment is connected to the Auxiliary Alarm card faceplate or External Alarm connector, both analog inputs show no applied voltage (0.0V).

3.15.2.1.4 Show T1/E1 LCR commands

lcr

Syntax

lcr [*lcr-id*] [**detail**]

Context

show

Description

This command displays T1/E1 line card redundancy (LCR) information.

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Parameters

lcr-id

displays information for the specified LCR group ID

Values 1 to 6

detail

displays detailed LCR information

Output

The following outputs are examples of LCR information:

- LCR (Output example, Table 70: LCR field descriptions)
- LCR Detailed (Output Example, Table 71: LCR detail field descriptions)

Output example

```
*A:Sar8 Dut-A# show lcr
===============================================================================
LCR Group Info
===============================================================================
ID                    MC-Ctl Work       Prot       Active     Request
                      State  MDA        MDA        MDA        Byte
-------------------------------------------------------------------------------
lcr-1                 Down   N/A        N/A        N/A        N/A
lcr-2                 Down   N/A        N/A        N/A        N/A
lcr-3                 N/A    N/A        N/A        N/A        N/A
lcr-5                 N/A    1/5        1/6        1/5        Prot: SF-Low
-------------------------------------------------------------------------------
No. of LCR Groups: 4
===============================================================================
```

```
*A:Sar8 Dut-A# show lcr "lcr-5"
===============================================================================
LCR Group Info
===============================================================================
ID                    MC-Ctl Work       Prot       Active     Request
                      State  MDA        MDA        MDA        Byte
-------------------------------------------------------------------------------
lcr-5                 N/A    1/5        1/6        1/5        Prot: SF-Low
===============================================================================
*A:Sar8 Dut-A# show lcr "lcr-5"
```

```
*A:Sar8 Dut-A# show lcr "lcr-5" detail
===============================================================================
LCR Group: lcr-5
===============================================================================
Description        : (Not Specified)
Group Id           : 5                    Active MDA          : 1/5
Working MDA        : 1/5                  Protection MDA      : 1/6
Revertive-mode     : non-revertive        Revert-time (min)   :
Request byte       : 0xc0 (SF-Low on Protect)
Multi-Chassis LCR  : No
Neighbor           : 0.0.0.0
Control link state : N/A
Advertise Interval : 1000 msec            Hold Time           : 3000 msec
-------------------------------------------------------------------------------
 LCR Working MDA - 1/5
```


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```
-------------------------------------------------------------------------------
Admin State        : up                  Operational State    : provisioned
Current LCR Status : sf                  No. of Switchovers   : 0
Last Switchover    : None                Switchover seconds   : 0
Last Switch Cmd    : noCmd
-------------------------------------------------------------------------------
 LCR Protection MDA - 1/6
-------------------------------------------------------------------------------
Admin State        : down                Operational State    : provisioned
Current LCR Status : sf                  No. of Switchovers   : 0
Last Switchover    : None                Switchover seconds   : 0
Last Switch Cmd    : noCmd
===============================================================================
*A:Sar8 Dut-A#
```

Table 70: LCR field descriptions

Label	Description
ID	The LCR group name
MC-Ctl State	Specifies the multi-chassis state
Work MDA	Specifies the physical MDA that is acting as the working MDA for this LCR group
Prot MDA	Specifies the physical MDA that is acting as the protection MDA for this LCR group
Active MDA	Specifies the active MDA
Request Byte	Specifies the value of the request byte received or transmitted on the protection MDA

Table 71: LCR detail field descriptions

Label	Description
LCR Group	Specifies an LCR group
Description	A description of the LCR group
Group ID	The LCR group identifier
Active MDA	Displays the active MDA
Working MDA	Displays the physical MDA that is acting as the working MDA for this LCR group
Protection MDA	Displays the physical MDA that is acting as the protection MDA for this LCR group
Revertive-mode	The revertive mode of the LCR group:

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Label	Description
	non-revertive – traffic remains on the protection MDA until another switch request is received revertive – when the condition that caused a switch to the protection MDA has been cleared, the traffic is switched back to the working MDA
Revert-time (min)	The configured time, in minutes, to wait after the working MDA has become functional again before making the working MDA active again. If the revertive mode is non-revertive, then this field is empty.
Request byte	Specifies the value of the request byte received or transmitted on the protection MDA
Multi-Chassis LCR	Indicates whether MC-LCR is configured
Neighbor	Displays the neighbor IP address. A 0.0.0.0 address indicates that the LCR group is an SC-LCR.
Control link state	Displays the current control link status
Advertise Interval	Displays the advertise interval
Hold time	Displays the hold time
LCR Working MDA	Specifies the working MDA
Admin State	Specifies whether the working MDA is administratively up or down
Operational State	Specifies the operational state of the working MDA
Current LCR Status	Specifies the current status of the LCR
No. of Switchovers	The number of switchovers that have occurred on this MDA
Last Switchover	Displays the timestamp of the last switchover
Switchover Seconds	Displays the cumulative Protection Switching Duration (PSD) time in seconds For a working MDA, this is the cumulative number of seconds that service was carried on the protection MDA

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Label	Description
Last Switch Cmd	Displays the last switch command that was performed on the working MDA
LCR Protection MDA	Specifies the protection MDA
Admin State	Specifies whether the protection MDA is administratively up or down
Operational State	Specifies the operational state of the protection MDA
Current LCR Status	Specifies the current status of the LCR
No. of Switchovers	The number of switchovers that have occurred on this MDA
Last Switchover	Displays the timestamp of the last switchover
Switchover Seconds	Displays the cumulative Protection Switching Duration (PSD) time in seconds For the protection MDA, this is the cumulative number of seconds that the protection MDA has been used to carry any working MDA traffic. This information is only valid if revertive switching is enabled.
Last Switch Cmd	Displays the last switch command that was performed on the protection MDA

3.15.2.1.5 Show microwave link commands

mw

Syntax

mw link [**mw-link-***id*] [**detail**]

mw radio *port-id* [**detail**] [**power**]

mw radio *port-id* **perfmon** [**all** | **g826** | **acm** | **power**]

mw radio software

Context

show

Description

This command displays information pertaining to a microwave link or an MPR-e radio.

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Parameters

acm

displays MWA performance monitoring adaptive coding and modulation (ACM) level information

all

displays all MWA performance monitoring information

g826

displays G.826 (BBE, ES, SES, and UAS) performance monitoring information

link

displays microwave link summary information

mw-link-*id*

identifies a specific microwave link

Values *id* = 1 to 24

power

displays MWA performance monitoring radio power information

radio

displays MPR-e radio summary information

port-id

identifies a specific port on a Packet Microwave Adapter card associated with the MPR-e radio, in the format *slot/mda/port*

detail

displays detailed microwave link or MPR-e radio information

perfmon

displays MWA performance monitoring information

power

displays MPR-e radio power measurement information

software

displays the state of the MPR-e radio software

Output

The following outputs are examples of microwave link and MPR-e radio information:

- microwave link detail (Output example, Table 72: Microwave link detail field descriptions)
- MPR-e radio detail (Output Example, Table 73: MPR-e radio detail field descriptions)
- MPR-e radio power measurement (Output example, Table 74: MPR-e radio power measurement field descriptions)
- MPR-e radio software state (Output example, Table 75: MPR-e radio software state field descriptions)
- MWA performance monitoring (Output example, Table 76: MWA performance monitoring field descriptions)

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Output example

```
*A:ALU-1>#  show>mw# link mw-link-1 detail
===============================================================================
Microwave Link
===============================================================================
Description        : Packet Microwave Link
Interface          : mw-link-11                IfIndex          : 1610973184
Admin State        : up                        Mode             : network
Oper State         : up
Oper Flag          :
Last State Change  : 08/15/2016 19:08:46
Transmit Diversity : enabled
  Position         : main
  Force            : diversity
Configured Address : 48:f7:f1:b6:1d:33
Hardware Address   : 48:f7:f1:b6:1d:33
Link Alarm Synthesis
--------------------
     0     0     0     0     0     0     0
   CRI   MAJ   MIN   WAR   IND | COM   EQT
Protection         : 1+1HSB
-------------------------------------------------------------------------------
                      Main      Spare     Abnormal
Type Activity  Revert Command   Command   Condition
-------------------------------------------------------------------------------
EPS  Spare     Yes    Forced    Automatic N/A
TPS  Main      Yes    Automatic Automatic N/A
RPS  Main      Yes    Automatic Automatic N/A
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
                                                    Tx    Oper    Alarm
Port      Name                      Type    Link Role    State State   State
-------------------------------------------------------------------------------
1/5/1     MPT-3-A                   MPT-HC  11   Main    On    Up      Ok
1/6/1     MPT-3-B                   MPT-HC  11   Spare   Auto  Up      Ok
-------------------------------------------------------------------------------
Discovered Peer Radio
---------------------
NE Ip Address      : 10.10.10.3
Slot/Port          : 3/1
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                               0                     0
Packets                                              0                     0
Discards                                             0                     0

Queue 1
  Octets                                             0                     0
  Packets                                            0                     0
  Discards                                           0                     0

Queue 2
  Octets                                             0                     0
  Packets                                            0                     0
  Discards                                           0                     0

Queue 3
  Octets                                             0                     0
  Packets                                            0                     0
```


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```
  Discards                                          0                    0

Queue 4
  Octets                                            0                    0
  Packets                                           0                    0
  Discards                                          0                    0

Queue 5
  Octets                                            0                    0
  Packets                                           0                    0
  Discards                                          0                    0
===============================================================================
```

Table 72: Microwave link detail field descriptions

Label	Description
Microwave Link	
Description	The microwave link description
Interface	The microwave link interface
IfIndex	The microwave link interface index number, which reflects its initialization sequence
Admin State	The microwave link interface administrative state
Mode	The microwave link interface mode
Oper State	The microwave link interface operational state
Oper Flag	The microwave link interface operational flag:
	noRadioCfg: the link has no radios configured
	linkAdminDown: the link is admin down
	noRadiosPresent: no radios detected
	noRadiosReady: no radios are ready
	incompatibleConfig: radio configuration is incompatible
	radioFailure: radio equipment has failure
	receptionFailure: radio reception failure
	di: defect indication
	txMuted: no radios transmitting
Last State Change	The last time that the operational status of the microwave link interface changed state
Transmit Diversity	The configured state of transmit diversity antenna: enabled or disabled

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Label	Description
Position	The configured antenna position: main or diversity
Force	The configured antenna switching: not forced or diversity
Configured Address	The configured microwave link interface address
Hardware Address	The configured microwave link interface hardware or system-assigned MAC address
Link Alarm Synthesis	The microwave link alarm synthesis
Protection	The configured microwave link protection
Type	The type of protection scheme
Activity	The type of MPR-e radio activity, either main or spare
Revert	Indicates whether revertive switching has been configured on the microwave link
Main Command	The type of command configured on the main MPR-e radio, either forced or automatic
Spare Command	The type of command configured on the spare MPR-e radio, either forced or automatic
Abnormal Condition	Indicates whether an abnormal condition has been detected
Port	The 7705 SAR-8 Shelf V2 or 7705 SAR-18 port configured for an MPR-e radio.
Name	The name configured for the MPR-e radio
Type	The type of MPR-e radio
Link	The microwave link ID associated with the MPR-e radio
Role	The role of the MPR-e radio, either main or spare
Tx State	The transmit state of the MPR-e radio
Oper State	The operational state of the MPR-e radio
Alarm State	The alarm state of the MPR-e radio
Discovered Peer radio	
NE Ip Address	The network element IP address of a peer radio
Slot/Port	The slot and port of the peer radio
Traffic Statistics	

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Label	Description
Octets Input/Output	The total number of input/output octets
Packets Input/Output	The total number of input/output packets
Discards Input/Output	The total number of input/output discards
Queue Octets Input/Output	The number of input/output octets per queue
Queue Packets Input/Output	The number of input/output packets per queue
Queue Discards Input/Output	The number of input/output discards per queue

Output example

```
*A:ALU-1># show mw radio 1/5/1 detail
===============================================================================
Microwave Radio
===============================================================================
Name               : MPT-3-A
Interface          : 1/5/1                      Mode             : Single NE
Link               : mw-link-20                 Role             : Main
Tx State           : On                         Oper State       : up
Oper Flag          :
Suppressed Faults  : HighBer RSL
Database Filename  : mpt_3_a.tar
Last State Change  : 11/15/2012 19:56:02        IfIndex          : 44072960
Mgmt Last Up       : 11/15/2012 19:56:01
Mgmt Last Lost     : Never
Radio Alarm Synthesis
---------------------
     0     0     0     0     0     0     0
   CRI   MAJ   MIN   WAR   IND | COM   EQT
Radio Information
-----------------
Type               : MPT-HC
Frequency Band     : 15 GHz
Modules            : XPIC
Software           : Ok
CompanyId          : ALU                        Mnemonic         : MPT-MSX
Hardware Part Num  : 3DB20423BAAB04             CLEI Code        : ----------
Software Part Num  : 3DB20502AAAA03             Factory Id       : CIT
Date Identifier    : 00                         Date             : 110919
Serial Number      : SH1136X00ZJ
Customer Field     :
===============================================================================
```

Table 73: MPR-e radio detail field descriptions

Label	Description
Microwave Radio	
Name	The name configured for the MPR-e radio
Interface	The port configured for the MPR-e radio

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Label	Description
Mode	The MPR-e radio mode, either standalone or single NE
Link	The microwave link ID associated with the MPR-e radio
Role	The role configured for MPR-e radio, either main or spare
Tx State	The transmit state of the MPR-e radio
Oper State	The operational state of the MPR-e radio
Oper Flag	The MPR-e radio operational flag:
	portNotPresent: IDU port is not present
	portOperDown: IDU port is operationally down
	radioNotPresent: radio is not present
	radioCommError: radio communication error
	radioInit: IDU is initializing radio
	softwareDownload: radio is downloading software
	txMuted: radio is not transmitting
	radioNotReady: radio not ready
	radioEqFailure: radio equipment failure
	incompatibleShifter: radio incompatible with shifter configuration
	incompatibleFreq: radio incompatible with frequency configuration
	incompatiblePower: radio incompatible with power configuration
	incompatibleModParms: radio incompatible with modulation parameters
	di: radio defect indication
	radioLinkDown: radio link down
	rslThresholdFail: RSL threshold crossed
	lof: loss of radio frame
	protectionFail: protection failure
	proxyActive: MCT proxy session is active to the radio

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Label	Description
	noDbFile: radio database file is missing
	dbSyncInProgress: radio database synchronization in progress
	noDbConfig: radio database configuration is missing
	tpsTxMuted: radio is muted due to TPS activity
	noSoftware: IDU did not detect any software
	softwareMismatch: radio does not contain correct software
	issu: radio is in in-service software upgrade
	highBer: high bit error rate
Suppressed Faults	The microwave link faults that are suppressed, if any: • high bit error rate (HighBer) • RSL threshold crossing (RSL) • RDI • All
Database Filename	The MPR-e radio database filename
Last State Change	The date and time of last operational state change of the MPR-e radio.
IfIndex	The MPR-e radio interface index number, which reflects its initialization sequence
Mgmt Last Up	The alarm state of the MPR-e radio
Mgmt Last Lost	The alarm state of the MPR-e radio
Radio Alarm Synthesis	The alarm state of the MPR-e radio
Radio Information	The MPR-e radio information: Type Frequency Band Modules Software Company Id Mnemonic Hardware Part Number Common Language Equipment Identifier (CLEI) Code

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Label	Description
	Software Part Number Factory Id Date Identifier Date Serial Number Customer Field

Output example

```
*A:ALU-1>#  show>mw# radio 1/5/2 power
===============================================================================
Power Measurements
===============================================================================
                                                 TxPower (dBm)        RSL (dBm)
-------------------------------------------------------------------------------
Local Radio (Near End)                                25.0                -60.1
Peer Radio  (Far End)                                 40.0                -34.5
===============================================================================
```

Table 74: MPR-e radio power measurement field descriptions

Label	Description
Power Measurements	
Local Radio (Near End) TxPower (dBm)	The transmit power measurement of the near-end radio
Local Radio (Near End) RSL (dBm)	The received power from the near-end radio
Peer Radio (Far End) TxPower (dBm)	The transmit power measurement from the far-end radio
Peer Radio (Far End) RSL (dBm)	The received power from the far-end radio

Output example

```
*A:NOK-1>#  show>mw# radio software
===============================================================================
Microwave Radio Software Summary
===============================================================================
                                                        Software
Port      Name                      Type    Link Role   State       Progress
-------------------------------------------------------------------------------
1/5/1     MPT-3-A                   MPT-HC  20   Main   Ok
1/6/1     MPT-3-B                   MPT-HC  20   Spare  Ok
===============================================================================
```


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Table 75: MPR-e radio software state field descriptions

Label	Description
Microwave Radio Software Summary	
Port	The port configured for the MPR-e radio
Name	The name configured for the MPR-e radio
Type	The type of MPR-e radio
Link	The microwave link ID
Role	The role of the MPR-e radio, either main or spare
Software State	The state of the MPR-e radio software; the software states are: • Ok - the software that is running is correct • Ready - the software is downloaded and ready for upgrade • Requested - a software download has been requested; waiting for the download to begin • Forced - a software download has been forced; waiting for the download to begin • Downloading - a software download is in progress • Failed - a software download to this MPR-e radio has failed
Progress	The progress of the MPR-e radio software download

Output example

```
*A:7CSA:Dut-A# show mw radio 1/5/1 perfmon all
===============================================================
Microwave Radio Performance Monitoring
===============================================================
Family     : Normalized G.826
Admin State: Up                          Oper State: Up
===============================================================
===============================================================================
Section: Radio Hop  Period: 15 minutes  Data: Current
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/16/2019 09:30:00  652      Active            0     0     0     0
===============================================================================
===============================================================================
Section: Radio Hop  Period: 15 minutes  Data: Historic
===============================================================================
```


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```
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/16/2019 09:15:00  900      Active            0     0     0     0
10/16/2019 09:00:00  900      Active            0     0     0     0
10/16/2019 08:45:00  900      Active            0     0     0     0
10/16/2019 08:30:00  900      Active            0     0     0     0
10/16/2019 08:15:00  900      Active            0     0     0     0
10/16/2019 08:00:00  900      Active            0     0     0     0
===============================================================================
===============================================================================
Section: Radio Hop  Period: 24 hours  Data: Current
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/15/2019 19:00:00  52857    Active            0     0     0     0
===============================================================================
===============================================================================
Section: Radio Hop  Period: 24 hours  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/14/2019 19:00:00  86399    Active            0     0     0     0
10/13/2019 19:00:00  86399    Active            0     0     0     0
10/12/2019 19:00:00  86399    Active            0     0     0     0
10/11/2019 19:00:00  86399    Active            0     0     0     0
10/10/2019 19:00:00  86399    Active            0     0     0     0
10/09/2019 19:00:00  86399    Active            0     0     0     0
10/08/2019 19:00:00  86399    Active            0     0     0     0
10/08/2019 12:45:42  22457    Active    X       0     0     0     0
===============================================================================
===============================================================================
Section: Radio Link  Period: 15 minutes  Data: Current
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/16/2019 09:30:00  658      Active            0     0     0     0
===============================================================================
===============================================================================
Section: Radio Link  Period: 15 minutes  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/16/2019 09:15:00  900      Active            0     0     0     0
10/16/2019 09:00:00  900      Active            0     0     0     0
10/16/2019 08:45:00  900      Active            0     0     0     0
10/16/2019 08:30:00  900      Active            0     0     0     0
10/16/2019 08:15:00  900      Active            0     0     0     0
10/16/2019 08:00:00  900      Active            0     0     0     0
10/16/2019 07:45:00  900      Active            0     0     0     0
10/16/2019 07:30:00  900      Active            0     0     0     0
10/16/2019 07:15:00  900      Active            0     0     0     0
===============================================================================

===============================================================================
Section: Radio Link  Period: 24 hours  Data: Current
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
-------------------------------------------------------------------------------
10/15/2019 19:00:00  52861    Active            0     0     0     0
===============================================================================
===============================================================================
Section: Radio Link  Period: 24 hours  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect ES    SES   BBE   UAS
```


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```
-------------------------------------------------------------------------
10/14/2019 19:00:00  86399    Active            0     0     0     0
10/13/2019 19:00:00  86399    Active            0     0     0     0
10/12/2019 19:00:00  86399    Active            0     0     0     0
10/11/2019 19:00:00  86399    Active            0     0     0     0
10/10/2019 19:00:00  86399    Active            0     0     0     0
10/09/2019 19:00:00  86399    Active            0     0     0     0
10/08/2019 19:00:00  86399    Active            0     0     0     0
10/08/2019 12:45:43  22456    Active    X       0     0     0     0
=========================================================================

=========================================================================
Family     : Adaptive Coding and Modulation
Admin State: Up                          Oper State: Up
=========================================================================
=============================================================================================
Milliseconds at each modulation  Period: 15 minutes  Data: Current
=============================================================================================
Date                 Duration Suspect QPSK       8 PSK      16 QAM     32 QAM
                                      64 QAM     128 QAM    256 QAM
---------------------------------------------------------------------------------------------
10/16/2019 09:30:00  661              0          0          0          0
                                        0          0          661009
=============================================================================================
=============================================================================================
Milliseconds at each modulation  Period: 15 minutes  Data: Historic
=============================================================================================
Date                 Duration Suspect QPSK       8 PSK      16 QAM     32 QAM
                                      64 QAM     128 QAM    256 QAM
---------------------------------------------------------------------------------------------
10/16/2019 09:15:00  900              0          0          0          0
                                        0          0          900009
10/16/2019 09:00:00  900              0          0          0          0
                                        0          0          900009
10/16/2019 08:45:00  900              0          0          0          0
                                        0          0          900013
10/16/2019 08:30:00  900              0          0          0          0
                                        0          0          900008
10/16/2019 08:15:00  900              0          0          0          0
                                        0          0          900009
10/16/2019 08:00:00  900              0          0          0          0
                                        0          0          900008
10/16/2019 07:45:00  900              0          0          0          0
                                        0          0          900008
=============================================================================================
=============================================================================================
Milliseconds at each modulation  Period: 24 hours  Data: Current
=============================================================================================
Date                 Duration Suspect QPSK       8 PSK      16 QAM     32 QAM
                                      64 QAM     128 QAM    256 QAM
---------------------------------------------------------------------------------------------
10/15/2019 19:00:00  52866            0          0          0          0
                                        0          0          52866596
=============================================================================================
=============================================================================================
Milliseconds at each modulation  Period: 24 hours  Data: Historic
=============================================================================================
Date                 Duration Suspect QPSK       8 PSK      16 QAM     32 QAM
                                      64 QAM     128 QAM    256 QAM
---------------------------------------------------------------------------------------------
10/14/2019 19:00:00  86399            0          0          0          0
                                        0          0          86399968
10/13/2019 19:00:00  86399            0          0          0          0
                                        0          0          86399974
```


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```
10/12/2019 19:00:00  86399            0          0          0          0
                                      0          0          86399969
10/11/2019 19:00:00  86399            0          0          0          0
                                      0          0          86399972
10/10/2019 19:00:00  86399            0          0          0          0
                                      0          0          86399972
10/09/2019 19:00:00  86399            0          0          0          0
                                      0          0          86399967
10/08/2019 12:45:44  22455    X       0          0          0          0
                                      0          0          22455248
===============================================================================
===============================================================================
Family     : Power
Admin State: Up                          Oper State: Up
===============================================================================
===============================================================================
RX Power  Section: Radio Hop  Period: 15 minutes  Data: Current
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/16/2019 09:30:00  667      Active            65144     65147     65145
===============================================================================
===============================================================================
RX Power  Section: Radio Hop  Period: 15 minutes  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/16/2019 09:15:00  900      Active            65144     65147     65145
10/16/2019 09:00:00  900      Active            65144     65147     65145
10/16/2019 08:45:00  900      Active            65144     65147     65145
10/16/2019 08:30:00  900      Active            65144     65147     65145
10/16/2019 08:15:00  900      Active            65144     65147     65145
10/16/2019 08:00:00  900      Active            65144     65147     65145
10/16/2019 07:45:00  900      Active            65144     65147     65145
10/16/2019 07:30:00  900      Active            65144     65147     65145
===============================================================================
===============================================================================
RX Power  Section: Radio Hop  Period: 24 hours  Data: Current
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/15/2019 19:00:00  52870    Active            65144     65148     65146
===============================================================================
===============================================================================
RX Power  Section: Radio Hop  Period: 24 hours  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/14/2019 19:00:00  86399    Active            65144     65148     65146
10/13/2019 19:00:00  86399    Active            65144     65148     65146
10/12/2019 19:00:00  86399    Active            65144     65148     65146
10/11/2019 19:00:00  86399    Active            65143     65148     65145
10/10/2019 19:00:00  86399    Active            65143     65148     65146
10/09/2019 19:00:00  86399    Active            65143     65148     65146
10/08/2019 19:00:00  86399    Active            65143     65148     65146
10/08/2019 12:45:45  22454    Active    X       65143     65148     65145
===============================================================================
===============================================================================
RX Power  Section: Radio Link  Period: 15 minutes  Data: Current
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/16/2019 09:30:00  671      Active            65144     65147     65145
===============================================================================
```


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```
===============================================================================
RX Power  Section: Radio Link  Period: 15 minutes  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/16/2019 09:15:00  900      Active            65144     65147     65145
10/16/2019 09:00:00  900      Active            65144     65147     65145
10/16/2019 08:45:00  900      Active            65144     65147     65145
10/16/2019 08:30:00  900      Active            65144     65147     65145
10/16/2019 08:15:00  900      Active            65144     65147     65145
10/16/2019 08:00:00  900      Active            65144     65147     65145
10/16/2019 07:45:00  900      Active            65144     65147     65145
10/16/2019 07:30:00  900      Active            65144     65147     65145
10/16/2019 07:15:00  900      Active            65144     65147     65145
===============================================================================
===============================================================================
RX Power  Section: Radio Link  Period: 24 hours  Data: Current
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/15/2019 19:00:00  52873    Active            65144     65148     65146
===============================================================================
===============================================================================
RX Power  Section: Radio Link  Period: 24 hours  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/14/2019 19:00:00  86399    Active            65144     65148     65146
10/13/2019 19:00:00  86399    Active            65144     65148     65146
10/12/2019 19:00:00  86399    Active            65144     65148     65146
10/11/2019 19:00:00  86399    Active            65143     65148     65145
10/10/2019 19:00:00  86399    Active            65143     65148     65146
10/09/2019 19:00:00  86399    Active            65143     65148     65146
10/08/2019 19:00:00  86399    Active            65143     65148     65146
10/08/2019 12:45:46  22453    Active    X       65143     65148     65145
===============================================================================
===============================================================================
TX Power  Section: Radio Hop  Period: 15 minutes  Data: Current
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/16/2019 09:30:00  674      N/A               70        70        70
===============================================================================
===============================================================================
TX Power  Section: Radio Hop  Period: 15 minutes  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/16/2019 09:15:00  900      N/A               70        70        70
10/16/2019 09:00:00  900      N/A               70        70        70
10/16/2019 08:45:00  900      N/A               70        70        70
10/16/2019 08:30:00  900      N/A               70        70        70
10/16/2019 08:15:00  900      N/A               70        70        70
10/16/2019 08:00:00  900      N/A               70        70        70
10/16/2019 07:45:00  900      N/A               70        70        70
10/16/2019 07:30:00  900      N/A               70        70        70
10/16/2019 07:15:00  900      N/A               70        70        70
10/16/2019 07:00:00  900      N/A               70        70        70
===============================================================================
===============================================================================
TX Power  Section: Radio Hop  Period: 24 hours  Data: Current
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
```


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```
10/15/2019 19:00:00  52876    N/A               70        70        70
===============================================================================
===============================================================================
TX Power  Section: Radio Hop  Period: 24 hours  Data: Historic
===============================================================================
Date                 Duration EPS       Suspect Min Power Max Power Mean Power
-------------------------------------------------------------------------------
10/14/2019 19:00:00  86399    N/A               70        70        70
10/13/2019 19:00:00  86399    N/A               70        70        70
10/12/2019 19:00:00  86399    N/A               70        70        70
10/11/2019 19:00:00  86399    N/A               70        70        70
10/10/2019 19:00:00  86399    N/A               70        70        70
10/09/2019 19:00:00  86399    N/A               70        70        70
10/08/2019 19:00:00  86399    N/A               70        70        70
10/08/2019 12:45:47  22452    N/A       X       70        70        70
===============================================================================
*A:7CSA:Dut-A#
```

Table 76: MWA performance monitoring field descriptions

Label	Description
Microwave Radio Performance Monitoring	
Family	The category of monitoring statistics, either Normalized G.826, Adaptive Coding and Modulation, or Power
Admin State	The administrative state of the microwave link, either Up or Down
Oper State	The operational state of the microwave link, either Up or Down
Section	The section being monitored, either Radio Hop or Radio Link
Period	The reporting period, either 15 minutes or 24 hours
Data	The type of data being collected, either current or historic
Date	The date and time of the monitoring period
Duration	The duration of the monitoring period in seconds
EPS	The EPS state at the time of recording this period
Suspect	Suspected faults (marked with an x)
ES	Errored Seconds statistics
SES	Severely Errored Seconds statistics
BBE	Background Block Errors statistics

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Label	Description
UAS	Unavailable Seconds statistics
QPSK	Quadrature Phase Shift Keying modulation statistics
8 PSK	Eight Phase Shift Keying modulation statistics
16 QAM	16-state Quadrature Amplitude Modulation statistics
32 QAM	32-state Quadrature Amplitude Modulation statistics
64 QAM	64-state Quadrature Amplitude Modulation statistics
128 QAM	128-state Quadrature Amplitude Modulation statistics
256 QAM	256-state Quadrature Amplitude Modulation statistics
Min Power	Minimum power statistics
Max Power	Maximum power statistics
Mean Power	Mean power statistics

3.15.2.1.6 Show port commands

port

Syntax

port [*port-id*] [**statistics**] [**detail**]

port *port-id* **acr** [**detail**]

port *port-id* **associations**

port *port-id* **cisco-hdlc**

port *port-id* **description**

port *port-id* **dot1x** [**detail**]

port *port-id* **ethernet** [**efm-oam** | **detail**]

port *port-id* **frame-relay** [**detail** | **dlci** *dlci*]

port *port-id* **ima-link**

port *port-id* **macsec** [*sub-port-id*] [**detail**] [**statistics**]

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port *port-id* **ppp** [**detail**]

port aps[*-group-id*][**.***channel*]

port lcr[*-group-id*/*port*][**.***channel*]

Context

show

Description

This command displays port or channel information.

If no command line options are specified, the **show port** command displays summary information for all ports on provisioned adapter cards, fixed platforms, and modules.

If the **detail** keyword is specified without any *port-id*, a detailed output of every port in the system is displayed whether the ports are configured or not. This is useful for gathering full reports or as an input into the "| match" filtering command to display a customized summary of fields.

If the *port-id* parameter only specifies a portion of a port identifier, a summary of all ports that start with that portion is displayed. For example, specifying a slot number and an MDA number displays a summary of all ports on that MDA. If no *port-id* is specified, a summary of all ports in the system is displayed.

If the port identifier specifies a unique port, information for that port is displayed. The specific information displayed depends on the type of port. Additional information is displayed if the **detail** keyword is included. In addition, information subsets can be displayed by using various keywords. For example, the **dot1x** keyword displays only the dot1x information for the port.

Parameters

port-id

specifies the physical port ID

t**Syntax**

port-id *slot*[*/mda*[*/port*]] or *slot*/*mda*/*port*[.*channel*]

where:

slot	1	
mda	1 to 6	7705 SAR-8 Shelf V2
	1 to 12 and X1 to X4	7705 SAR-18
	1 (Ethernet), 2 (T1/E1), or 3 (module)	7705 SAR-M
	1 (Ethernet), 2 (module position 1), or 3 (module position 2)	7705 SAR-H
	1 (Ethernet), 2 (RS-232)	7705 SAR-Hc
	1 (Ethernet) or 2 (T1/E1)	7705 SAR-A
	1 (Ethernet) or 2 (GNSS RF)	7705 SAR-Ax

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	1 (Ethernet)	7705 SAR-Wx (Ethernet-only variants and Ethernet and PoE+ variants)
	3 (GPS)	7705 SAR-Wx (variants with GPS)
	1 (for T1/E1 ports)	7705 SAR-X
	2 (for Ethernet XOR RJ45 ports 2/1A and 2/2A, Ethernet XOR SFP ports 2/1B and 2/2B, Ethernet ports 2/3 to 2/6, and 10GigE SFP+ port 2/7)	
	3 (for Ethernet XOR RJ45 ports 3/1A and 3/2A, Ethernet XOR SFP ports 3/1B and 3/2B, Ethernet ports 3/3 to 3/6, and 10GigE SFP+ port 3/7)	
port	1 to 2	2-port OC3/STM1 Channelized Adapter card
	1 to 2 physical ports, 1 virtual port (designated as "v-port" or port 3)	2-port 10GigE (Ethernet) Adapter card
		2-port 10GigE (Ethernet) module
	1 to 4	4-port OC3/STM1 Clear Channel Adapter card
		4-port OC3/STM1 / 1-port OC12/STM4 Adapter card
		4-port DS3/E3 Adapter card
		4-port SAR-H Fast Ethernet module
	1 to 6	6-port E&M Adapter card
		6-port FXS Adapter card
		6-port Ethernet 10Gbps Adapter card
		6-port SAR-M Ethernet module
	1 to 8	8-port Gigabit Ethernet Adapter card
		8-port Voice & Teleprotection card
		8-port C37.94 Teleprotection card
		8-port FXO Adapter card
		Packet Microwave Adapter card
	1 to 10	10-port 1GigE/1-port 10GigE X-Adapter card (10-port 1GigE mode)
	1	10-port 1GigE/1-port 10GigE X-Adapter card (1-port 10GigE mode)
	1	GPS Receiver module (GPS RF port)

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		GNSS Receiver card (GNSS RF port)
	1 to 12	12-port Serial Data Interface card
	1 to 16	16-port T1/E1 ASAP Adapter card
	1 to 32	32-port T1/E1 ASAP Adapter card
	1 to 7 (Ethernet), 1 to 16 (T1/E1), or 1 (module)	7705 SAR-M
	1 to 8 (Ethernet)	7705 SAR-H
	1 to 6 (Ethernet), 1 to 2 (RS-232)	7705 SAR-Hc
	1 to 2 (RS-232 ports)	4-port T1/E1 and RS-232 Combination module
	3 to 4 (T1/E1 ports)	4-port T1/E1 and RS-232 Combination module
	1 to 12 (Ethernet) or 1 to 8 (T1/E1)	7705 SAR-A
	1 to 12 (Ethernet) or 1 (GNSS RF)	7705 SAR-Ax
	1 to 5 (Ethernet) (on the Ethernet-only variants and Ethernet and PoE+ variants) or 1 (for GPS)	7705 SAR-Wx
	1 to 8 (T1/E1 ports), 1 or 2 (Ethernet XOR RJ45/SFP ports), 3 to 6 (Ethernet ports), 7 (Ethernet SFP+ ports)	7705 SAR-X
channel	ds1, e1, codir, or tpif	for **config>port>tdm** information
	em, fxo, or fxs	for **config>port>voice** information
	rs232, rs530, v35, or x21	for **config>port>serial** information
	1 to 24 (DS1) or 1 to 32 (E1)	for **config>port>tdm>channel-group** information
	1 (E&M)	for **config>port>voice>em>channel-group** information
	1 (DS0)	for **config>port>tdm>codir>channel-group, config>port>tdm>tpif>channel-group, config>port>voice>fxo>channel-group,** and

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	config>port>voice>fxs>channel-group information
1 (RS-232, RS-530, V.35, or X.21)	for **config>port>serial>channel-group** information

statistics

displays only port counter summary information

statistics detail

displays only port counter detail information

acr

displays ACR-capable port information

acr detail

displays ACR-capable port detail information

cisco-hdlc

displays cHDLC port information

description

displays port description strings

dot1x

displays statistics and status information for 802.1x ports

dot1x detail

displays statistics and status detail information for 802.1x ports

associations

displays a list of current router interfaces to which the port is associated

ppp

displays PPP protocol information for the port

ppp detail

displays PPP protocol detail information for the port

ethernet

displays Ethernet port information

ethernet efm-oam

displays EFM OAM information

ethernet detail

displays Ethernet port detail information

frame-relay

displays port-level frame relay statistics

frame-relay detail

displays frame relay port information

frame-relay dlci

displays circuit-level frame relay statistics

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ima-link

displays port-level IMA link information

macsec

displays port-level MACsec information. Specifying the subport ID displays MACsec information for the specified subport.

aps[*-group-id***][.***channel***]**

specifying only the keyword displays all the ports in APS groups. Specifying the group ID displays information for the specified APS group.

lcr[*-group-id/port***][.***channel***]**

specifying only the keyword displays all the ports in LCR groups. Specifying the group ID and port displays information for the port in the specified LCR group.

Output

The following outputs are examples of port information:

- General (Output example, Table 77: General port field descriptions)
- Port Statistics (Output Example, Table 78: Port statistics field descriptions)
- BERT and signaling status (Output Example)
- Specific, Ethernet (Output Example, Table 79: Specific port field descriptions (GigE port with optical SFP))
- Specific, PoE Enabled (Output Example, Table 80: PoE port field descriptions (Ethernet))
- Specific, Serial (Output Example, Table 81: Specific port field descriptions (serial port))
- Specific, SONET/SDH (Output Example, Table 82: Specific port field descriptions (SONET/SDH port))
- Specific, Voice E&M (Output Example, Table 83: Specific port field descriptions (E&M voice port))
- Specific, Voice FXO (Output Example, Table 84: Specific port field descriptions (FXO voice port))
- Specific, Voice FXS (Output Example, Table 85: Specific port field descriptions (FXS voice port))
- Specific, DS0 Voice Channel Group (Output Example, Table 86: Specific port field descriptions (DS0 voice channel group))
- Detail, SONET/SDH (Output Example, Table 87: Port detail field descriptions (SONET/SDH port))
- Detail, Ethernet (Output Example, Table 88: Port detail field descriptions (Ethernet, access mode))
- Detail, Ethernet (Output Example, Table 89: Port detail field descriptions (Ethernet, network mode))
- Detail, 10G Ring Ethernet (Output Example, Table 90: Port detail field descriptions (ring Ethernet))
- Detail, 2.5G Virtual Ethernet (Output example, Table 91: Port detail field descriptions (v-port))
- Detail, TDM/DS1 (Output example (DS1), Table 92: Port detail field descriptions (TDM DS1/E1 interface))
- Detail, TDM/E1 (Output example (E1), Table 92: Port detail field descriptions (TDM DS1/E1 interface))
- Serial Channel (Output example, Table 93: Port serial channel field descriptions)
- Voice Channel, E&M (Output example, Table 94: Port voice channel field descriptions)
- Channel Group (Output example, Table 95: Port channel group field descriptions)
- Channelized DS3 (Output example, Table 96: Port channelized DS3 field descriptions)

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- Clear Channel DS3 (Output example, Table 97: Port clear channel DS3 field descriptions)
- ACR Detail (Output example, Table 98: Port ACR detail field descriptions)
- dot1x (Output example, Table 99: Port dot1x field descriptions)
- Descriptions (Output example, Table 100: Port description field descriptions)
- Associations (Output example, Table 101: Port associations field descriptions)
- IMA Link (Output example, Table 102: Port IMA link field descriptions)
- PPP (Output example, Table 103: Port PPP field descriptions)
- CEM (Output example, Table 104: Port CEM field descriptions)
- Frame Relay (Output example, Table 105: Port frame relay field descriptions)
- Frame Relay DLCI (Output example, Table 106: Port frame relay DLCI field descriptions)
- HDLC and cHDLC (Output example, Table 106: Port frame relay DLCI field descriptions)
- TDM Codir or TPIF (Output example, Table 107: Port field descriptions (TDM codirectional or TPIF))
- GNSS (Output example, Table 108: Port field descriptions (GNSS))
- APS (Output example, Table 109: Port field descriptions (APS))
- Specific APS Port ID (Output example, Table 110: Port field descriptions (with APS ID))
- LCR (Output example, Table 111: Port field descriptions (LCR))
- Specific LCR Port ID (Output example, Table 112: Port field descriptions (with LCR port ID))

Output example

```
*A:NOK-1># show port 1/1
===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
1/1/1       Down  No   Ghost
1/1/2       Down  No   Ghost
1/1/2.1     Down  No   Ghost   1514 1514    - accs cem  serial
1/1/3       Down  No   Ghost
1/1/4       Down  No   Ghost
1/1/4.1     Down  No   Ghost   1514 1514    - accs cem  serial
1/1/5       Down  No   Ghost
1/1/6       Down  No   Ghost
1/1/7       Down  No   Ghost
1/1/8       Down  No   Ghost
1/1/9       Down  No   Ghost
1/1/10      Down  No   Ghost
1/1/11      Down  No   Ghost
1/1/12      Down  No   Ghost
===============================================================================

*A:NOK-1># show port 1/2
===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
1/2/1       Down  No   Ghost
1/2/1.sts3  Up    No   Ghost   1524 1524    - accs atm  sonet
```


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```
1/2/2       Up    No   Ghost
1/2/2.sts3  Down  No   Ghost   1572 1572    - netw pppa sonet
1/2/3       Down  No   Ghost
1/2/4       Down  No   Ghost
===============================================================================
*A:NOK-1>#

A:NOK-1># show port 1/3
===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
1/3/1       Down  No   Ghost
1/3/1.1     Down  No   Ghost   1514 1514    - accs cem  tdm
1/3/2       Down  No   Ghost
1/3/2.1     Down  No   Ghost   1514 1514    - accs cem  tdm
1/3/3       Down  No   Ghost
1/3/4       Down  No   Ghost
1/3/5       Down  No   Ghost
1/3/6       Down  No   Ghost
1/3/7       Down  No   Ghost
1/3/8       Down  No   Ghost
1/3/9       Down  No   Ghost
1/3/10      Down  No   Ghost
1/3/11      Down  No   Ghost
1/3/12      Down  No   Ghost
1/3/13      Down  No   Ghost
1/3/14      Down  No   Ghost
1/3/15      Down  No   Ghost
1/3/16      Down  No   Ghost
1/3/16.1    Down  No   Ghost   1572 1572    - netw unkn tdm
===============================================================================
```

Table 77: General port field descriptions

Label	Description
Port ID	The port ID configured or displayed in the *slot/mda/port* format
Admin State	Up: the administrative state is up
	Down: the administrative state is down
Link	Yes: a physical link is present
	No: a physical link is not present
Port State	Up: the port is physically present and has a physical link
	Down: the port is physically present but does not have a link
	Ghost: the port is not physically present
	None: the port is in its initial creation state or about to be deleted

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Label	Description
	Link Up: the port is physically present and has a physical link. When Link Up appears at the lowest level of a TDM tributary, it means the physical connection is active but the port is waiting before data traffic can flow. It is a waiting state and indicates that data traffic will not flow until it transitions to the Up state.
	Link Down: the port is physically present but does not have a link
Cfg MTU	The configured MTU
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets
LAG/Bndl	The link aggregation group (LAG) or multilink bundle to which a TDM port is assigned
Port Mode	network: the port is configured for transport network use
	access: the port is configured for service access
	hybrid: the port is configured for hybrid use (transport network and service access per VLAN)
Port Encp	The encapsulation type on the port
Port Type	The type of port or optics installed
SFP/MDI MDX	The SFP type on an Ethernet port (Ethernet, Fast Ethernet, or GigE)

Output example

```
*A:NOK-1># show port 1/1 statistics detail
===============================================================================
Port Statistics on Slot 1
===============================================================================
Port                    Ingress         Ingress         Egress          Egress
Id                      Packets          Octets         Packets         Octets
-------------------------------------------------------------------------------
1/1/1                         0               0               0               0
1/1/1.rs232                   0               0               0               0
1/1/2                         0               0               0               0
1/1/2.rs232                   0               0               0               0
1/1/2.1                       0               0               0               0
1/1/3                         0               0               0               0
1/1/4                         0               0               0               0
1/1/4.v35                     0               0               0               0
1/1/4.1                       0               0               0               0
1/1/5                         0               0               0               0
1/1/6                         0               0               0               0
1/1/7                         0               0               0               0
1/1/8                         0               0               0               0
```


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```
1/1/9                          0                0                0                0
1/1/10                         0                0                0                0
1/1/11                         0                0                0                0
1/1/12                         0                0                0                0
===============================================================================
*A:NOK-1>#

*A:NOK-1># show port 1/2 statistics detail
===============================================================================
Port Statistics on Slot 1
===============================================================================
Port                    Ingress         Ingress         Egress          Egress
Id                      Packets          Octets         Packets          Octets
-------------------------------------------------------------------------------
1/2/1                          0                0                0                0
1/2/1.sts3                     0                0                0                0
1/2/2                          0                0                0                0
1/2/2.sts3                     0                0                0                0
1/2/3                          0                0                0                0
1/2/4                          0                0                0                0
===============================================================================
*A:NOK-1>#

*A:NOK-1># show port 1/5 statistics detail
===============================================================================
Port Statistics on Slot 1
===============================================================================
Port                    Ingress         Ingress         Egress          Egress
Id                      Packets          Octets         Packets          Octets
-------------------------------------------------------------------------------
1/5/1                          0                0                0                0
1/5/2                          0                0                0                0
1/5/3                          0                0                0                0
1/5/4                          0                0                0                0
1/5/5                          0                0                0                0
1/5/6                          0                0                0                0
1/5/7                          0                0                0                0
1/5/8                          0                0                0                0
===============================================================================
*A:NOK-1>#
```

Output example

```
show port slot/mda/port.ds1
===============================================================================
TDM DS1 Interface
===============================================================================
Description        : DS1
Interface          : 1/2/1.ds1
Type               : ds1                     Framing             : esf
Admin Status       : up                      Oper Status         : up | diag
Physical Link      : yes                     Clock Source        : node-timed
Signal Mode        : none
Last State Change  : 10/18/2024 16:18:48     Channel IfIndex     : 574652417
Loopback           : none                    Invert Data         : false
Remote Loop respond: false                   In Remote Loop      : false
Load-balance-algo  : Default                 Egr. Sched. Pol     : N/A
Cfg Alarm          : ais los
Alarm Status       :
BER SD Threshold   : N/A                     BER SF Threshold    : N/A
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
Sync. Status Msg.  : Disabled                Tx DUS/DNU          : Disabled
```


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```
===============================================================================
BERT information
===============================================================================
Chan Group Id : 1                           Status        : idle|active
Pattern       : 2e11 | 2e15 | 2e20 | 2e20-qrss
Length        : 64k|56k                     Direction     : line|internal

Synched       : 00h00m00s                   Errors        : 0
===============================================================================
Signaling Insertion information
===============================================================================
Chan-Group Id : 1                           Status        : idle|active
ABCD          : 1010                        Direction     : line|internal
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                      867196693008           845845269984
Packets                                       4516788291             4405556784
Errors                                                 0                3218259
===============================================================================
DS1/E1 CAS Signaling
===============================================================================
          Rx    Tx                                  Rx    Tx
Timeslot  ABCD  ABCD                    Timeslot  ABCD  ABCD
-------------------------------------------------------------------------------
1         1010  1010                    13        1010  1010
2                                       14
3                                       15
4                                       16
5                                       17
6                                       18
7                                       19
8                                       20
9                                       21
10                                      22
11                                      23
12                                      24
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Packets                                     4516961945             4405730438
Discards                                               0                      0
Unknown Proto Discards                                 0
===============================================================================
```

Table 78: Port statistics field descriptions

Label	Description
Port ID	The port ID configured or displayed in the *slot/mda/port* format
Ingress Packets	The number of ingress packets coming into the port
Ingress Octets	The number of ingress octets coming into the port

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Label	Description
Egress Packets	The number of egress packets transmitted from the port
Egress Octets	The number of egress octets transmitted from the port

Output example

```
*A:ALU-1># show port 1/5/8
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/5/8                       Oper Speed       : 1 Gbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 40108032                    Hold time up     : 0 seconds
Last State Change  : 11/24/2009 13:05:41         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled
Phys State Chng Cnt: 0

Configured Mode    : hybrid                      Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Ing. Acc. Wt.      : 50                          Egr. Acc. Wt.    : 50
Ing. Net. Wt.      : 50                          Egr. Net. Wt.    : 50
Net. Egr. Queue Pol: default
Auto-negotiate     : true                        MDI/MDX          : unknown
Net. Egr. ShaperPol: 2
Acc. Egr. ShaperPol: 5
Net. Scheduler Mode: 16-priority
Config Phy-tx-clock: auto-pref-slave             Oper Phy-tx-clock: N/A
SapEgr.Unshaped-Cir: 0 Kbps
SapEgr.Shaper Pol  : default
NetEgr.Unshaped-Cir: 0 Kbps
Allow Eth-BN       : True
BN Egr.Rate in use : 765000                      Eth-BN hold time : 6
Egress Rate        : Default                     Ingress Rate     : n/a
Egr.Rate Incl.FCS  : Disabled
Ingress CBS(bytes) : 130816                      Src-pause        : Disabled
                                                 LACP Tunnel      : Disabled
Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Use Broadcast Addr : False

Loopback           : none                        Swap Mac Addr    : Disabled
Loopback Time Left : unspecified
Cfm Loopback       : Disabled

Sync. Status Msg.  : Enabled                     Rx Quality Level : 0xf(dus)

PTP Asymmetry      : 0                           Edge Timestamp   : Disable
Timestamp Capable  : True

CRC Mon SD Thresh  : Disabled                    CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled

Configured Address : 00:1a:f0:d4:09:de
Hardware Address   : 00:1a:f0:d4:09:de
```


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```
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Status : operational
Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALU  IPUIAELDAB
TX Laser Wavelength: 850 nm                    Diag Capable     : yes
Connector Code     : LC                        Vendor OUI       : 00:90:65
Manufacture date   : 2009/07/09                Media            : Ethernet
Serial Number      : PFS3UTC
Part Number        : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF
SFP Sync-E Capable : yes

===============================================================================
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
===============================================================================
                             Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)              +27.1     +95.0      +90.0      -20.0     -25.0
Supply Voltage (V)            3.31      3.90       3.70       2.90      2.70
Tx Bias Current (mA)           6.3      17.0       14.0        2.0       1.0
Tx Output Power (dBm)        -4.47     -2.00      -2.00     -11.02    -11.74
Rx Optical Power (avg dBm)   -20.51      1.00      -1.00     -18.01!   -20.00!
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Octets                                           11076096               11075584
Packets                                             86532                  86529
Errors                                                  0                      0
Utilization (30 seconds)                            0.00%                  0.00%
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                      1
Multicast Packets                                   86532                  86528
Broadcast Packets                                       0                      0
Discards                                                0                      0
Unknown Proto Discards                                  0
===============================================================================
===============================================================================
Port Discard Statistics
===============================================================================
                               Input                                  Output
Inv L2 Packets   :                 0
Inv IP Packets   :                 0
CSM Ingress Queues                    CSM Egress Queues
  Hi             :                 0    Common         :                   0
  Low            :                 0
  Ftp            :                 0
===============================================================================

===============================================================================
Ethernet CFM Statistics
===============================================================================
```


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```
Cfm LbmRx        :                   0
Cfm LbReplyTx    :                   0  Cfm LbmDropped   :                   0

Num Bn Rate Chng :                   1  Last BnRateChng  : 04/12/2017 21:20:53
Valid BnmRx      :                   2  Last Valid BnmRx : 04/12/2017 21:21:10
Invalid BnmRx    :                   0
BnmOutOfRangeBW  :                   0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
In Pause Frames  :                   0  Out Pause Frames :                   0
===============================================================================
*A:ALU-1>#
```

Table 79: Specific port field descriptions (GigE port with optical SFP)

Label	Description
Ethernet Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Link-level	The type of link for which the port is configured
Admin State	up: the administrative state is up
	down: the administrative state is down
Oper State	up: the operating state is up
	down: the operating state is down
Reason Down	Indicates that the port has gone down due to Link Loss Forwarding
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Single Fiber Mode	Yes: single fiber mode
	No: not single fiber mode
IfIndex	The interface's index number, which reflects its initialization sequence
Last State Change	The last time that the operational status of the port changed state

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Label	Description
Last Cleared Time	The time since the last clear
Phys State Chng Cnt	The physical state change counter. This counter increments when a fully qualified (debounced) transition occurs at the physical layer of an Ethernet port, including the following transitions of the port state as displayed in the **show port** *slot/mda/port* output: • from Down to Link Up or Up • from Link Up or Up to Down This counter does not increment for changes only in the link protocol states. That is, if the physical link is up, any transitions of the port state due to link protocols (for example, 802.3ah EFM OAM, LACP, 802.1ag) do not cause the counter to increment. The following port state transitions are examples of transitions that are not counted: • from Link Up to Up • from Up to Link Up
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
	hybrid: the port is configured for hybrid use (transport network and service access per VLAN)
Dot1Q Ethertype	The Ethertype expected when the port's encapsulation type is dot1q
QinQ Ethertype	The Ethertype expected when the port's encapsulation type is qinq
Ing. Pool % Rate	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port or channel for ingress buffering
Net. Egr. Queue Pol	default: the default policy is used
	network: the network egress queue policy is used
Egr. Sched. Pol	The egress scheduling policy
Net. Egr. ShaperPol	The network egress shaper policy ID
Acc. Egr. ShaperPol	The access egress shaper policy ID
Net. Scheduler Mode	The network scheduler mode
Auto-negotiate	true: the link attempts to automatically negotiate the link speed and duplex parameters

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Label	Description
	false: the duplex and speed values are used for the link
Config Phy-tx-clock	The mode used to establish timing control of a 1000Base-T port. The options are: • N/A – the port does not support 1000Base-T • auto-pref-master – prefers to be master during autonegotiation • auto-pref-slave – prefers to be slave during autonegotiation • slave – the port is forced to be slave • master – the port is forced to be master
Oper Phy-tx-clock	The operational value of the MASTER-SLAVE relationship of the 1000Base-T physical layer transmit clock. The options are: • N/A – the port or the inserted SFP does not support 1000Base-T, the port is down, or negotiation failed • slave – the port is slave • master – the port is master
SapEgr.Shaper Pol	The SAP egress shaper policy for the port
SapEgr.Unshaped-Cir	The CIR rate for the aggregate of all the unshaped 4-priority SAPs on the port
NetEgr.Unshaped-Cir	The CIR rate for the aggregate of all the unshaped VLANs on the port
Allow Eth-BN	Indicates whether Ethernet Bandwidth Notification (ETH-BN) is allowed on the port: True or False
BN Egr.Rate in use	The egress rate in use based on the request from the ETH-BN server MEP
Eth-BN hold time	The configured hold time (in seconds) between an egress rate change based on a received Bandwidth Notification Message (BNM) and the next change request that will be accepted
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate
Egr.Rate Incl.FCS	The configured state of egress rate FCS inclusion: enabled or disabled
Ingress CBS (bytes)	Indicates the ingress committed buffer space

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Label	Description
Src-pause	A notification to slow down the transmission rate when it exceeds the bandwidth limit
LACP Tunnel	Indicates whether LACP packet tunneling is enabled
Down-when-looped	Enabled: The down-when-looped feature is enabled on the port
	Disabled: The down-when-looped feature is disabled on the port
Keep-alive	The time interval between keepalive PDUs transmitted toward the network during loop detection by the down-when-looped feature
Loop Detected	Indicates whether a loop is detected on the port
Retry	The minimum wait time before the port is re-enabled after it is brought down due to a loop detection
Use Broadcast Addr	Indicates whether the down-when-looped feature has been configured to compare the destination MAC address of received PDUs to the broadcast MAC address instead of the MAC address of the port
Loopback	The type of loopback configured on the port, either line, internal, or none
Swap Mac Addr	Indicates whether MAC address swapping is enabled
Loopback Time Left	The number of seconds left in a timed loopback If there is no loopback configured or the configured loopback is latched, the value is unspecified If configured loopback is persistent, the value persistent.
Cfm Loopback	Indicates whether the CFM loopback is enabled
Sync. Status Msg.	Indicates whether Synchronization Status Messaging is enabled on the port
PTP Asymmetry	Indicates whether PTP asymmetry is enabled
Edge Timestamp	Indicates whether the edge timestamp is enabled
Timestamp Capable	Indicates whether the port is timestamp-capable
CRC Mon SD Thresh	Indicates the CRC signal degrade threshold value (1 to 9), if enabled
CRC Mon SF Thresh	Indicates the CRC signal fail threshold value (1 to 9), if enabled

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Label	Description
CRC Mon Window	Indicates the CRC window sampling size value (5 to 60)
Rx Quality Level	The Synchronization Status Messaging quality level value received on the port
Code-Type	The Synchronization Status Messaging quality level code type
Tx Quality Level	The Synchronization Status Messaging quality level value transmitted on the port
Tx DUS/DNU	Indicates whether the transmission of the QL-DUS/DNU value in synchronization status messages is enabled or disabled on the port
Configured Address	The base chassis Ethernet MAC address
Hardware Address	The interface hardware- or system-assigned MAC address at its protocol sublayer
Cfg Alarm	The type of alarms to be logged and reported for the Ethernet port
Alarm Status	The current alarm state
Oper Speed	The operating speed of the interface
Config Speed	The configured speed of the interface
Oper Duplex	full: the link is operating at full-duplex mode half: the link is operating at half-duplex mode
Config Duplex	full: the link is set at full-duplex mode half: the link is set at half-duplex mode
MTU	The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets
Hold time up	The link-up dampening time in seconds
Hold time down	The link-down dampening time in seconds
Encap Type	null: ingress frames will not use any tags or labels to delineate a service
	dot1q: ingress frames carry 802.1Q tags, where each tag signifies a different service
	qinq: ingress frames carry two 802.1Q tags, where the outer tag is the service provider tag and the inner tag is the customer service tag

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Label	Description
Egr. Pool % Rate	The amount of egress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port or channel for egress buffering
MDI/MDX	Ethernet type
Transceiver Data	The following information is provided for a configured transceiver (SFP): • transceiver status • transceiver type • model number • TX laser wavelength • whether it is diagnostics capable • connector code • vendor organizationally unique identifier (OUI) • manufacture date • media • serial number • part number • optical compliance • link length support: • whether it is Sync-E capable
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated	
	SFP manufacturers specifications guidelines contained in specification SFF-8472, for the following: • temperature (C) • supply voltage (V) • Tx bias current (mA) • Tx output power (dBm) • Rx optical power (avg dBm) For the above categories, the following values are shown: • Value is the current measured value of each variable • High Alarm is the measurement of Value that will cause a DDM High Alarm to be output • High Warn is the measurement of Value that will cause a DDM High Warning Alarm to be output • Low Warn is the measurement of Value that will cause a DDM Low Warning Alarm to be output

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Label	Description
	• Low Alarm is the measurement of Value that will cause a DDM Low Alarm to be output If alarms/warnings are raised, there will be an "!" in the output
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Utilization Input/Output	An average computed over the configured interval presented as a percentage of the maximum possible utilization on the Ethernet port.
Port Statistics	
Unicast packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast

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Label	Description
	or broadcast address at this sublayer, including those that were discarded or not sent.
Broadcast packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts.
Port Discard Statistics	
Inv L2 Packets Input	The number of invalid packets discarded due to an unknown Layer 2 ID
Inv IP Packets Input	The number of invalid IP packets discarded
CSM Ingress Queues Input	The number of incoming control packets discarded
CSM Egress Queues Output	The number of outgoing control packets discarded
Ethernet CFM Statistics	
Cfm LbmRx	The number of LBMs received
Cfm LbReplyTx	The number of LBRs transmitted
Cfm LbmDropped	The number of LBMs dropped
Num Bn Rate Chng	The number of times that the port egress rate is dynamically changed based on Bandwidth Notification (BN) messages Note: not every bandwidth change indicated by a BNM triggers a port egress rate change

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Label	Description
Last BnRateChng	The time that the port egress rate was last changed based on a BNM
Valid BnmRx	The number of valid BN messages received
Last Valid BnmRx	The time that the last valid BNM was received
Invalid BnmRx	The number of invalid BN messages received
BnmOutOfRangeBW	The number of BN messages received with a requested bandwidth that was out of range
Ethernet-like Medium Statistics	
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets
FCS Errors	The number of frames received that are an integral number of octets in length but do not pass the FCS check
SQE Errors	The number of times that the SQE TEST ERROR is received
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Too long Frames	The number of frames received that exceed the maximum permitted frame size
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present
In Pause Frames	The number of IEEE 802.3x pause frames received for flow control; traffic is momentarily disrupted
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully
Late Collisions	The number of times that a collision is detected later than one slotTime into the transmission of a packet
Excess Collisns	The number of frames for which a transmission fails due to excessive collisions

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Label	Description
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sublayer transmit error
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sublayer receive error
Out Pause Frames	The number of IEEE 802.3x pause frames sent for flow control; traffic is momentarily disrupted

Output example

```
*A:ALU-1># show port 1/1/7 detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet TX
Interface          : 1/1/7                     Oper Speed       : N/A
Link-level         : Ethernet                  Config Speed     : 1 Gbps
Admin State        : down                      Oper Duplex      : N/A
Oper State         : down                      Config Duplex    : full
Physical Link      : No                        MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 44302336                  Hold time up     : 0 seconds
Last State Change  : 04/14/2014 14:05:25       Hold time down   : 0 seconds
Last Cleared Time  : N/A

Configured Mode    : access                    Encap Type       : Null
Dot1Q Ethertype    : 0x8100
Ing. Pool % Rate   : 100                       Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default
Auto-negotiate     : true                      MDI/MDX          : unknown
Config Phy-tx-clock: auto-pref-slave           Oper Phy-tx-clock: N/A
Allow Eth-BN       : True
BN Egr.Rate in use : 765000                    Eth-BN hold time : 6
Egress Rate        : Default                   Ingress Rate     : n/a
Down-when-looped   : Disabled                  Keep-alive       : 10
Loop Detected      : False                     Retry            : 120
Use Broadcast Addr : False

Loopback           : none                      Swap Mac Addr    : Disabled
Loopback Time Left : unspecified
Cfm Loopback       : Disabled

PoE Mode           : None                      PoE Detection       : Searching
Poe Class          : Class 0                   PoE Fault Reason    : none
PoE Maximum Power  : None                      PoE Power In Use    : 0.0 watts

Sync. Status Msg.  : Disabled                  Rx Quality Level : N/A

PTP Asymmetry      : 0                         Edge Timestamp   : Disable
Timestamp Capable  : False

CRC Mon SD Thresh  : Disabled                   CRC Mon Window : 10 seconds
CRC Mon SF Thresh  : Disabled

Configured Address : 6c:be:e9:b1:af:1b
Hardware Address   : 6c:be:e9:b1:af:1b
Cfg Alarm          :
Alarm Status       :
```


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```
Transceiver Data
Transceiver Status : not-equipped
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                            10728                  14236
Packets                                             102                    156
Errors                                                0                      0
Utilization (30 seconds)                          0.00%                  0.00%
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                     102                    101
Multicast Packets                                     0                     52
Broadcast Packets                                     0                      3
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================

===============================================================================
Port Discard Statistics
===============================================================================
                              Input                                 Output
Inv L2 Packets   :                0
Inv IP Packets   :                0

CSM Ingress Queues                   CSM Egress Queues
  Hi             :                0    Common         :                    0
  Medium         :                0
  Low            :                0
===============================================================================

===============================================================================
Port Control Statistics
===============================================================================

-------------------------------------------------------------------------------
Ingress Queue CTL             Packets                 Octets
     Forwarded :                0                       0
     Dropped   :                0                       N/A

Egress Queue CTL              Packets                 Octets
     Forwarded :                0                       0
     Dropped   :                0                       N/A
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                0  Sngl Collisions  :                    0
FCS Errors       :                0  Mult Collisions  :                    0
SQE Test Errors  :                0  Late Collisions  :                    0
CSE              :                0  Excess Collisns  :                    0
Too long Frames  :                0  Int MAC Tx Errs  :                    0
Symbol Errors    :                0  Int MAC Rx Errs  :                    0
In Pause Frames  :                0  Out Pause Frames :                    0
===============================================================================
```


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```
===============================================================================
Ethernet CFM Statistics
===============================================================================

Cfm LbmRx        :                   0
Cfm LbReplyTx    :                   0  Cfm LbmDropped   :                   0

Num Bn Rate Chng :                   1  Last BnRateChng  : 04/12/2017 21:20:53
Valid BnmRx      :                   2  Last Valid BnmRx : 04/12/2017 21:21:10
Invalid BnmRx    :                   0
BnmOutOfRangeBW  :                   0
===============================================================================
*A:ALU-1>#
```

Table 80: PoE port field descriptions (Ethernet)

Label	Description
Ethernet Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Oper Speed	The operating speed of the interface
Link-level	Ethernet: the port is configured as Ethernet
Config Speed	The configured speed of the interface
Admin State	up: the port is administratively up
	down: the port is administratively down
Oper Duplex	The operating duplex mode of the interface
Oper State	up: the port is operationally up
	down: the port is operationally down
Config Duplex	full: the link is configured to full-duplex mode
	half: the link is configured to half-duplex mode
Physical Link	Yes: a physical link is present
	No: a physical link is not present
MTU	The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets
Single Fiber Mode	Yes: single fiber mode
	No: not single fiber mode

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Label	Description
IfIndex	The interface's index number, which reflects its initialization sequence
Hold time up	The link-up dampening time in seconds. The port link dampening timer value that reduces the number of link transitions reported to upper layer protocols.
Last State Change	The last time that the operational status of the port changed state
Hold time down	The link-down dampening time in seconds. The down timer controls the dampening timer for link down transitions.
Last Cleared Time	The time since the last clear
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
	hybrid: the port is configured for hybrid use (transport network and service access per VLAN)
Encap Type	null: ingress frames will not use any tags or labels to delineate a service
	dot1q: ingress frames carry 802.1Q tags, where each tag signifies a different service
	qinq: ingress frames carry two 802.1Q tags, where the outer tag is the service provider tag and the inner tag is the customer service tag
Dot1Q Ethertype	The protocol carried in a dot1q Ethernet frame
Ing. Pool % Rate	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering
Egr. Pool % Rate	The amount of egress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for egress buffering
Net.Egr. Queue Pol.	The number of the associated network egress queue QoS policy, or default if the default policy is used
Auto-negotiate	true: the link attempts to automatically negotiate the link speed and duplex parameters
	false: the duplex and speed values are used for the link
MDI/MDX	Indicates the Ethernet interface type

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Label	Description
Config Phy-tx-clock	The mode used to establish timing control of a 1000Base-T port. The options are: • N/A – the port does not support 1000Base-T • auto-pref-master – prefers to be master during autonegotiation • auto-pref-slave – prefers to be slave during autonegotiation • slave – the port is forced to be slave • master – the port is forced to be master
Oper Phy-tx-clock	The operational value of the master-slave relationship of the 1000Base-T physical layer transmit clock. The options are: • N/A – the port or the inserted SFP does not support 1000Base-T, the port is down, or negotiation failed • slave – the port is slave • master – the port is master
Allow Eth-BN	Indicates whether Ethernet Bandwidth Notification (ETH-BN) is allowed on the port: True or False
BN Egr.Rate in use	The egress rate in use based on the request from the ETH-BN server MEP
Eth-BN hold time	The configured hold time (in seconds) between an egress rate change based on a received Bandwidth Notification Message (BNM) and the next change request that will be accepted
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate
Ingress Rate	The maximum amount of ingress bandwidth (in kilobits per second) that this Ethernet interface can generate
Down-when-looped	Enabled: The down-when-looped feature is enabled on the port
	Disabled: The down-when-looped feature is disabled on the port
Keep-alive	The time interval between keepalive PDUs transmitted toward the network during loop detection by the down-when-looped feature
Loop Detected	Indicates whether a loop is detected on the port

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Label	Description
Retry	The minimum wait time before the port is re-enabled after it is brought down due to a loop detection
Use Broadcast Addr	Indicates whether the down-when-looped feature has been configured to compare the destination MAC address of received PDUs to the broadcast MAC address instead of the MAC address of the port
Loopback	The type of loopback configured on the port, either line, internal, or none
Swap Mac Addr.	Indicates whether MAC address swapping is enabled
Loopback Time Left	The number of seconds left in a timed loopback If there is no loopback configured or the configured loopback is latched, the value is unspecified. If configured loopback is persistent, the value persistent
Cfm Loopback	Indicates whether the CFM loopback is enabled
PoE Mode	Indicates whether the port is using Poe, PoE+, or if the PoE function is turned off (disabled)
PoE Detection	Indicates the detection state of the PoE port
PoE Class	Displays the class of the PoE device connected to the port, as defined in IEEE 802.3af
PoE Fault Reason	Displays the reason the PoE port is down if a fault is detected
PoE Maximum Power	Indicates the maximum amount of PoE power configured and available on the port
PoE Power in Use	Indicates the amount of PoE power being used by the port
Sync. Status Msg.	Indicates whether Synchronization Status Messaging is enabled on the port
Rx Quality Level	The Synchronization Status Messaging quality level value received on the port
PTP Asymmetry	Indicates whether PTP asymmetry is enabled
Edge Timestamp	Indicates whether the edge timestamp is enabled
Timestamp Capable	Indicates whether the port is timestamp-capable
CRC Mon SD Thresh	Indicates the CRC signal degrade threshold value (1 to 9), if enabled

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Label	Description
CRC Mon SF Thresh	Indicates the CRC signal fail threshold value (1 to 9), if enabled
CRC Mon Window	Indicates the CRC window sampling size value (1 to 10)
Configured Address	The base chassis Ethernet MAC address
Hardware Address	The interface hardware- or system-assigned MAC address at its protocol sublayer
Cfg Alarm	The type of alarms to be logged and reported for the port
Alarm Status	The current alarm state
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Utilization Input/Output	An average computed over the configured interval presented as a percentage of the maximum possible utilization on the Ethernet port.
Port Statistics	
Unicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a

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Label	Description
	multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent
Broadcast Packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts
Port Discard Statistics	
Inv L2 Packets Input	The number of invalid packets that are discarded due to an unknown Layer 2 ID
Inv IP Packets Input	The number of invalid IP packets that are discarded
CSM Ingress Queues Input	The number of incoming control packets discarded
CSM Egress Queues Output	The number of outgoing control packets discarded
Port Control Statistics	
Ingress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the ingress control queue. For access ports, this statistic applies only to Ethernet cards. For network ports, this statistic applies to all adapter cards.

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Label	Description
Egress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the egress control queue. For access ports, this statistic applies only to Ethernet cards. For network ports, this statistic applies to all adapter cards.
Ethernet-like Medium Statistics	
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets
FCS Errors	The number of frames received that are an integral number of octets in length but do not pass the FCS check
SQE Errors	The number of times that the SQE TEST ERROR is received
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Too long Frames	The number of frames received that exceed the maximum permitted frame size
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present
In Pause Frames	The number of IEEE 802.3x pause frames received for flow control; traffic is momentarily disrupted
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully
Late Collisions	The number of times that a collision is detected later than one slotTime into the transmission of a packet
Excess Collisns	The number of frames for which a transmission fails due to excessive collisions
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sublayer transmit error

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Label	Description
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sublayer receive error
Out Pause Frames	The number of IEEE 802.3x pause frames sent for flow control; traffic is momentarily disrupted
Ethernet CFM Statistics	
Cfm LbmRx	The number of LBMs received
Cfm LbReplyTx	The number of LBRs transmitted
Cfm LbmDropped	The number of LBMs dropped
Num Bn Rate Chng	The number of times that the port egress rate is dynamically changed based on Bandwidth Notification (BN) messages Note: not every bandwidth change indicated by a BNM triggers a port egress rate change
Last BnRateChng	The time that the port egress rate was last changed based on a BNM
Valid BnmRx	The number of valid BN messages received
Last Valid BnmRx	The time that the last valid BNM was received
Invalid BnmRx	The number of invalid BN messages received
BnmOutOfRangeBW	The number of BN messages received with a requested bandwidth that was out of range

Output example

```
*A:ALU-1># show port 1/1/1
===============================================================================
Serial RS-232 Physical Interface
===============================================================================
Description        : RS-232/V.35/X.21
Interface          : 1/1/1                 Port IfIndex         : 35684352
Admin Status       : down                  Oper Status          : down
Physical Link      : No
Type               : rs232
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
*A:ALU-1>#
```


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Table 81: Specific port field descriptions (serial port)

Label	Description
Serial RS-232 Physical Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Port IfIndex	The interface's index number, which reflects its initialization sequence
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operational state is up
	down: the operational state is down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Type	The type of serial interface
Port Statistics	
Packets input/output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards input/output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards input/output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1># show port 1/2/1
===============================================================================
```


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```
SONET/SDH Interface
===============================================================================
Description        : OC-3 SONET/SDH
Interface          : 1/2/1                  Speed               : oc3
Admin Status       : up                     Oper Status         : up
Physical Link      : Yes                    Loopback Mode       : none
Single Fiber Mode  : No
Ing. Pool % Rate   : 100                    Egr. Pool % Rate    : 100
APS Group          : none                   APS Role            : none
Clock Source       : node                   Framing             : sonet
Last State Change  : 11/24/2009 13:05:56    Port IfIndex        : 46170112
Last Cleared Time  : N/A                    DDM Events          : Enabled
J0 String          : 0x01                   Section Trace Mode  : byte
Rx S1 Byte         : 0x00 (stu)             Rx K1/K2 Byte       : 0x00/0x00
Tx S1 Byte         : 0x00 (stu)             Tx DUS/DNU          : Disabled
Rx J0 String (Hex) : 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Cfg Alarm          : loc lrdi lb2er-sf slof slos
Alarm Status       :
BER SD Threshold   : 6                      BER SF Threshold    : 3
Hold time up       : 500 milliseconds
Hold time down     : 0 milliseconds

Transceiver Data

Transceiver Status : operational
Transceiver Type   : SFP
Model Number       : 3HE00034AAAA02  ALU  IPUIAEXDAB
TX Laser Wavelength: 1310 nm                Diag Capable        : yes
Connector Code     : LC                     Vendor OUI          : 00:00:00
Manufacture date   : 2009/04/25             Media               : SONET/SDH
Serial Number      : 1XX200083926037
Part Number        : FTM3101CSL2iAL
Optical Compliance : OC3-SR-MM
Link Length support: 2000m for 50u MMF; 2000m for 62.5u MMF
SFP Sync-E Capable : n/a
===============================================================================
Transceiver Digital Diagnostic Monitoring (DDM), Externally Calibrated
===============================================================================
                            Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)              +36.6    +100.0      +95.0      -35.0     -40.0
Supply Voltage (V)            3.28      3.80       3.63       2.97      2.70
Tx Bias Current (mA)           8.2      60.0       50.0        0.2       0.1
Tx Output Power (dBm)        -15.44    -13.00     -14.00     -20.00    -21.02
Rx Optical Power (avg dBm)   -16.14     -9.00     -10.00     -33.00    -35.22
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Packets                                             0                      0
Discards                                            0                      0
Unknown Proto Discards                              0
===============================================================================
*A:ALU-1>#
```

Table 82: Specific port field descriptions (SONET/SDH port)

Label	Description
SONET/SDH interface	

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Label	Description
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Speed	The speed of a SONET/SDH port
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operational state is up
	down: the operational state is down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Loopback Mode	The loopback mode on the port
Single Fiber Mode	Yes: single fiber mode No: not single fiber mode
Ing. Pool % Rate	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering
Egr. Pool % Rate	The amount of egress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for egress buffering
APS group	The automatic protection switching group
APS role	The automatic protection switching group role
Clock Source	node: the link uses the internal clock when transmitting data loop: the link recovers the clock from the received data stream
Framing	sonet: the port is configured for SONET framing sdh: the port is configured for SDH framing
Last State Change	The last time that the operational status of the port changed state
Port IfIndex	The interface's index number, which reflects its initialization sequence
Last Cleared Time	The time since the last clear

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Label	Description
DDM Events	Enabled: digital diagnostic monitoring events is enabled for the port Disabled: digital diagnostic monitoring events is disabled for the port
J0 String	The section trace value that is sent to the far-end port
Section Trace Mode	byte: the section trace in the SONET section header is set in bytes string: a text string is used to identify the SONET section header increment-z0: an incremental STM ID is configured instead of a static value
Rx S1 Byte	The synchronization status message value of the received SONET/SDH S1 byte
Rx K1/K2 Byte	The value of the received SONET/SDH K1/K2 byte
Tx S1 Byte	The synchronization status message value of the transmitted SONET/SDH S1 byte
Tx DUS/DNU	Indicates whether the transmission of the QL-DUS/DNU value in synchronization status messages is enabled or disabled on the port
Rx J0 String (Hex)	The hex value of the received J0
Cfg Alarm	The type of alarms to be logged and reported for the SONET/SDH port
Alarm Status	The current alarm state
BER SD Threshold	The configured threshold for line signal degradation BER error rate, that when crossed determines the signal degradation and signal failure
BER SF Threshold	The configured threshold for line signal failure BER error rate, that when crossed determines the signal degradation and signal failure
Hold time up	The hold-timer value for link-up event dampening
Hold time down	The hold-timer value for link-down event dampening
Transceiver Data	The following information is provided for a configured transceiver (SFP): • transceiver status • transceiver type • model number

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Label	Description
	• TX laser wavelength • whether it is diagnostics capable • connector code • vendor organizationally unique identifier (OUI) • manufacture date • media • serial number • part number • optical compliance • link length support • whether it is Sync-E capable
Transceiver Digital Diagnostic Monitoring (DDM), Externally Calibrated	
	SFP manufacturers specifications guidelines contained in specification SFF-8472, for the following: • temperature (C) • supply voltage (V) • Tx bias current (mA) • Tx output power (dBm) • Rx optical power (avg dBm) For the above categories, the following values are shown: • Value is the current measured value of each variable • High Alarm is the measurement of Value that will cause a DDM High Alarm to be output • High Warn is the measurement of Value that will cause a DDM High Warning Alarm to be output • Low Warn is the measurement of Value that will cause a DDM Low Warning Alarm to be output • Low Alarm is the measurement of Value that will cause a DDM Low Alarm to be output If alarms/warnings are raised, an "!" is included in the output
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested

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Label	Description
	be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/ Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1># show port 1/1/1
===============================================================================
Voice Physical Interface
===============================================================================
Description        : E&M
Interface          : 1/1/1                 Port IfIndex         : 41975808
Admin Status       : up                    Oper Status          : up
Physical Link      : Yes
Type               : em
TLP Rx             : 0.0                   Audio Wires          : four-wires
TLP Tx             : 0.0
===============================================================================

===============================================================================
Port Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Packets                                          106012                105984
Discards                                              0                     0
Unknown Proto Discards                                0
===============================================================================
*A:ALU-1>#
```

Table 83: Specific port field descriptions (E&M voice port)

Label	Description
Voice Physical Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format

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Label	Description
Port IfIndex	The interface's index number, which reflects its initialization sequence
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operating state is up
	down: the operating state is down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Type	The type of voice interface
TLP Rx	The receive transmission level point value for the port
Audio Wires	Four-wire or two-wire (for E & M only)
TLP Tx	The transmit transmission level point value for the port
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1>#  show port 1/1/5
===============================================================================
Voice Physical Interface
===============================================================================
Description        : FXO
```


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```
Interface          : 1/1/5                    Port IfIndex         : 39878656
Admin Status       : down                     Oper Status          : down
Physical Link      : no
Type               : fxo                      Signaling Type       : 3600ls
TLP Rx             : 0.0                      Line Balance         : nominal
TLP Tx             : 0.0
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                      Input                Output
-------------------------------------------------------------------------------
Packets                                                 0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
*A:ALU-1>#
```

Table 84: Specific port field descriptions (FXO voice port)

Label	Description
Voice Physical Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Port IfIndex	The interface's index number, which reflects its initialization sequence
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operating state is up
	down: the operating state is down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Type	The type of voice interface (fxo)
Signaling Type	The signaling type: Mu-law: **3600ls** – loop start A-law: **1511profile1** – 1511 loop start **3600re** – remote extension **1511sn137** – 1511 profile 137
TLP Rx	The receive transmission level point value for the port

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Label	Description
Line Balance	nominal or 800
TLP Tx	The transmit transmission level point value for the port
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1>#  show port 1/6/1
===============================================================================
Voice Physical Interface
===============================================================================
Description        : FXO
Interface          : 1/1/5                  Port IfIndex         : 39878656
Admin Status       : down                   Oper Status          : down
Physical Link      : no
Type               : fxs                    Signaling Type       : 3600ls
TLP Rx             : -3.0                   Line Balance         : nominal
TLP Tx             : 0.0                    Ring Generation      : 16
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                               0                     0
Discards                                              0                     0
Unknown Proto Discards                                0
===============================================================================
*A:ALU-1>#
```


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Table 85: Specific port field descriptions (FXS voice port)

Label	Description
Voice Physical Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Port IfIndex	The interface's index number, which reflects its initialization sequence
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operating state is up
	down: the operating state is down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Type	The type of voice interface (fxs)
Signaling Type	The signaling type: Mu-law: **3600ls** – loop start **3600plar** – private line automatic ringdown A-law: **1511plar** – 1511 private line automatic ringdown **3600plar** – private line automatic ringdown **1511profile1** – 1511 loop start **3600re** – remote extension **1511sn137** – 1511 profile 137
TLP Rx	The receive transmission level point value for the port
Line Balance	nominal or 800
TLP Tx	The transmit transmission level point value for the port
Ring Generation	The frequency of the generated ring signal
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a

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Label	Description
	multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1>#  show port 1/6/1.1
===============================================================================
Voice DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/6/1.1
Admin Status       : down                    Oper Status          : down
Last State Change  : 01/31/2011 16:06:07     Chan-Grp IfIndex     : 572555325
Configured Mode    : access                  Encap Type           : cem
Admin MTU          : 1514                    Oper MTU             : 1514
Physical Link      : No
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                     0
Packets                                                0                     0
Errors                                                 0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
```


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Table 86: Specific port field descriptions (DS0 voice channel group)

Label	Description
Voice	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operating state is up
	down: the operating state is down
Chan-grp IfIndex	The channel group's index number, which reflects its initialization sequence
Last State Change	Date and time of last state change
Configured Mode	short, long, nominal or 800
Admin MTU	The configured MTU
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Encap Type	The transmit transmission level point value for the port
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors

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Label	Description
	preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/ Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1># show port 1/2/2 detail
===============================================================================
SONET/SDH Interface
===============================================================================
Description        : OC-3 SONET/SDH
Interface          : 1/2/2                  Speed               : oc3
Admin Status       : up                     Oper Status         : up
Physical Link      : Yes                    Loopback Mode       : none
Single Fiber Mode  : No
Ing. Pool % Rate   : 100                    Egr. Pool % Rate    : 100
APS Group          : none                   APS Role            : none
Clock Source       : node                   Framing             : sonet
Last State Change  : 12/02/2009 11:14:23    Port IfIndex        : 46170112
Last Cleared Time  : N/A                    DDM Events          : Enabled
J0 String          : 0x01                   Section Trace Mode  : byte
Rx S1 Byte         : 0x00 (stu)             Rx K1/K2 Byte       : 0x00/0x00
Tx S1 Byte         : 0x00 (stu)             Tx DUS/DNU          : Disabled
Rx J0 String (Hex) : 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Cfg Alarm          : loc lrdi lb2er-sf slof slos
Alarm Status       :
BER SD Threshold   : 6                      BER SF Threshold    : 3
```


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```
Hold time up       : 500 milliseconds
Hold time down     : 0 milliseconds

Transceiver Data

Transceiver Status : operational
Transceiver Type   : SFP
Model Number       : 3HE00034AAAA02  ALU  IPUIAEXDAB
TX Laser Wavelength: 1310 nm               Diag Capable         : yes
Connector Code     : LC                    Vendor OUI           : 00:00:00
Manufacture date   : 2009/04/25            Media                : SONET/SDH
Serial Number      : 1XX200083926037
Part Number        : FTM3101CSL2iAL
Optical Compliance : OC3-SR-MM
Link Length support: 2000m for 50u MMF; 2000m for 62.5u MMF
SFP Sync-E Capable : n/a
=========================
Sonet Section
=========================
ES-S     :             2
SES-S    :             1
SEFS-S   :             0
CV-S     :         65561
LOS      :             0
LOC      :             0
LOF      :             0
OOF      :             0
B1 Error :             0
=========================
=========================================
Sonet Line
=========================================
                                Far End
-----------------------------------------
ES-L     :             2               3
SES-L    :             1               3
UAS-L    :             0               0
CV-L     :         49425               0
AIS-L    :             0
RDI-L    :             1
B2 Error :             0
S1 Error :             0
M1 Error :         24834
=========================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                 0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
*A:ALU-1>#
```

Table 87: Port detail field descriptions (SONET/SDH port)

Label	Description
SONET/SDH interface	
Description	A text description of the port

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Label	Description
Interface	The port ID displayed in the *slot/mda/port* format
Speed	The speed of a SONET/SDH port
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operational state is up
	down: the operational state is down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Loopback Mode	The loopback mode on the port
Single Fiber Mode	Yes: single fiber mode No: not single fiber mode
Ing. Pool % Rate	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering
Egr. Pool % Rate	The amount of egress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for egress buffering
Clock Source	node: the link uses the internal clock when transmitting data loop: the link recovers the clock from the received data stream
Framing	sonet: the port is configured for SONET framing sdh: the port is configured for SDH framing
Last State Change	The last time that the operational status of the port changed state
Port IfIndex	The interface's index number, which reflects its initialization sequence
Last Cleared Time	The time since the last clear
DDM Events	Enabled: digital diagnostic monitoring events is enabled for the port Disabled: digital diagnostic monitoring events is disabled for the port
J0 String	The section trace value that is sent to the far-end port

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Label	Description
Section Trace Mode	byte: the section trace in the SONET section header is set in bytes string: a text string is used to identify the SONET section header increment-z0: an incremental STM ID is configured instead of a static value
Rx S1 Byte	The synchronization status message value of the received SONET/SDH S1 byte
Rx K1/K2 Byte	The value of the received SONET/SDH K1/K2 byte
Tx S1 Byte	The synchronization status message value of the transmitted SONET/SDH S1 byte
Tx DUS/DNU	Indicates whether the transmission of the QL-DUS/DNU value in synchronization status messages is enabled or disabled on the port
Rx J0 String (Hex)	The hex value of the received J0
Cfg Alarm	The type of alarms to be logged and reported for the SONET/SDH port
Alarm Status	The current alarm state
BER SD Threshold	The configured threshold for line signal degradation BER error rate, that when crossed determines the signal degradation and signal failure
BER SF Threshold	The configured threshold for line signal failure BER error rate, that when crossed determines the signal degradation and signal failure
Hold time up	The hold-timer value for link-up event dampening
Hold time down	The hold-timer value for link-down event dampening
Transceiver Data	The following information is provided for a configured SFP: • transceiver status • transceiver type • model number • TX laser wavelength • whether it is diagnostics capable • connector code • vendor organizationally unique identifier (OUI) • manufacture date

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Label	Description
	• media • serial number • part number • optical compliance • link length support: • whether it is Sync-E capable
Sonet Section	
ES-S	The number of Errored Seconds errors
SES-S	The number of Severely Errored Seconds errors
SEFS-S	The number of Severely Errored Framing Seconds errors
CV-S	The number of Code Violations errors
LOS	The number of Loss of Signal errors
LOC	The number of Loss of Clock errors
LOF	The number of Loss of Frame errors
OOF	The number of Out of Frame errors
B1 Error	The number of B1 errors
Sonet Line	
ES-L	The number of Errored Seconds errors, at the near end and far end
SES-L	The number of Severely Errored Seconds errors, at the near end and far end
UAS-L	The number of Unavailable Seconds errors, at the near end and far end
CV-L	The number of Code Violations errors, at the near end and far end
AIS-L	The number of Alarm Indication Signal errors
RDI-L	The number of remote defect indication errors
B2 Error	The number of B2 errors
S1 Error	The number of S1 errors
M1 Error	The number of M1 errors

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Label	Description
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Ethernet Output example (access mode)

```
*A:ALU-1># show port 1/5/8 detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/5/8                       Oper Speed       : 1 Gbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1518
Single Fiber Mode  : No
IfIndex            : 44302336                    Hold time up     : 0 seconds
Last State Change  : 10/04/2011 14:05:25         Hold time down   : 0 seconds
Last Cleared Time  : 10/04/2011 14:04:37         DDM Events       : Enabled
Phys State Chng Cnt: 3

Configured Mode    : access                      Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default
Auto-negotiate     : true                        MDI/MDX          : MDX
Net. Scheduler Mode: 16-priority
Config Phy-tx-clock: auto-pref-slave             Oper Phy-tx-clock: slave
SapEgr.Unshaped-Cir: 0 Kbps
SapEgr.Shaper-Pol  : EgrShprPolicy
NetEgr.Unshaped-Cir: 0 Kbps
Allow Eth-BN       : True
BN Egr.Rate in use : 765000                      Eth-BN hold time : 6
Egress Rate        : 1111                        Ingress Rate     : n/a
Egr.Rate Incl.FCS  : Disabled
Ingress CBS(bytes) : 130816                      Src-pause        : Disabled
                                                 LACP Tunnel      : Disabled
```


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```
Down-when-looped   : Disabled                  Keep-alive       : 10
Loop Detected      : False                     Retry            : 120
Use Broadcast Addr : False

Loopback           : none                      Swap Mac Addr    : Disabled
Loopback Time Left : unspecified
Cfm Loopback       : Disabled

Sync. Status Msg.  : Disabled                  Rx Quality Level : N/A

PTP Asymmetry      : 0                         Edge Timestamp   : Disable
Timestamp Capable  : False

Configured Address : 2001:db8::
Hardware Address   : 2001:db8::
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Status : operational
Transceiver Type   : SFP
Model Number       : 3HE00062AAAA01  ALA  IPUIAEHDAA
TX Laser Wavelength: 0 nm                      Diag Capable     : no
Connector Code     : Unknown                   Vendor OUI       : 00:90:65
Manufacture date   : 2010/01/15                Media            : Ethernet
Serial Number      : PH23PQS
Part Number        : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
Link Length support: 100m for copper
SFP Sync-E Capable : no

===============================================================================
Traffic Statistics
===============================================================================
                                                 Input                 Output
-------------------------------------------------------------------------------
Octets                                           10728                  14236
Packets                                            102                    156
Errors                                               0                      0
Utilization (30 seconds)                          0.00%                  0.00%
===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                   3  Drop Events      :                   0
Multicast Pckts  :                  52  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :               24964
Packets                         :                 258
Packets of 64 Octets            :                  54
Packets of 65 to 127 Octets     :                 204
Packets of 128 to 255 Octets    :                   0
Packets of 256 to 511 Octets    :                   0
Packets of 512 to 1023 Octets   :                   0
Packets of 1024 to 1518 Octets  :                   0
Packets of 1519 or more Octets  :                   0
===============================================================================

===============================================================================
```


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```
Port Statistics
===============================================================================
                                                 Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                    102                    101
Multicast Packets                                    0                     52
Broadcast Packets                                    0                      3
Discards                                             0                      0
Unknown Proto Discards                               0
===============================================================================

===============================================================================
Port Discard Statistics
===============================================================================
                               Input                                  Output
Inv L2 Packets   :                 0  Port MTU Exceeded:                    0
Inv MPLS Labels  :                 0
Inv IP Packets   :                 0

CSM Ingress Queues                    CSM Egress Queues
  Hi             :                 0    Common         :                   0
  Medium         :                 0
  Low            :                 0
===============================================================================

===============================================================================
Port Control Statistics
===============================================================================

-------------------------------------------------------------------------------
Ingress Queue CTL             Packets                Octets
     Forwarded :                102                    13482
     Dropped   :                0                      N/A

Egress Queue CTL              Packets                Octets
     Forwarded :                56                     3184
     Dropped   :                0                      N/A
===============================================================================

===============================================================================
Ethernet CFM Statistics
===============================================================================

Cfm LbmRx        :                 0
Cfm LbReplyTx    :                 0  Cfm LbmDropped   :                   0

Num Bn Rate Chng :                 1  Last BnRateChng  : 04/12/2017 21:20:53
Valid BnmRx      :                 2  Last Valid BnmRx : 04/12/2017 21:21:10
Invalid BnmRx    :                 0
BnmOutOfRangeBW  :                 0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                 0  Sngl Collisions  :                   0
FCS Errors       :                 0  Mult Collisions  :                   0
SQE Test Errors  :                 0  Late Collisions  :                   0
CSE              :                 0  Excess Collisns  :                   0
Too long Frames  :                 0  Int MAC Tx Errs  :                   0
Symbol Errors    :                 0  Int MAC Rx Errs  :                   0
In Pause Frames  :                 0  Out Pause Frames :                   0
===============================================================================
```


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Table 88: Port detail field descriptions (Ethernet, access mode)

Label	Description
Ethernet Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Oper Speed	The operating speed of the interface
Link-level	Ethernet: the port is configured as Ethernet
Config Speed	The configured speed of the interface
Admin State	up: the port is administratively up
	down: the port is administratively down
Oper Duplex	The operating duplex mode of the interface
Oper State	up: the port is operationally up
	down: the port is operationally down
Config Duplex	full: the link is configured to full-duplex mode
	half: the link is configured to half-duplex mode
Physical Link	Yes: a physical link is present
	No: a physical link is not present
MTU	The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets
IfIndex	The interface's index number, which reflects its initialization sequence
Hold time up	The link-up dampening time in seconds. The port link dampening timer value that reduces the number of link transitions reported to upper layer protocols.
Last State Change	The last time that the operational status of the port changed state
Hold time down	The link-down dampening time in seconds. The down timer controls the dampening timer for link down transitions.
Phys State Chng Cnt	The physical state change counter. This counter increments when a fully qualified (debounced) transition occurs at the physical layer of an Ethernet port, including

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Label	Description
	the following transitions of the port state as displayed in the **show port** *slot/mda/port* output: • from Down to Link Up or Up • from Link Up or Up to Down This counter does not increment for changes only in the link protocol states. That is, if the physical link is up, any transitions of the port state due to link protocols (for example, 802.3ah EFM OAM, LACP, 802.1ag) do not cause the counter to increment. The following port state transitions are examples of transitions that are not counted: • from Link Up to Up • from Up to Link Up
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
	hybrid: the port is configured for hybrid use (transport network and service access per VLAN)
Encap Type	null: ingress frames will not use any tags or labels to delineate a service
	dot1q: ingress frames carry 802.1Q tags, where each tag signifies a different service
	qinq: ingress frames carry two 802.1Q tags, where the outer tag is the service provider tag and the inner tag is the customer service tag
Dot1Q Ethertype	The protocol carried in a dot1q Ethernet frame
QinQ Ethertype	The protocol carried in a qinq Ethernet frame
Net. Egr. Queue Pol.	The number of the associated network egress queue QoS policy, or default if the default policy is used
Auto-negotiate	true: the link attempts to automatically negotiate the link speed and duplex parameters
	false: the duplex and speed values are used for the link
Net. Scheduler Mode	The network scheduler mode
SapEgr.Unshaped-Cir	The CIR rate for the aggregate of all the unshaped 4-priority SAPs on the port
SapEgr.Shaper-Pol	The access egress shaper policy ID

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Label	Description
NetEgr.Unshaped-Cir	The CIR rate for the aggregate of all the unshaped VLANs on the port
NetEgr. Shaper-Pol	The network egress shaper policy ID
Allow Eth-BN	Indicates whether Ethernet Bandwidth Notification (ETH-BN) is allowed on the port: True or False
BN Egr.Rate in use	The egress rate in use based on the request from the ETH-BN server MEP
Eth-BN hold time	The configured hold time (in seconds) between an egress rate change based on a received Bandwidth Notification Message (BNM) and the next change request that will be accepted
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate
Ingress Rate	The maximum amount of ingress bandwidth (in kilobits per second) that this Ethernet interface can generate
Egr.Rate Incl.FCS	The configured state of egress rate FCS inclusion: enabled or disabled
LACP Tunnel	Indicates whether LACP packet tunneling is enabled
Down-when-looped	Enabled: The down-when-looped feature is enabled on the port
	Disabled: The down-when-looped feature is disabled on the port
Keep-alive	The time interval between keepalive PDUs transmitted toward the network during loop detection by the down-when-looped feature
Loop Detected	Indicates whether a loop is detected on the port
Retry	The minimum wait time before the port is re-enabled after it is brought down due to a loop detection
Use Broadcast Addr	Indicates whether the down-when-looped feature has been configured to compare the destination MAC address of received PDUs to the broadcast MAC address instead of the MAC address of the port
Loopback	The type of loopback configured on the port, either line, internal, or none
Swap Mac Addr.	Indicates whether MAC address swapping is enabled

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Label	Description
Loopback Time Left	The number of seconds left in a timed loopback If there is no loopback configured or the configured loopback is latched, the value is unspecified. If configured loopback is persistent, the value persistent
Cfm Loopback	Indicates whether the CFM loopback is enabled
Sync. Status Msg.	Indicates whether Synchronization Status Messaging is enabled on the port
Rx Quality Level	The Synchronization Status Messaging quality level value received on the port
Code-Type	The Synchronization Status Messaging quality level code type, either SONET or SDH
Tx Quality Level	The Synchronization Status Messaging quality level value transmitted on the port
Tx DUS/DNU	Indicates whether the transmission of the QL-DUS/DNU value in synchronization status messages is enabled or disabled on the port
Configured Address	The base chassis Ethernet MAC address
Hardware Address	The interface hardware- or system-assigned MAC address at its protocol sublayer
Cfg Alarm	The type of alarms to be logged and reported for the port
Alarm Status	The current alarm state
Transceiver Data	The following information is provided for a configured transceiver (SFP): • transceiver status • transceiver type • model number • TX laser wavelength • whether it is diagnostics capable • connector code • vendor organizationally unique identifier (OUI) • manufacture date • media • serial number • part number • optical compliance

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Label	Description
	• link length support: • whether it is Sync-E capable
Transceiver Digital Diagnostic Monitoring (DDM), Externally Calibrated	
	SFP manufacturers specifications guidelines contained in specification SFF-8472, for the following: • temperature (C) • supply voltage (V) • Tx bias current (mA) • Tx output power (dBm) • Rx optical power (avg dBm) For the above categories, the following values are shown: • Value is the current measured value of each variable • High Alarm is the measurement of Value that will cause a DDM High Alarm to be output • High Warn is the measurement of Value that will cause a DDM High Warning Alarm to be output • Low Warn is the measurement of Value that will cause a DDM Low Warning Alarm to be output • Low Alarm is the measurement of Value that will cause a DDM Low Alarm to be output If alarms/warnings are raised, there will be an "!" in the output
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors

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Label	Description
	preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Utilization Input/Output	An average computed over the configured interval presented as a percentage of the maximum possible utilization on the Ethernet port.
Ethernet Statistics	
Broadcast Pckts	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Multicast Pckts	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent.
Undersize Pckts	The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed
Oversize Pckts	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed
Collisions	The best estimate of the total number of collisions on this Ethernet segment
Drop Events	The total number of times that packets were detected as being dropped due to a lack of resources (not necessarily the total number of packets dropped)
CRC/Align Errors	The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS

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Label	Description
	Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Fragments	The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Jabbers	The total number of packets received that were longer than 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Octets	Total number of octets received
Packets	Number of packets received, broken down by size
Port Statistics	
Unicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent
Broadcast Packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space

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Label	Description
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts
Port Discard Statistics	
Inv L2 Packets Input	The number of invalid packets that are discarded due to an unknown Layer 2 ID
Port MTU Exceeded	Indicates that the port MTU has been exceeded
Inv MPLS Labels	The number of MPLS labels discarded
Inv IP Packets Input	The number of invalid IP packets that are discarded
H. Policed Packets	The number of packets that are discarded due to hard policing
CSM Ingress Queues Input	The number of incoming control packets discarded
CSM Egress Queues Output	The number of outgoing control packets discarded
Port Control Statistics	
Ingress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the ingress control queue. For access ports, this statistic applies only to Ethernet cards. For network ports, this statistic applies to all adapter cards.
Egress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the egress control queue. For access ports, this statistic applies only to Ethernet cards. For network ports, this statistic applies to all adapter cards.
Ethernet CFM Statistics	
Cfm LbmRx	The number of LBMs received
Cfm LbReplyTx	The number of LBRs transmitted
Cfm LbmDropped	The number of LBMs dropped

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Label	Description
Num Bn Rate Chng	The number of times that the port egress rate is dynamically changed based on Bandwidth Notification (BN) messages Note: not every bandwidth change indicated by a BNM triggers a port egress rate change
Last BnRateChng	The time that the port egress rate was last changed based on a BNM
Valid BnmRx	The number of valid BN messages received
Last Valid BnmRx	The time that the last valid BNM was received
Invalid BnmRx	The number of invalid BN messages received
BnmOutOfRangeBW	The number of BN messages received with a requested bandwidth that was out of range
Ethernet-like Medium Statistics	
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets
FCS Errors	The number of frames received that are an integral number of octets in length but do not pass the FCS check
SQE Errors	The number of times that the SQE TEST ERROR is received
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Too long Frames	The number of frames received that exceed the maximum permitted frame size
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present
In Pause Frames	The number of IEEE 802.3x pause frames received for flow control; traffic is momentarily disrupted
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully

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Label	Description
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully
Late Collisions	The number of times that a collision is detected later than one slotTime into the transmission of a packet
Excess Collisns	The number of frames for which a transmission fails due to excessive collisions
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sublayer transmit error
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sublayer receive error
Out Pause Frames	The number of IEEE 802.3x pause frames sent for flow control; traffic is momentarily disrupted

Note: The 7705 SAR counts both Ethernet packets with errors and valid Ethernet packets under Ethernet port statistics. For each received errored packet, both aggregate Ethernet statistics and the errored Ethernet statistics are incremented.

Ethernet Output example (network mode)

The **show>port** output for an Ethernet port in network mode is similar to the access mode output (see Ethernet Output example (access mode)) with the addition of a section for queue statistics. The output example below shows only the queue statistics fields.

```
*A:ALU-1># show port 1/1/1 detail
===============================================================================
Ethernet Interface
===============================================================================

.....

===============================================================================
Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
Ingress Queue  1             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    4626                    6939000
     Out Profile forwarded :    2425                    3637500
     Out Profile dropped   :    0                       0
Ingress Queue  2             Packets                 Octets
     In Profile  forwarded :    2022                    3033000
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  3             Packets                 Octets
     In Profile  forwarded :    2024                    3036000
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  4             Packets                 Octets
```


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```
     In Profile  forwarded :    2404                    3606000
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  5             Packets                 Octets
     In Profile  forwarded :    2396                    3594000
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  6             Packets                 Octets
     In Profile  forwarded :    2342                    3513000
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  7             Packets                 Octets
     In Profile  forwarded :    2306                    3459000
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  8             Packets                 Octets
     In Profile  forwarded :    2301                    3451500
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  9             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 10             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 11             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 12             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 13             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 14             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 15             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue 16             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
```


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```
Ingress Queue CTL            Packets                 Octets
     Forwarded :                0                       0
     Dropped   :                0                       N/A

Unshaped Egress Queue  1     Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    129084                  193109664
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  2     Packets                 Octets
     In Profile  forwarded :    128674                  192496304
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  3     Packets                 Octets
     In Profile  forwarded :    128685                  192512760
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  4     Packets                 Octets
     In Profile  forwarded :    154389                  230965944
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  5     Packets                 Octets
     In Profile  forwarded :    154372                  230940512
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  6     Packets                 Octets
     In Profile  forwarded :    154306                  230841776
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  7     Packets                 Octets
     In Profile  forwarded :    154265                  230780440
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Unshaped Egress Queue  8     Packets                 Octets
     In Profile  forwarded :    154261                  230774456
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0

Total Egress from all Shaped and Unshaped Queues
                             Packets                 Octets
     In Profile  forwarded :    1028952                 1539312192
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    129084                  193109664
     Out Profile dropped   :    0                       0

Egress Queue CTL             Packets                 Octets
     Forwarded :                16                      1024
     Dropped   :                0                       N/A
===============================================================================
```

See Table 88: Port detail field descriptions (Ethernet, access mode) for field descriptions common to both access and network mode outputs.

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Table 89: Port detail field descriptions (Ethernet, network mode)

Label	Description
Queue Statistics	
Ingress Queue	For the specified ingress queue, the number of packets and octets that are: • In Profile forwarded/dropped • Out Profile forwarded/dropped
Unshaped Egress Queue	For the specified unshaped egress queue, the of number packets and octets that are: • In Profile forwarded/dropped • Out Profile forwarded/dropped
Total Egress from all Shaped and Unshaped Queues	For all shaped and unshaped queues, the total number of egress packets and octets that are: • In Profile forwarded/dropped • Out Profile forwarded/dropped
Egress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the egress control queue.

Output example

```
sar18# show port 1/11/1 detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10-Gig Bridged Ethernet
Interface          : 1/11/1                    Oper Speed       : 10 Gbps
Link-level         : Ethernet                  Config Speed     : N/A
Admin State        : up                        Oper Duplex      : full
Oper State         : up                        Config Duplex    : N/A
Physical Link      : Yes                       MTU              : 9728
Single Fiber Mode  : No
IfIndex            : 39878656                  Hold time up     : 0 seconds
Last State Change  : 11/03/2012 21:30:51       Hold time down   : 0 seconds
Last Cleared Time  : N/A                       DDM Events       : Enabled

Configured Mode    : network                   Encap Type       : Null&dot1q
Dot1Q Ethertype    : 0x8100                    VLAN Filter      : 2
Ing. Pool % Rate   : 100                       Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default
Net. Scheduler Mode: 16-priority
Auto-negotiate     : N/A                       MDI/MDX          : N/A
Config Phy-tx-clock: not-applicable            Oper Phy-tx-clock: N/A
Egress Rate        : Default                   Ingress Rate     : Default
Ingress CBS(bytes) : 130816                    Src-pause        : N/A
                                               LACP Tunnel      : N/A

Down-when-looped   : N/A                       Keep-alive       : N/A
```


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```
Loop Detected      : N/A                        Retry            : N/A
Use Broadcast Addr : N/A

Loopback           : none                       Swap Mac Addr    : Disabled
Loopback Time Left : unspecified
Cfm Loopback       : dot1p
Cfm Loopback Vlan  : 10-15,20,47

Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A

PTP Asymmetry      : N/A                        Edge Timestamp   : Disable
Timestamp Capable  : False

Configured Address :
Hardware Address   :
Cfg Alarm          : remote local
Alarm Status       :

===============================================================================
Traffic Statistics
===============================================================================
                                                Input                 Output
-------------------------------------------------------------------------------
Octets                                             0                      0
Packets                                            0                      0
Errors                                             0                      0
Utilization (30 seconds)                       0.00%                  0.00%
===============================================================================
===============================================================================
Ethernet Statistics
===============================================================================
Broadcast Pckts  :                   0  Drop Events      :                   0
Multicast Pckts  :                   0  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                         :                 0
Packets                        :                 0
Packets of 64 Octets           :                 0
Packets of 65 to 127 Octets    :                 0
Packets of 128 to 255 Octets   :                 0
Packets of 256 to 511 Octets   :                 0
Packets of 512 to 1023 Octets  :                 0
Packets of 1024 to 1518 Octets :                 0
Packets of 1519 or more Octets :                 0
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                    0                      0
Multicast Packets                                  0                      0
Broadcast Packets                                  0                      0
Discards                                           0                      0
Unknown Proto Discards                             0
===============================================================================
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
```


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```
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
In Pause Frames  :                   0  Out Pause Frames :                   0
===============================================================================
===============================================================================
===============================================================================
Ethernet CFM Loopback Statistics   N/A
===============================================================================
Queue Statistics
===============================================================================
-------------------------------------------------------------------------------
Egress Queue  1              Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
===============================================================================
*A:7705custDoc:Sar18#
```

Table 90: Port detail field descriptions (ring Ethernet)

Label	Description
Ethernet Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Oper Speed	The operating speed of the interface
Link-level	Ethernet: the port is configured as Ethernet
Config Speed	The configured speed of the interface
Admin State	up: the port is administratively up
	down: the port is administratively down
Oper Duplex	The operating duplex mode of the interface
Oper State	up: the port is operationally up
	down: the port is operationally down
Config Duplex	full: the link is configured to full-duplex mode
	half: the link is configured to half-duplex mode
Physical Link	Yes: a physical link is present
	No: a physical link is not present
MTU	The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets
Single Fiber Mode	Yes: single fiber mode

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Label	Description
	No: not single fiber mode
IfIndex	The interface's index number, which reflects its initialization sequence
Hold time up	The link-up dampening time in seconds The port link dampening timer value that reduces the number of link transitions reported to upper layer protocols
Last State Change	The last time that the operational status of the port changed state
Hold time down	The link-down dampening time in seconds. The down timer controls the dampening timer for link down transitions.
Last Cleared Time	The time since the last clear
DDM Events	Enabled: digital diagnostic monitoring events is enabled for the port
	Disabled: digital diagnostic monitoring events is disabled for the port
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
Encap Type	null: ingress frames will not use any tags or labels to delineate a service
	dot1q: ingress frames carry 802.1Q tags, where each tag signifies a different service
	null&dot1q: applies only to port 1 and port 2 on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module. The encapsulation type for these ports is not user-configurable.
Dot1Q Ethertype	The protocol carried in a dot1q Ethernet frame
VLAN Filter	The filter ID of the VLAN filter
Ing. Pool % Rate	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering
Egr. Pool % Rate	The amount of egress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for egress buffering

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Label	Description
Net. Egr. Queue Pol.	The number of the associated network egress queue QoS policy, or default if the default policy is used
Net. Scheduler Mode	The mode for servicing CoS queues; 16-priority scheduling is the only supported value
Auto-negotiate	true: the link attempts to automatically negotiate the link speed and duplex parameters
	false: the duplex and speed values are used for the link
MDI/MDX	Ethernet type
Config Phy-tx-clock	The mode used to establish timing control of a 1000Base-T port. The options are: • N/A – the port does not support 1000Base-T • auto-pref-master – prefers to be master during autonegotiation • auto-pref-slave – prefers to be slave during autonegotiation • slave – the port is forced to be slave • master – the port is forced to be master
Oper Phy-tx-clock	The operational value of the master-slave relationship of the 1000Base-T physical layer transmit clock. The options are: • N/A – the port or the inserted SFP does not support 1000Base-T, the port is down, or negotiation failed • slave – the port is slave • master – the port is master
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate
Ingress Rate	The maximum amount of ingress bandwidth (in kilobits per second) that this Ethernet interface can generate
Ingress CBS (bytes)	Indicates the ingress committed buffer space
Src-pause	A notification to slow down the transmission rate when it exceeds the bandwidth limit
LACP Tunnel	Indicates whether LACP packet tunneling is enabled
Down-when-looped	Enabled: The down-when-looped feature is enabled on the port

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Label	Description
	Disabled: The down-when-looped feature is disabled on the port
Keep-alive	The time interval between keepalive PDUs transmitted toward the network during loop detection by the down-when-looped feature
Loop Detected	Indicates whether a loop is detected on the port
Retry	The minimum wait time before the port is re-enabled after it is brought down due to a loop detection
Use Broadcast Addr	Indicates whether the down-when-looped feature has been configured to compare the destination MAC address of received PDUs to the broadcast MAC address instead of the MAC address of the port
Loopback	The type of loopback configured on the port, either line, internal, or none
Swap Mac Addr.	Indicates whether MAC address swapping is enabled
Loopback Time Left	The number of seconds left in a timed loopback If there is no loopback configured or the configured loopback is latched, the value is unspecified. If configured loopback is persistent, the value persistent
Cfm Loopback	Indicates whether the CFM loopback is high priority, low priority, dot1p, or disabled
Cfm Loopback Vlan	Indicates the VLAN IDs for VLANs that have a CFM loopback enabled
Sync. Status Msg.	Indicates whether Synchronization Status Messaging is enabled on the port
Rx Quality Level	The Synchronization Status Messaging quality level value received on the port
PTP Asymmetry	Indicates whether PTP asymmetry is enabled
Edge Timestamp	Indicates whether the edge timestamp is enabled
Timestamp Capable	Indicates whether the port is timestamp-capable
Code-Type	The Synchronization Status Messaging quality level code type, either SONET or SDH
Configured Address	The base chassis Ethernet MAC address

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Label	Description
Hardware Address	The interface hardware- or system-assigned MAC address at its protocol sublayer
Cfg Alarm	The type of alarms to be logged and reported for the port
Alarm Status	The current alarm state
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Utilization Input/Output	An average computed over the configured interval presented as a percentage of the maximum possible utilization on the Ethernet port.
Ethernet Statistics	
Broadcast Pckts	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Multicast Pckts	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be

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Label	Description
	transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent.
Undersize Pckts	The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed
Oversize Pckts	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed
Collisions	The best estimate of the total number of collisions on this Ethernet segment
Drop Events	The total number of times that packets were detected as being dropped due to a lack of resources (not necessarily the total number of packets dropped)
CRC/Align Errors	The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Fragments	The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Jabbers	The total number of packets received that were longer than 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Octets	Total number of octets received
Packets	Number of packets received, broken down by size
Port Statistics	
Unicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a

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Label	Description
	multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent
Broadcast Packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts
Ethernet-like Medium Statistics	
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets
FCS Errors	The number of frames received that are an integral number of octets in length but do not pass the FCS check
SQE Errors	The number of times that the SQE TEST ERROR is received

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Label	Description
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Too long Frames	The number of frames received that exceed the maximum permitted frame size
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present
In Pause Frames	The number of IEEE 802.3x pause frames received for flow control; traffic is momentarily disrupted
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully
Late Collisions	The number of times that a collision is detected later than one slotTime into the transmission of a packet
Excess Collisns	The number of frames for which a transmission fails due to excessive collisions
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sublayer transmit error
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sublayer receive error
Out Pause Frames	The number of IEEE 802.3x pause frames sent for flow control; traffic is momentarily disrupted
Ethernet CFM Loopback Statistics N/A	
Queue Statistics	
Egress Queue	In Profile forwarded/dropped
	Out Profile forwarded/dropped

Output example

```
sar18# show port 1/11/v-port detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 2.5G Virtual Ethernet Port
Interface          : 1/11/v-port               Oper Speed       : 2.50 Gbps
Link-level         : Ethernet                  Config Speed     : N/A
Admin State        : up                        Oper Duplex      : N/A
Oper State         : up                        Config Duplex    : N/A
```


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```
Physical Link      : Yes                          MTU              : 1572
Single Fiber Mode  : No
IfIndex            : 39944192                     Hold time up     : N/A
Last State Change  : 11/03/2012 21:30:51          Hold time down   : N/A
Last Cleared Time  : N/A

Configured Mode    : network                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                       QinQ Ethertype   : 0x8100
Ing. Pool % Rate   : 100                          Egr. Pool % Rate : 100
Net. Egr. Queue Pol: r.nw.q4
Net. Scheduler Mode: 16-priority
Auto-negotiate     : N/A                          MDI/MDX          : N/A
Config Phy-tx-clock: not-applicable               Oper Phy-tx-clock: N/A
Allow Eth-BN       : True
BN Egr.Rate in use : 765000                       Eth-BN hold time : 6
Egress Rate        : Default                      Ingress Rate     : Default
Ingress CBS(bytes) : 130816                       Src-pause        : Disabled
                                                  LACP Tunnel      : N/A

Down-when-looped   : Disabled                     Keep-alive       : 10
Loop Detected      : False                        Retry            : 120
Use Broadcast Addr : False

Loopback           : none                         Swap Mac Addr    : Disabled
Loopback Time Left : unspecified
Cfm Loopback       : Disabled

Sync. Status Msg.  : Disabled                     Rx Quality Level : N/A

PTP Asymmetry      : N/A                          Edge Timestamp   : Disable
Timestamp Capable  : False

CRC Mon SD Thresh  : Disabled                     CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled

Configured Address :
Hardware Address   :
Cfg Alarm          : N/A
Alarm Status       : N/A

===============================================================================
Traffic Statistics
===============================================================================
                                                 Input                 Output
-------------------------------------------------------------------------------
Octets                                              0                      0
Packets                                             0                      0
Errors                                              0                      0
Utilization (30 seconds)                         0.00%                  0.00%
===============================================================================
===============================================================================
Ethernet Statistics
===============================================================================
Broadcast Pckts  :                   0  Drop Events      :                   0
Multicast Pckts  :                   0  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0
Octets                          :                  0
Packets                         :                  0
Packets of 64 Octets            :                  0
Packets of 65 to 127 Octets     :                  0
Packets of 128 to 255 Octets    :                  0
Packets of 256 to 511 Octets    :                  0
```


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```
Packets of 512 to 1023 Octets  :                  0
Packets of 1024 to 1518 Octets :                  0
Packets of 1519 or more Octets :                  0
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                 Input                  Output
-------------------------------------------------------------------------------
Unicast Packets                                     0                       0
Multicast Packets                                   0                       0
Broadcast Packets                                   0                       0
Discards                                            0                       0
Unknown Proto Discards                              0
===============================================================================
===============================================================================
Port Discard Statistics
===============================================================================
                                Input                                  Output
Inv L2 Packets   :                  0  Port MTU Exceeded:                    0
Inv MPLS Labels  :                  0
Inv IP Packets   :                  0
H.Policed Packets:                  0
CSM Ingress Queues                     CSM Egress Queues
  Hi             :                  0    Common         :                   0
  Medium         :                  0
  Low            :                  0
===============================================================================
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                  0  Sngl Collisions  :                   0
FCS Errors       :                  0  Mult Collisions  :                   0
SQE Test Errors  :                  0  Late Collisions  :                   0
CSE              :                  0  Excess Collisns  :                   0
Too long Frames  :                  0  Int MAC Tx Errs  :                   0
Symbol Errors    :                  0  Int MAC Rx Errs  :                   0
In Pause Frames  :                  0  Out Pause Frames :                   0
===============================================================================
===============================================================================
Ethernet CFM Statistics
===============================================================================
Cfm LbmRx        :                  0
Cfm LbReplyTx    :                  0  Cfm LbmDropped   :                   0

Num Bn Rate Chng :                  1  Last BnRateChng  : 04/12/2017 21:20:53
Valid BnmRx      :                  2  Last Valid BnmRx : 04/12/2017 21:21:10
Invalid BnmRx    :                  0
BnmOutOfRangeBW  :                  0
===============================================================================
===============================================================================
Queue Statistics
===============================================================================
-------------------------------------------------------------------------------
Add-drop Port Queue  1       Packets                 Octets
     In Profile  forwarded :    8700493441110376715     8700493580567332216
     In Profile  dropped   :    243616594368814244      2209638931652
     Out Profile forwarded :    12884901891             8700494542739924144
     Out Profile dropped   :    143944465151581384      284544364229582056
Ingress Queue  1             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
```


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```
Ingress Queue  9             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue CTL            Packets                 Octets
     Forwarded :               0                       0
     Dropped   :               0                       N/A
Egress Queue  1              Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Egress Queue CTL             Packets                 Octets
     Forwarded :               0                       0
     Dropped   :               0                       N/A
===============================================================================
```

Table 91: Port detail field descriptions (v-port)

Label	Description
Ethernet Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Oper Speed	The operating speed of the interface
Link-level	Ethernet: the port is configured as Ethernet
Config Speed	The configured speed of the interface
Admin State	up: the port is administratively up
	down: the port is administratively down
Oper Duplex	The operating duplex mode of the interface
Oper State	up: the port is operationally up
	down: the port is operationally down
Config Duplex	full: the link is configured to full-duplex mode
	half: the link is configured to half-duplex mode
Physical Link	Yes: a physical link is present
	No: a physical link is not present
MTU	The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets
Single Fiber Mode	Yes: single fiber mode
	No: not single fiber mode

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Label	Description
IfIndex	The interface's index number, which reflects its initialization sequence
Hold time up	The link-up dampening time in seconds The port link dampening timer value that reduces the number of link transitions reported to upper layer protocols
Last State Change	The last time that the operational status of the port changed state
Hold time down	The link-down dampening time in seconds. The down timer controls the dampening timer for link down transitions.
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
Encap Type	null: ingress frames will not use any tags or labels to delineate a service
	dot1q: ingress frames carry 802.1Q tags, where each tag signifies a different service
	null&dot1q: applies only to port 1 and port 2 on the 2-port 10GigE (Ethernet) Adapter card and 2-port 10GigE (Ethernet) module. The encapsulation type for these ports is not user-configurable.
Dot1Q Ethertype	The protocol carried in a dot1q Ethernet frame
QinQ Ethertype	The protocol carried in a QinQ Ethernet frame
Ing. Pool % Rate	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering
Egr. Pool % Rate	The amount of egress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for egress buffering
Net. Egr. Queue Pol.	The number of the associated network egress queue QoS policy, or default if the default policy is used
Auto-negotiate	true: the link attempts to automatically negotiate the link speed and duplex parameters
	false: the duplex and speed values are used for the link
Net. Scheduler Mode	The mode for servicing CoS queues; 16-priority scheduling is the only supported value

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Label	Description
MDI/MDX	Ethernet type
Config Phy-tx-clock	The mode used to establish timing control of a 1000Base-T port. The options are: • N/A – the port does not support 1000Base-T • auto-pref-master – prefers to be master during autonegotiation • auto-pref-slave – prefers to be slave during autonegotiation • slave – the port is forced to be slave • master – the port is forced to be master
Oper Phy-tx-clock	The operational value of the master-slave relationship of the 1000Base-T physical layer transmit clock. The options are: • N/A – the port or the inserted SFP does not support 1000Base-T, the port is down, or negotiation failed • slave – the port is slave • master – the port is master
Allow Eth-BN	Indicates whether Ethernet Bandwidth Notification (ETH-BN) is allowed on the port: True or False
BN Egr.Rate in use	The egress rate in use based on the request from the ETH-BN server MEP
Eth-BN hold time	The configured hold time (in seconds) between an egress rate change based on a received Bandwidth Notification Message (BNM) and the next change request that will be accepted
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate
Ingress Rate	The maximum amount of ingress bandwidth (in kilobits per second) that this Ethernet interface can generate
Ingress CBS (bytes)	Indicates the ingress committed buffer space
Src-pause	A notification to slow down the transmission rate when it exceeds the bandwidth limit
LACP Tunnel	Indicates whether LACP packet tunneling is enabled
Down-when-looped	Enabled: The down-when-looped feature is enabled on the port

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Label	Description
	Disabled: The down-when-looped feature is disabled on the port
Keep-alive	The time interval between keepalive PDUs transmitted toward the network during loop detection by the down-when-looped feature
Loop Detected	Indicates whether a loop is detected on the port
Retry	The minimum wait time before the port is re-enabled after it is brought down due to a loop detection
Use Broadcast Addr	Indicates whether the down-when-looped feature has been configured to compare the destination MAC address of received PDUs to the broadcast MAC address instead of the MAC address of the port
Loopback	The type of loopback configured on the port, either line, internal, or none
Swap Mac Addr.	Indicates whether MAC address swapping is enabled
Loopback Time Left	The number of seconds left in a timed loopback If there is no loopback configured or the configured loopback is latched, the value is unspecified. If configured loopback is persistent, the value persistent
Cfm Loopback	Indicates whether the CFM loopback is high priority, low priority, dot1p, or disabled
Sync. Status Msg.	Indicates whether Synchronization Status Messaging is enabled on the port
Rx Quality Level	The Synchronization Status Messaging quality level value received on the port
PTP Asymmetry	Indicates whether PTP asymmetry is enabled
Edge Timestamp	Indicates whether the edge timestamp is enabled
Timestamp Capable	Indicates whether the port is timestamp-capable
CRC Mon SD Thresh	Indicates the CRC signal degrade threshold value (1 to 9), if enabled
CRC Mon SF Thresh	Indicates the CRC signal fail threshold value (1 to 9), if enabled
CRC Mon Window	Indicates the CRC window sampling size value (5 to 60)
Configured Address	The base chassis Ethernet MAC address

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Label	Description
Hardware Address	The interface hardware- or system-assigned MAC address at its protocol sublayer
Cfg Alarm	The type of alarms to be logged and reported for the port
Alarm Status	The current alarm state
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Utilization Input/Output	An average computed over the configured interval presented as a percentage of the maximum possible utilization on the Ethernet port.
Ethernet Statistics	
Broadcast Pckts	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Multicast Pckts	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be

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Label	Description
	transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent.
Undersize Pckts	The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed
Oversize Pckts	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed
Collisions	The best estimate of the total number of collisions on this Ethernet segment
Drop Events	The total number of times that packets were detected as being dropped due to a lack of resources (not necessarily the total number of packets dropped)
CRC/Align Errors	The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Fragments	The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Jabbers	The total number of packets received that were longer than 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Octets	Total number of octets received
Packets	Number of packets received
Packets of *n* Octets	Number of packets received, broken down by size
Port Statistics	
Unicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested

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Label	Description
	be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent
Broadcast Packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts
Port Discard Statistics	
Inv L2 Packets Input	The number of invalid packets that are discarded due to an unknown Layer 2 ID
Port MTU Exceeded Output	Indicates that the port MTU has been exceeded
Inv MPLS Labels Input	The number of MPLS labels discarded
Inv IP Packets Input	The number of invalid IP packets that are discarded
H. Policed Packets Input	The number of packets that are discarded due to hard policing
CSM Ingress Queues Input	The number of incoming control packets discarded
CSM Egress Queues Output	The number of outgoing control packets discarded

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Label	Description
Ethernet-like Medium Statistics	
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets
FCS Errors	The number of frames received that are an integral number of octets in length but do not pass the FCS check
SQE Errors	The number of times that the SQE TEST ERROR is received
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Too long Frames	The number of frames received that exceed the maximum permitted frame size
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present
In Pause Frames	The number of IEEE 802.3x pause frames received for flow control; traffic is momentarily disrupted
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully
Late Collisions	The number of times that a collision is detected later than one slotTime into the transmission of a packet
Excess Collisns	The number of frames for which a transmission fails due to excessive collisions
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sublayer transmit error
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sublayer receive error
Out Pause Frames	The number of IEEE 802.3x pause frames sent for flow control; traffic is momentarily disrupted
Ethernet CFM Statistics	

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Label	Description
Cfm LbmRx	The number of LBMs received
Cfm LbReplyTx	The number of LBRs transmitted
Cfm LbmDropped	The number of LBMs dropped
Num Bn Rate Chng	The number of times that the port egress rate is dynamically changed based on Bandwidth Notification (BN) messages Note: not every bandwidth change indicated by a BNM triggers a port egress rate change
Last BnRateChng	The time that the port egress rate was last changed based on a BNM
Valid BnmRx	The number of valid BN messages received
Last Valid BnmRx	The time that the last valid BNM was received
Invalid BnmRx	The number of invalid BN messages received
BnmOutOfRangeBW	The number of BN messages received with a requested bandwidth that was out of range
Queue Statistics	
Add-drop Port Queue	In Profile forwarded/dropped
	Out Profile forwarded/dropped
Ingress Queue	In Profile forwarded/dropped
	Out Profile forwarded/dropped
Ingress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the ingress control queue. For access ports, this statistic applies only to Ethernet cards. For network ports, this statistic applies to all adapter cards.
Egress Queue	In Profile forwarded/dropped
	Out Profile forwarded/dropped
Egress Queue CTL	The number of forwarded packets and octets, and the number of dropped packets, for the egress control queue. For access ports, this statistic applies only to Ethernet cards. For network ports, this statistic applies to all adapter cards.

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Output example (DS1)

```
*A:7705:Dut-C>config>port# show port 1/3/25.ds1 detail
===============================================================================
TDM DS1 Interface
===============================================================================
Description        : DS1
Interface          : 1/3/25.ds1
Type               : ds1                     Framing             : esf
Admin Status       : up                      Oper Status         : up
Physical Link      : yes                     Clock Source        : node-timed
Signal Mode        : none
Last State Change  : 03/04/2022 15:34:41     Channel IfIndex     : 577536025
Loopback           : none                    Invert Data         : false
Remote Loop respond: false                   In Remote Loop      : false
Load-balance-algo  : Default                 Egr. Sched. Pol     : N/A
Cfg Alarm          : ais los
Alarm Status       :
BER SD Threshold   : N/A                     BER SF Threshold    : N/A
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
Sync. Status Msg.  : Enabled                 Tx DUS/DNU          : Disabled
Rx Quality Level   : 0x04(stu)               Tx Quality Level    : 0x08(st3)
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                     0
Packets                                                0                     0
Errors                                                 0                     0
============================
DS1/E1 Line
============================

----------------------------
ES                     0
SES                    0
SEFS                   0
UAS                    0
CSS                    0
PCV                    0
LES                    0
BES                    0
LCV      :             0
=========================
Transmit:
FE-LOF   :             0
AIS      :             0
Receive:
FE-LOF   :             0
AIS      :             0
LOS      :             0
LOF      :             0
Looped   :             0
=========================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
```


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```
Unknown Proto Discards                                0
===============================================================================
```

Output example (E1)

```
*A:ALU-1>config# show port 1/3/1.e1 detail
===============================================================================
TDM E1 Interface
===============================================================================
Description        : E1
Interface          : 1/3/1.e1
Type               : e1                      Framing              : g704
Admin Status       : down                    Oper Status          : down
Physical Link      : no                      Clock Source         : node-timed
Clock Sync State   : normal
Signal Mode        : cas
Last State Change  : 10/30/2008 14:40:26     Channel IfIndex      : 576749569
Loopback           : none
Remote Loop respond: N/A                     In Remote Loop       : N/A
Load-balance-algo  : default                 Egr. Sched. Pol      : N/A
Cfg Alarm          : ais los ber-sd ber sf
Alarm Status       :
BER SD Threshold   : 10                BER SF Threshold: 10
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
Sync. Status Msg.  : Enabled                 Tx DUS/DNU           : Disabled
Ssm-bit            : 6
Rx Quality Level   : 0x02(prc)               Tx Quality Level     : 0x02(prc)
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                0                     0
Packets                                               0                     0
Errors                                                0                     0
============================
DS1/E1 Line
============================
----------------------------
ES                     0
SES                    0
SEFS                   0
UAS                    0
CSS                    0
PCV                    0
LES                    0
BES                    0
LCV      :             0
=========================
Transmit:
FE-LOF   :             0
AIS      :             0
Receive:
FE-LOF   :             0
AIS      :             0
LOS      :             0
LOF      :             0
Looped   :             0
=========================
===============================================================================
DS1/E1 CAS Signalling Bits
===============================================================================
```


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```
          Rx    Tx                                  Rx    Tx
Timeslot  ABCD  ABCD                    Timeslot    ABCD  ABCD
-------------------------------------------------------------------------------
1         n/a   n/a                     13          n/a   n/a
2         n/a   n/a                     14          n/a   n/a
3         n/a   n/a                     15          n/a   n/a
4         n/a   n/a                     16          n/a   n/a
5         n/a   n/a                     17          n/a   n/a
6         n/a   n/a                     18          n/a   n/a
7         n/a   n/a                     19          n/a   n/a
8         n/a   n/a                     20          n/a   n/a
9         n/a   n/a                     21          n/a   n/a
10        n/a   n/a                     22          n/a   n/a
11        n/a   n/a                     23          n/a   n/a
12        n/a   n/a                     24          n/a   n/a
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Packets                                              0                      0
Discards                                             0                      0
Unknown Proto Discards                               0
===============================================================================
```

Table 92: Port detail field descriptions (TDM DS1/E1 interface)

Label	Description
TDM DS1/E1 Interface	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Type	The type of interface
Framing	The DS1/E1 framing to be used for the port If SSM is enabled, framing is always esf for DS1 and g704 for E1
Admin Status	up: the port is administratively up
	down: the port is administratively down
Oper Status	up: the port is operationally up
	down: the port is operationally down
Physical Link	yes: a physical link is present
	no: a physical link is not present
Clock Source	loop-timed: the link recovers the clock from the received data stream

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Label	Description
	node-timed: the link uses the internal clock when transmitting data adaptive: clocking is derived from the incoming pseudowire packets differential: clocking is derived from a common clock compared to differential clock recovery data in the RTP header in the TDM PW overhead
Signal Mode	The port signaling mode
Last State Change	The last time that the operational status of the port changed state
Channel IfIndex	The channel interface index number
Loopback	The port loopback mode
Remote Loop respond	The DS1/E1 channel response to remote loopbacks
In Remote Loop	Indicates whether incoming remote loopback is enabled
Load-balance-algo	The load balance algorithm used on the port
Egr. Sched. Pol	The egress scheduling policy
Cfg Alarm	The type of alarms to be logged and reported for the port
Alarm Status	The current alarm state
BER SD Threshold	The configured value of the BER SD threshold
BER SF Threshold	The configured value of the BER SF threshold
Hold time up	The hold-timer value for link-up event dampening
Hold time down	The hold-timer value for link-down event dampening
Sync. Status Msg.	The setting of SSM: enabled or disabled
Tx DUS/DNU	The setting of **tx-dus**: enabled or disabled
Ssm-bit	The Sa bit that carries the quality level value on E1 interfaces: Sa4 to Sa8
Rx Quality Level	The SSM QL value received on the interface
Tx Quality Level	The SSM QL value transmitted on the interface
Clock Sync State	The current state of the clock recovery function
Traffic Statistics	

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Label	Description
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
DS1/E1 Line	The DS1/E1 Line statistics
ES	The number of Errored Seconds errors
SES	The number of Severely Errored Seconds errors
SEFS	The number of Severely Errored Framing Seconds errors
UAS	The number of Unavailable Seconds errors
CSS	The number of Controlled Slip Seconds errors
PCV	The number of Path Code Violations errors
LES	The number of Line Errored Seconds errors
BES	The number of Bursty Errored Seconds alarms
LCV	The number of Line Code Violations errors
Transmit	The transmit statistics: FE-LOF: the number of far-end loss of frame errors AIS: the number of alarm indication signal errors
Receive	The receive statistics: FE-LOF: the number of far-end loss of frame errors

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Label	Description
	AIS: the number of alarm indication signal errors LOS: the number of loss of signal errors LOF: the number of loss of frame errors
Looped	The number of looped packet errors
DS1/E1 CAS Signalling Bits	The CAS signaling bit information
Timeslot	The timeslot number (1 to 24 for DS1, 2 to 32 for E1)
Rx ABCD	The signaling bits received in the timeslot, where each signaling bit is represented by a 1 (set) or a 0 (not set), and 0000 represents a timeslot that is in use but not receiving any signaling bits (for example, 1000 means that the A bit is set); "n/a" indicates timeslots not in use
Tx ABCD	The signaling bits transmitted from the timeslot, where each signaling bit is represented by a 1 (set) or a 0 (not set), and 0000 represents a timeslot that is in use but not transmitting any signaling bits (for example, 1000 means that the A bit is set); "n/a" indicates timeslots not in use
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast, multicast, or broadcast address at this sublayer
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts.

Output example

```
*A:ALU-1># show port 1/2/1.v35
===============================================================================
Serial RS-232 Interface
===============================================================================
Description        : V35
Interface          : 1/2/1.v35
Type               : v35
Admin Status       : up                      Oper Status          : up
```


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```
Physical Link      : yes                    Clock Source         : slave
Device Mode        : synchronous            Speed                : 64k
Character Length   : N/A                    Parity               : N/A
Stop Bits          : N/A
Device Gender      : dte                    Duplex               : full
Last State Change  : 02/13/2015 21:03:47    Channel IfIndex      : 574652417
Loopback           : none
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
Cfg Alarm          :
Alarm Status       :
===============================================================================

===========================================
Serial Control Leads
===========================================
Inputs          Cfg         Netw  Line  Mon
-------------------------------------------
dtr-dsr [DSR] : high        1     1     off
rts-dcd [DCD] : high        1     0     off
alb-cts [CTS] : high        1     1     off

Outputs         Cfg         Netw  Line
-------------------------------------------
dsr-dtr [DTR] : high        1     1
dcd-rts [RTS] : high        1     1
cts-alb [ALB] : high        1     1

===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Octets                                         39022208              39022016
Packets                                          609722                609719
Errors                                                0                     0

===============================================================================
Port Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Packets                                        609722                609719
Discards                                            0                     0
Unknown Proto Discards                              0
===============================================================================
```

```
*A:ALU-1># show port 1/2/7.x21
===============================================================================
Serial RS-232 Interface
===============================================================================
Description        : X21
Interface          : 1/2/7.x21
Type               : x21
Admin Status       : up                     Oper Status          : up
Physical Link      : yes                    Clock Source         : slave
Device Mode        : synchronous            Speed                : 64k
Character Length   : N/A                    Parity               : N/A
Stop Bits          : N/A
Device Gender      : dte                    Duplex               : full
Data Position      : N/A                    S-Bit Signaling      : N/A
Last State Change  : 02/13/2015 21:03:50    Channel IfIndex      : 574849031
Loopback           : none
```


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```
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
Cfg Alarm          :
Alarm Status       :
===============================================================================

===========================================
Serial Control Leads
===========================================
Inputs          Cfg         Netw  Line  Mon
-------------------------------------------
c-i [I]       : high        1     1     off

Outputs         Cfg         Netw  Line
-------------------------------------------
i-c [C]       : high        1     1

===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Octets                                         39403456              39403264
Packets                                          615679                615676
Errors                                                0                     0

===============================================================================
Port Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Packets                                        615679                615676
Discards                                            0                     0
Unknown Proto Discards                              0
===============================================================================
```

```
*A:ALU-1># show port 1/2/4.rs232
===============================================================================
Serial RS-232 Interface
===============================================================================
Description        : RS232
Interface          : 1/2/4.rs232
Type               : rs232
Admin Status       : up                      Oper Status          : up
Physical Link      : yes                     Clock Source         : slave
Device Mode        : synchronous             Speed                : 9600
Character Length   : N/A                     Parity               : N/A
Stop Bits          : N/A                     Multi-Drop           : disabled
Device Gender      : dce                     Duplex               : full
Data Position      : F0-B5                   S-Bit Signaling      : on
Last State Change  : 02/13/2015 21:04:16     Channel IfIndex      : 574750724
Loopback           : none
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
Cfg Alarm          : hcmOof hcmRai
Alarm Status       :
===============================================================================

===========================================
Serial Control Leads
===========================================
Inputs          Cfg         Netw  Line  Mon
-------------------------------------------
```


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```
dtr-dsr [DTR] : high        1     1     off
rts-dcd [RTS] : high        1     1     off
alb-cts [ALB] : high        1     0     off
rdl-ri  [RDL] : high        1     0     off

Outputs         Cfg         Netw  Line
-------------------------------------------
dsr-dtr [DSR] : high        1     1
dcd-rts [DCD] : high        1     1
cts-alb [CTS] : high        1     1
ri-rdl  [RI]  : high        1     1

===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                         17935808              17932416
Packets                                          280247                280194
Errors                                                0                     0

===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Packets                                          280247                280194
Discards                                              0                     0
Unknown Proto Discards                                0
===============================================================================
```

The following output is an example of raw socket statistics.

```
*A:ALU-1># show port 1/12/6.1
===============================================================================
Serial Socket
===============================================================================
Description        : SOCKET
Interface          : 1/12/6.1
Admin Status       : up                      Oper Status          : up
Last State Change  : 01/24/2017 15:21:05     Socket IfIndex       : 595787809
Configured mode    : access                  Encap Type           : raw
Physical Link      : yes
EOP Length         : 511                     Squelch Delay        : Disabled
EOP Idle Timeout   : 5000                    Unsquelch Delay      : Disabled
EOP Special Char   : Disabled                Inter-Session Delay  : 10
Squelch Status     : off
===============================================================================

============================================================
Socket Statistics
============================================================
                                                      Count
------------------------------------------------------------
Characters received                                    4088
Characters transmitted                                 4088
End of packet idle timeout                                0
End of packet length                                      8
End of packet special character                           0
Ingress forwarded packets                                 8
Egress forwarded packets                                  8
Ingress dropped packets                                   0
Egress dropped packets                                    0
```


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```
Squelch activated                                       0
===============================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                             4088                   4088
Packets                                               8                      8
Errors                                                0                      0
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Packets                                               8                      8
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================
```

Table 93: Port serial channel field descriptions

Label	Description
Serial RS-232 Interface	
Description	The description of the port
Interface	The port ID displayed in the *slot/mda/port.channel* format
Type	The type of serial interface
Admin Status	up: the administrative state is up down: the administrative state is down
Oper Status	up: the operational state is up down: the operational state is down
Physical Link	yes: a physical link is present no: a physical link is not present
Clock Source	The source of the transmit clock: On the 12-port Serial Data Interface card, version 2: slave On the 12-port Serial Data Interface card, version 3: • for RS-232 and RS-530 interfaces: external, slave, dcr-serial • for V.35 and X.21 interfaces: external, slave
Device Mode	The operational mode of the device, either synchronous (the device transmits data continuously based on timing) or asynchronous (the device transmits data one character at a time)

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Label	Description
	Asynchronous mode is supported only on channels with subrate speeds of 38 400 b/s or less RS-232, RS-530, and X.21 channels support synchronous and asynchronous modes (RS-530 channels are only supported on the 12-port Serial Data Interface card, version 3) V.35 channels support synchronous mode only
Speed	The speed of the interface
Character Length	The number of data bits used to transmit a character; for asynchronous devices only
Parity	The parity bit in a character; for asynchronous devices only
Stop Bits	The number of stop bits used signify the end of a character; for asynchronous devices only
Multi-Drop	The MDDB mode; supported on RS-232 and X.21 synchronous or asynchronous links, and on RS-530 asynchronous links (RS-530 links are only supported on the 12-port Serial Data Interface card, version 3): disabled: MDDB mode is off slave: device operates as an MDDB slave device master: device operates as an MDDB master device
Device Gender	The gender of the device: dce: the device is performing the role of the data communications equipment dte: the device is performing the role of the data terminal equipment
Duplex	The duplex mode: half: single transmission path (supported only if multidrop data bridge is enabled in slave mode) full: two independent transmission paths, one in each direction
Data Position	The HCM data start position; applies to RS-232, RS-530, and X.21 interfaces only (RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3)
S-Bit-Signaling	Indicates whether S-bit signaling is turned on or off; applies to RS-232, RS-530, and X.21 interfaces only

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Label	Description
	(RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3)
Last State Change	The last time the operational status of the port changed state
Channel IfIndex	The channel group index number
Loopback	The loopback mode for the port or channel: bidir-b: bidirectional loopback B takes place on the control card (CSM) side of the adapter card and is closer to the system (not supported on the 12-port Serial Data Interface card, version 3) bidir-e: bidirectional loopback E takes place on the data device side of the adapter card and is closer to the line none: there is no loopback done at the associated port or channel
Hold time up	The hold-timer value for link-up event dampening
Hold time down	The hold-timer value for link-down event dampening
Cfg Alarm	The HCM alarms to be reported for RS-232, RS-530, or X.21 interfaces (RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3): hcmOof: local HCM out-of-frame errors are raised and cleared hcmRai: HCM remote alarm indication events are raised and cleared
Alarm Status	The current alarm status
Serial Control Leads (the input and output leads, which carry control signals)	
Inputs	The input control leads
dtr-dsr	The Data Terminal Ready/Data Set Ready input control lead (applicable only for RS-232, RS-530, and V.35 interfaces; RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3)
rts-dcd	The Request To Send/Data Carrier Detect input control lead (applicable only for RS-232, RS-530, and V.35 interfaces; RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3)
ll-tm	The Local Loopback/Test Mode input control lead (only supported on RS-530 interfaces on the 12-port Serial Data Interface card, version 3)

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Label	Description
rl-cts	The Remote Loopback/Clear To Send input control lead (only supported on RS-530 interfaces on the 12-port Serial Data Interface card, version 3)
alb-cts	The Analog Loopback/Clear To Send input control lead (applicable only for RS-232 and V.35 interfaces) Not supported on the 4-port T1/E1 and RS-232 Combination module
rdl-ri	The Remote Digital Loopback/Ring Indicator input control lead (applicable only for RS-232 interfaces) Not supported on the 4-port T1/E1 and RS-232 Combination module
c-i	The Control/Indication input control lead (applicable only for X.21 interfaces)
Cfg	The configuration of the input signaling leads: • high: the input control lead is assumed to be on • low: the input control lead is assumed to be off • end-to-end: the input control lead follows that of the remote end. It can only be configured when the interface speed is <64 kb/s and is only applicable on the following control leads: – rts-dcd – alb-cts – rl-cts – c-i
Outputs	The output control leads
dsr-dtr	The Data Set Ready/Data Terminal Ready output control lead (applicable only for RS-232, RS-530, and V.35 interfaces; RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3) Not supported on the 4-port T1/E1 and RS-232 Combination module
dcd-rts	The Data Carrier Detect/Request To Send output control lead (applicable only for RS-232, RS-530, and V.35 interfaces; RS-530 interfaces are only supported on the 12-port Serial Data Interface card, version 3)
cts-alb	The Clear To Send/Analog Loopback output control lead (applicable only for RS-232 and V.35 interfaces)

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Label	Description
ri-rdl	The Ring Indicator/Remote Digital Loopback output control lead (applicable only for RS-232 interfaces)
cts-rl	The Clear To Send/Remote Loopback output control lead (only supported on RS-530 interfaces on the 12-port Serial Data Interface card, version 3)
tm-ll	The Test Mode/Local Loopback output control lead (only supported on RS-530 interfaces on the 12-port Serial Data Interface card, version 3)
i-c	The Indication/Control output control lead (applicable only for X.21 interfaces)
Cfg	The configuration of the output signaling leads: • high: the output control lead is forced on • low: the output control lead is forced off • end-to-end: the input control lead follows that of the remote end. It can only be configured when the interface speed is <64 kb/s and is only applicable on the following control leads: – dcd-rts – cts-alb – follows that of the remote end except when the output control lead is carrying a CTS signal on an RS-232 port operating at subrate speeds. In this case, the control lead follows the HCM status: • if the HCM status is Up, the CTS output control lead is 1 • if the HCM status is Down, the CTS output control lead is 0 – cts-rl – i-c
Netw	The value that indicates the current states of the input and output control leads. These values are transported over the network; therefore, are referred to as network-side values: • 0 indicates low • 1 indicates high • blank indicates unknown (for example, due to a shutdown)
Line	The value that indicates the current signal levels of the input and output control leads connected to the attached

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Label	Description
	CPE. These values are signaled over the (physical) line; therefore, are referred to as line-side values: • 0 indicates low • 1 indicates high • blank indicates unknown (for example, due to a shutdown)
Mon	Indicates whether monitoring is enabled (on) or disabled (off) for the control lead; applies to input control leads only
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space

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Label	Description
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
Serial Socket	
Description	The configured port type
Interface	The interface ID displayed in the format *slot/mda/port.channel*
Admin Status	The administrative status of the port, either up or down
Oper status	The operational status of the port, either up or down
Last State Change	The last time the operational status of the channel changed state
Socket IfIndex	The socket index number
Configured mode	The port mode (serial raw sockets support access mode only)
Encap Type	The encapsulation type of the port (serial raw sockets support encapsulation type raw only)
Physical Link	Indicates whether a physical link is present
EOP Length	The number of characters (in bytes) that trigger sending an IP transport packet when end of packet is declared
Squelch Delay	Indicates whether squelch delay is enabled or disabled
EOP Idle Timeout	The limit, in milliseconds, that a queued packet can remain idle before an end of packet is declare
Unsquelch Delay	Indicates whether unsquelch delay is enabled or disabled
EOP Special Char	Indicates whether the sending of a special character that declares end of packet is enabled or disabled
Inter-Session Delay	The time delay, in milliseconds, between transmission of a session’s data over a serial port and the transmission of the next queued session’s data

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Label	Description
Squelch Status	Indicates whether squelch is enabled (on) or disabled (off)
Socket Statistics	
Characters received	The number of data characters received
Characters transmitted	The number of data characters sent
End of packet idle timeout	The number of times that end of packet has been declared due to an EOP idle timeout
End of packet length	The number of times that an IP transport packet was sent due to the EOP packet length being exceeded
End of packet special character	The number of times that end of packet has been declared due to an EOP special character being sent
Ingress forwarded packets	The number of ingress forwarded packets
Egress forwarded packets	The number of egress forwarded packets
Ingress dropped packets	The number of ingress dropped packets
Egress dropped packets	The number of egress dropped packets
Squelch activated	The number of times that squelch was activated

Output example

```
*A:ALU-1># show port 1/1/1.em detail
===============================================================================
Voice Interface
===============================================================================
Description        : EM
Interface          : 1/1/1.em
Type               : em
Admin Status       : up                      Oper Status          : up
Physical Link      : yes                     Clock Source         : node-timed
Signaling Mode     : em                      Signal Mode          : cas
Fault Signaling    : idle
Idle Code          : 13 (0b1101)             Seized Code          : 5 (0b0101)
Last State Change  : 01/08/2010 14:23:28     Channel IfIndex      : 578846721
Loopback           : none
===============================================================================
===============================================================================
Voice E&M Signaling Leads
===============================================================================
Inputs          Cfg         Scans            Outputs         Cfg         Drives
-------------------------------------------------------------------------------
m             : end-to-end  0                e             : end-to-end  0
===============================================================================
===============================================================================
Voice Signalling Bits
===============================================================================
          Rx    Tx
DS0       ABCD  ABCD
```


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```
-------------------------------------------------------------------------------
1         1101  1101
===============================================================================
================================================
Voice Call Usage Statistics (state: idle)
================================================
                                       Accumulated
------------------------------------------------
I/C Call Count                                  0
I/C Call Count, Ans                             0
I/C Call Time                                   0
I/C Call Time, Ans                              0
O/G Call Count                                  0
O/G Call Count, Ans                             0
O/G Call Time                                   0
O/G Call Time, Ans                              0
Out Of Service Time                            10
Idle Time                                      39
Total Call Count                                0
Total Call Time                                 0
================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                 Input                Output
-------------------------------------------------------------------------------
Octets                                          388432                388256
Packets                                          24277                 24266
Errors                                               0                     0
===============================================================================
Port Statistics
===============================================================================
                                                 Input                Output
-------------------------------------------------------------------------------
Packets                                          30868                 30857
Discards                                             0                     0
Unknown Proto Discards                               0
===============================================================================
```

Table 94: Port voice channel field descriptions

Label	Description
Voice Interface	
Description	The description of the port
Interface	The port ID displayed in the *slot/mda/port.channel* format
Type	The type of voice interface
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operational state is up
	down: the operational state is down
Physical Link	yes: a physical link is present

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Label	Description
	no: a physical link is not present
Clock Source	node-timed: the link uses the internal clock when transmitting data
Signaling Mode	The signaling mode used by the interface, either em or transmission-only
Signal Mode	The network signaling transport scheme, either cas for em signaling or none for transmission-only signaling
Fault Signaling	The type of fault signaling used by the channel, either idle or seized
Idle Code	The ABCD signaling code to be transmitted when the channel is configured to transmit idle fault signaling
Seized Code	The ABCD signaling code to be transmitted when the channel is configured to transmit seized fault signaling
Last State Change	The last time the operational status of the channel changed state
Channel IfIndex	The channel index number
Loopback	The loopback mode for the channel: internal-analog, internal-digital, or none
Voice E&M Signaling Leads	
Inputs	The type of input signaling lead (M-lead), shown only if the signaling mode is E&M
Cfg	The configuration of the input signaling lead:
	high: (the input signaling lead is assumed on)
	low: (the input signaling lead is assumed off)
	end-to-end: (the input signaling lead follows that of the remote end)
Scans	The current scanned value of the input lead, which can either be 0 (idle) or 1 (seized)
Outputs	The type of output lead (E-lead), shown only if the signaling mode is E&M
Cfg	The configuration of the output signaling lead:
	high: (the output signaling lead is forced on)
	low: (the output signaling lead is forced off)

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Label	Description
	end-to-end: (the output signaling lead follows that of the remote end)
Drives	The current value set on the output lead, which can either be 0 (idle) or 1 (seized)
Voice Signalling Bits	
DS0	The number of DS0 voice signaling bits
Rx ABCD	The signaling bits received from the network side
Tx ABCD	The signaling bits transmitted to the network side
Voice Call Usage Statistics	
State	The state of the channel (non-forwarding, out-of-service, idle, incoming, or outgoing), and voice call usage statistics. Non-forwarding means that the channel is in shutdown mode or has no SAP configured; incoming means that the call was received by the channel; outgoing means that the call was originated by the channel
Accumulated	The total accumulated statistics since the last time the statistics were cleared
I/C Call Count	The number of incoming calls
I/C Call Count, Ans	The number of incoming calls that were answered
I/C Call Time	The total duration (in seconds) of all incoming calls
I/C Call Time, Ans	The total duration (in seconds) of all incoming calls that were answered
O/G Call Count	The number of outgoing calls
O/G Call Count, Ans	The number of outgoing calls that were answered
O/G Call Time	The total duration (in seconds) of all outgoing calls
O/G Call Time, Ans	The total duration (in seconds) of all outgoing calls that were answered
Out-Of-Service Time	The time (in seconds) for which the circuit had alarms raised against the service. The only valid statistics for transmission-only mode are Out-Of-Service Time and Idle Time.

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Label	Description
Idle Time	The total duration the circuit was in an idle state (that is, on-hook). The only valid statistics for transmission-only mode are Out-Of-Service Time and Idle Time. When the system is in transmission-only mode and in a forwarding state, there is no signaling. To show that the system is active (that is, not in an out-of-service state), the “Idle Time” counter is incremented. This is a design intent.
Total Call Count	The sum of I/C Call Count and O/G Call Count
Total Call Time	The sum of I/C Call Time and O/G Call Time
Traffic Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space

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Label	Description
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1># show port 1/4/1.5
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/4/1.5
TimeSlots          :
Speed              : 64                      CRC                 : 16
Admin Status       : down                    Oper Status         : down
BER SF Link Down   : disabled
Last State Change  : 06/22/2009 12:29:42     Chan-Grp IfIndex    : 578846785
Loopback           : line
Configured mode    : access                  Encap Type          : atm
Admin MTU          : 1524                    Oper MTU            : 1524
Scramble           : true
Physical Link      : Yes                     Bundle Number       : none
Idle Cycle Flags   : n/a                     Load-balance-algo   : n/a
Payload Fill Type  : n/a                     Payload Pattern     : n/a
Signal Fill Type   : n/a                     Signal Pattern      : n/a
Ing. Pool % Rate   : 100                     Egr. Pool % Rate    : 100
Egr. Sched. Pol    : n/a
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                    0
Packets                                                0                    0
Errors                                                 0                    0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                    0
Discards                                               0                    0
Unknown Proto Discards                                 0
===============================================================================
*A:ALU-1#
*A:ALU-1># show port 1/1/2.1
===============================================================================
Serial DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/1/2.1
```


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```
TimeSlots          : 1
Admin Status       : down                    Oper Status          : down
Last State Change  : 06/28/2009 15:32:14     Chan-Grp IfIndex     : 572588095
Configured Mode    : access                  Encap Type           : cem
Admin MTU          : 1514                    Oper MTU             : 1514
Physical Link      : No                      Bundle Number        : none
Idle Cycle Flags   : n/a
Payload Fill Type  : all-ones                Payload Pattern      : n/a
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                     0
Packets                                                0                     0
Errors                                                 0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
*A:ALU-1#

*A:ALU-1># show port 1/1/1.1
===============================================================================
Voice DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/1/1.1
Admin Status       : up                      Oper Status          : up
Last State Change  : 01/08/2010 14:23:29     Chan-Grp IfIndex     : 578846781
Configured Mode    : access                  Encap Type           : cem
Admin MTU          : 1514                    Oper MTU  : 1514
Physical Link      : Yes
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                            611744                611584
Packets                                            38234                 38224
Errors                                                 0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                            38234                 38224
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
*A:ALU-1#

A:ALU-1# show port 1/2/2.1.1
===============================================================================
TDM DS1 Interface
===============================================================================
Description        : DS1
```


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```
Interface          : 1/2/2.1.1
Type               : ds1                      Framing             : esf
Admin Status       : up                       Oper Status         : down
Physical Link      : no                       Clock Source        : node-timed
Last State Change  : 01/26/2009 15:35:50      Channel IfIndex     : 574685991
Loopback           : none
Remote Loop respond: false                    In Remote Loop      : false
Load-balance-algo  : default                  Egr. Sched. Pol     : N/A
Cfg Alarm          : ais los
Alarm Status       :
Hold time up       : 0 milliseconds
Hold time down     : 0 milliseconds
===============================================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0

===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                 0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
```

Table 95: Port channel group field descriptions

Label	Description
Description	A text description of the port
Interface	The port ID displayed in the format *slot/mda/port.channel-group-id*
Timeslots	The number of timeslots that are part of this channel group
Speed	The speed of the interface
CRC	The checksum used for the channel group (16 or 32)
Admin Status	Up: the port is administratively up
	Down: the port is administratively down
BER SF Link Down	Indicates whether BER SF Link Down is enabled
Oper Status	Up: the port is operationally up
	Down: the port is operationally down

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Label	Description
Remote Loop respond	Indicates whether the channel will respond to requests for remote loopbacks
Cfg Alarm	Indicates the alarms configured
Last State Change	The last time the operational status of the port changed state
Chan Grp IfIndex	The channel group index number
Channel IfIndex	The channel interface index number
Loopback	The type of loopback configured on the channel group: line, internal, or none
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
Encap Type	The encapsulation type for the channel group (atm, cem, ipcp, ppp-auto, hdlc, or cisco-hdlc)
Admin MTU	The configured MTU
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets
Scramble	Indicates whether payload scrambling is enabled on channel groups (only applicable if encap type is atm)
Hold time up	The hold-timer value for link-up event dampening
Hold time down	The hold-timer value for link-down event dampening
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Bundle Number	The number assigned to the multilink bundle
Idle Cycle Flags	The value transmitted by the DS0, DS1, or E1 interface during idle cycles
Clock Source	loop-timed: the link recovers the clock from the received data stream node-timed: the link uses the internal clock when transmitting data adaptive: clocking is derived from the incoming pseudowire packets
Payload Fill Type	The payload type to be transmitted when the circuit emulation service is not operational or temporarily

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Label	Description
	experiences underrun conditions (only valid for CESoPSN services)
Payload Pattern	The user-defined pattern transmitted if the payload fill type is pattern
Signal Fill Type	The signaling type to be transmitted when the circuit emulation service is not operational or temporarily experiences underrun conditions (only valid for CESoPSN with CAS)
Signal Pattern	The user-defined pattern transmitted if the payload fill type is pattern
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space

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Label	Description
Unknown proto discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. For ATM, this field displays cells discarded on an invalid vpi/vci. Unknown proto discards do not show up in the packet counts.

Output example

```
A:ALU-1# show port 1/4/1.ds3

===============================================================================
TDM Interface
===============================================================================
Description        : DS3
Interface          : 1/4/1.ds3
Type               : ds3                     Framing              : m23
Admin Status       : up                      Oper Status          : up
Physical Link      : No                      Clock Source         : node-timed
Last State Change  : 10/02/2009 19:21:59     Port IfIndex         : 578846721
Configured mode    : access                  Encap Type           : atm
Admin MTU          : 1524                    Oper MTU             : 1524
Scramble           : true
Ing. Pool % Rate   : 100                     Egr. Pool % Rate     : 100
Egr. Sched. Pol    : N/A
CRC                : 32                      Channelized          : DS1
Idle Cycle Flags   : n/a                     Loopback             : line
FEAC Loop Respond  : Disabled                In FEAC Loop         : No
BERT Duration      : N/A                     BERT Pattern         : none
BERT Synched       : 00h00m00s               Err Insertion Rate   : 0
BERT Errors        : 0                       BERT Status          : idle
BERT Total Bits    : N/A
Cfg Alarm          : ais los
Alarm Status       :
Subrate CSU Mode   : none                    Subrate Step         : 0
MDL Transmit       : none
-------------------------------------------------------------------------------
Local MDL Information
-------------------------------------------------------------------------------
EIC                :                         LIC                  :
FIC                :                         Unit                 :
PFI                :
Idle Signal Port   :
Test Signal Gen    :
-------------------------------------------------------------------------------
Far End MDL Information
-------------------------------------------------------------------------------
EIC                :                         LIC                  :
FIC                :                         Unit                 :
PFI                :
Idle Signal Port   :
Test Signal Gen    :
===============================================================================
```


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```
===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                                0                      0
Packets                                               0                      0
Errors                                                0                      0
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Packets                                               0                      0
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================
```

Table 96: Port channelized DS3 field descriptions

Label	Description
Description	A text description of the port
Interface	The port ID displayed in the format *slot/mda/port.channel-group-id*
Type	The type of interface
Timeslots	The number of timeslots that are part of this channel group
Speed	The speed of the interface
CRC	The checksum used for the channel group (16 or 32)
Admin Status	Up: the port is administratively up
	Down: the port is administratively down
Oper Status	Up: the port is operationally up
	Down: the port is operationally down
Last State Change	The last time the operational status of the port changed state
Chan Grp IfIndex	The channel group index number
Configured Mode	network: the port is configured for transport network use
	access: the port is configured for service access
Encap Type	The encapsulation type for the channel group (atm, cem, ipcp, ppp-auto)
Admin MTU	The configured MTU

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Label	Description
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets
Scramble	Indicates whether payload scrambling is enabled on channel groups (only applicable if encap type is atm)
CRC	Indicates the precision of the cyclic redundancy check: 16 – a 16-bit CRC calculation 32 – a 32-bit CRC calculation; 32-bit CRC increases the error detection ability, but it also adds some performance overhead
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Idle Cycle Flags	The value transmitted by the DS0, DS1, or E1 interface during idle cycles
FEAC Loop Respond	Indicates whether the associated DS3 interface can respond to remote loop signals
Cfg Alarm	The alarms that have alarm reporting enabled
Alarm Status	The current alarm state (for example, stray, malformed, packet loss, overrun, underrun, remote packet loss, remote fault, or remote RDI)
Framing	The DS3 framing mode
Clock Source	loop-timed: the link recovers the clock from the received data stream node-timed: the link uses the internal clock when transmitting data adaptive: clocking is derived from the incoming pseudowire packets
Port IfIndex	The interface’s index number, which reflects its initialization sequence
oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets
Channelized	The level of channelization on the port
Loopback	The port loopback mode
In FEAC Loop	The remote loopback state
Local MDL Information	The MDL strings sent by the near end

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Label	Description
Far End MDL Information	The MDL strings received from the far end
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/ Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. For ATM, this field displays cells discarded

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Label	Description
	on an invalid vpi/vci. Unknown proto discards do not show up in the packet counts.

Output example

```
A:ALU-1# show port 1/4/1
===============================================================================
TDM DS3 Physical Interface
===============================================================================
Description        : DS3/E3
Interface          : 1/4/1                 Port IfIndex         : 41975808
Admin Status       : down                  Oper Status          : down
Physical Link      : No
Type               : ds3                   Buildout             : short
Hardware Address   : 2001:db8::
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                               0                     0
Discards                                              0                     0
Unknown Proto Discards                                0
===============================================================================
```

Table 97: Port clear channel DS3 field descriptions

Label	Description
Description	A text description of the port
Interface	The port ID displayed in the format *slot/mda/port*
Port IfIndex	The interface's index number, which reflects its initialization sequence
Admin Status	Up: the port is administratively up
	Down: the port is administratively down
Oper Status	Up: the port is operationally up
	Down: the port is operationally down
Physical Link	Yes: a physical link is present
	No: a physical link is not present
Type	The type of interface
Buildout	The line buildout (cable length) for the DS3 physical interface
Hardware Address	The port's hardware address

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Label	Description
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/ Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. For ATM, this field displays cells discarded on an invalid vpi/vci. Unknown proto discards do not show up in the packet counts.

Output example

```
*A:ALU-1># show port 1/4/1.e1 acr detail
===============================================================================
Adaptive Clock Recovery (ACR) Configuration
===============================================================================
Clock Master PW  : 1/4/1.1
Clock Sync State : normal
-------------------------------------------------------------------------------
CEM SAP Configuration Information
-------------------------------------------------------------------------------
Endpoint Type  : NxDS0                   Bit-rate       : 16
Payload Size   : 32                      Jitter Buffer  : 5
Use RTP Header : No                      Differential   : No
Timestamp Freq : 0                       CAS Framing    : No CAS
Effective PDVT : +/-2.500 ms

Cfg Alarm      : stray malformed pktloss overrun underrun
Alarm Status   :
-------------------------------------------------------------------------------
CEM SAP Statistics
-------------------------------------------------------------------------------
                          Packets           Seconds           Events
Egress Stats
Forwarded             :  32993106
Dropped               :  0
Missing               :  0
Reordered Forwarded   :  0
Underrun              :  8058                                 0
Overrun               :  0                                    0
```


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```
Misordered Dropped    :  0
Malformed Dropped     :  0
LBit Dropped          :  0
Error                 :                    3
Severely Error        :                    2
Unavailable           :                    0
Failure Count         :                                    1
Jitter Buffer Depth   :  0
Ingress Stats
Forwarded             :  32995595
Dropped               :  0
===============================================================================
===============================================================================
Adaptive Clock Recovery (ACR)
  - Internal Digital Phase Locked Loop (DPLL) Statistics
===============================================================================
                     frequency   frequency       phase       phase
                        offset      offset       error       error
                          mean      stddev        mean      stddev
time                     (ppb)       (ppb)        (ns)        (ns)
-------------------------------------------------------------------------------
10/08/2008 11:27:11        220           1         273          94
10/08/2008 11:26:11        217           1         240         120
10/08/2008 11:25:11        214           1          79         157
10/08/2008 11:24:11        214           1         -15         102
10/08/2008 11:23:11        214           1          82         117
10/08/2008 11:22:11        213           1          12         113
10/08/2008 11:21:11        213           1         -64         119
10/08/2008 11:20:11        213           1         -66         126
10/08/2008 11:19:11        214           1         -41         117
10/08/2008 11:18:11        215           1          72         125
10/08/2008 11:17:11        214           1         -34          95
10/08/2008 11:16:11        214           1         -28         115
10/08/2008 11:15:11        215           1          30          89
10/08/2008 11:14:11        214           1          12          95
10/08/2008 11:13:11        214           1          19         144
-------------------------------------------------------------------------------
Current
24 Hour
(137 min)           214         19
===============================================================================

===============================================================================
ACR State Statistics
===============================================================================
Algorithm State Counts
  normal                : 4121
  Phase-tracking        : 3
  Freq-tracking         : 0
  Holdover              : 0
  Free-run              : 8
Events
  ACR Calc Out of Range : 0
  Prolonged ACR Failure : 1
  Excessive Packet Loss : 0
  Excessive Phase Shift : 0
===============================================================================
```


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Table 98: Port ACR detail field descriptions

Label	Description
Adaptive Clock Recovery (ACR) Configuration	
Clock Master PW	The SAP being used by the port for recovering the clock
Clock Sync State	The current state of the ACR adaptive algorithm
CEM SAP Configuration Information	
Endpoint Type	The type of endpoint
Bit-rate	The number of DS0s or timeslots in the channel group
Payload Size	The number of octets contained in the payload of a TDM PW packet when the packet is transmitted
Jitter Buffer	The size of the receive jitter buffer, expressed in milliseconds
Use RTP Header	Indicates whether RTP headers are used in CES packets (Yes or No)
CAS Framing	The type of CAS framing
Effective PDVT	The peak-to-peak packet delay variation (PDV) used by the circuit emulation service Since the operating system may adjust the jitter buffer setting to ensure no packet loss, the configured jitter buffer value may not be the value used by the system. The effective PDVT provides an indication that the PDV has been adjusted by the operating system.
Cfg Alarm	The alarms that have alarm reporting enabled
Alarm Status	The current alarm state (for example, stray, malformed, packet loss, overrun, underrun, remote packet loss, remote fault, or remote RDI)
Internal Digital Phase Locked Loop (DPLL) Statistics	
ACR DPLL Statistics	frequency offset mean: the ACR frequency offset mean for the previous 15 sets of 60-s intervals
	frequency offset stddev: the ACR frequency offset standard deviation for the previous 15 sets of 60-s intervals
	phase error mean: the ACR input phase error mean and output DCO mean for the previous 15 sets of 60-s intervals

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Label	Description
	phase error stddev: the ACR input phase error standard deviation and output DCO standard deviation for the previous 15 sets of 60-s intervals
ACR State Statistics	
Algorithm State Counts	normal: the number of 2-s intervals the ACR algorithm was in the normal state
	Phase-tracking: the number of 2-s intervals the ACR algorithm was in the phase-tracking state
	Freq-tracking: the number of 2-s intervals the ACR algorithm was in the frequency tracking state
	Holdover: the number of 2-s intervals the ACR algorithm was in the holdover state
	Free-run: the number of 2-s intervals the ACR algorithm was in the free-run state
Events	ACR Calc Out of Range: the number of times the ACR algorithm was internally reset
	Prolonged ACR failure: the number of times the ACR algorithm was in the phase-tracking or holdover state for an extended period of time
	Excessive Packet Loss: increments every 2-second interval that ACR is in the phase-tracking state and the tolerated packet loss threshold is exceeded
	Excessive Phase Shift: increments each time the ACR algorithm transitions to the phase-tracking state from normal as a result of a phase shift above the tolerated shift level

Output example

```
*A:ALU-1# show port 1/5/2 dot1x detail
===============================================================================
802.1x Port Status
===============================================================================
Port control            : force-auth
Port status             : authorized
Authenticator PAE state : force-auth
Backend state           : initialize
Reauth enabled          : yes          Reauth period         : 3500
Max auth requests       : 2            Transmit period       : 30
Supplicant timeout      : 30           Server timeout        : 30
Quiet period            : 60
Radius-plcy             : N/A
Tunneling               : false
MAC-Authentication      : no           Wait period           : N/A
```


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```
===============================================================================
802.1x Session Statistics
===============================================================================
authentication method   : remote-radius
last session id         : PAC-02A10000-8A61E689
last session time       : 0497d02h
last session username   : N/A
last session term cause : N/A
user tx octets          : 0            user tx frames        : 0
user rx octets          : 0            user rx frames        : 0
===============================================================================
802.1x Authentication Statistics
===============================================================================
authentication method   : None
tx frames               : 0          rx frames             : 0
tx req/id frames        : 0          rx resp/id frames     : 0
tx request frames       : 0          rx response frames    : 0
rx start frames         : 0          rx logoff frames      : 0
rx unknown frame type   : 0          rx bad eap length     : 0
rx last version         : 0          rx last source mac    :
===============================================================================
802.1x Authentication Diagnostics
===============================================================================
Enters Connecting                    : 0
EapLogoffs While Connecting          : 0
Success While Authenticating         : 0
Timeouts While Authenticating        : 0
Failures While Authenticating        : 0
Reauths While Authenticating         : 0
EapStarts While Authenticating       : 0
EapLogoffs While Authenticating      : 0
Reauths While Authenticated          : 0
EapStarts While Authenticated        : 0
EapLogoffs While Authenticated       : 0
Backend Responses                    : 0
Backend Access Challenges            : 0
Backend Requests To Supplicant       : 0
Backend Non Nak Responses            : 0
Backend Auth Successes               : 0
Backend Auth Failures                : 0
===============================================================================
*A:ALU-1>#
```

Table 99: Port dot1x field descriptions

Label	Description
802.1x Port Status	
Port control	auto: the 802.1x authentication mode is configured as automatic. The port starts in an unauthorized state and stays in that state until the first supplicant is authenticated successfully.
	force-auth: 802.1x authentication is disabled and the port is automatically authorized
	force-unauth: the port will always remain in the unauthorized state

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Label	Description
Port status	authorized: the 802.1x port is authorized
	unauthorized: the 802.1x port is unauthorized
Authenticator PAE state	auto: the authenticator is set to the unauthorized state
	force-auth: the authenticator is set to the authorized state
	force-unauth: the authenticator is set to the unauthorized state
Backend state	request: the backend authentication machine is in the request state
	response: the backend authentication machine is in the response state
	success: the backend authentication machine is in the success state
	fail: the backend authentication machine is in the fail state
	timeout: the backend authentication machine is in the timeout state
	idle: the backend authentication machine is in the idle state
	initialize: the backend authentication machine is in the initialize state
Reauth enabled	Indicates whether reauthentication is enabled
Max auth requests	The maximum number of authentication requests the 7705 SAR sends to the RADIUS server before declaring the port unauthorized
Supplicant timeout	The number of seconds the 7705 SAR waits for a client to respond to an EAPOL message before considering the 802.1x authentication to have failed
Quiet period	The period, in seconds, between two authentication sessions during which no EAPOL frames are sent by the 7705 SAR
Radius-plcy	The name of the RADIUS policy used for 802.1x authentication
Tunneling	Indicates whether 802.1x port tunneling is on: true or false
MAC-Authentication	Indicates whether MAC authentication is enabled

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Label	Description
Reauth period	The delay, in seconds, before the 7705 SAR attempts reauthentication
Transmit period	The time, in seconds, that the 7705 SAR waits before sending a new EAPOL message
Server timeout	The time, in seconds, that the 7705 SAR waits for the RADIUS server to respond to the access request message before resending the request message the number of times specified by the max-auth-req command
Wait period	The delay period before MAC authentication is activated; N/A if MAC authentication is not enabled
802.1x Session Statistics	
authentication method	remote-radius: the authentication method used to establish the session
last session id	A unique identifier for the session, in the form of a printable ASCII string of at least three characters
last session time	The duration of the session in seconds
last session username	The username representing the identity of the supplicant PAE
last session term cause	The reason for the session termination: supplicantLogoff: the supplicant logged off
	portFailure: there was a port failure
	supplicantRestart: the supplicant state machine reinitialized
	reauthFailed: the reauthentication attempt failed
	authControlForceUnauth: the authentication mode was changed to always force unauthorized after being authorized
	portReInit: the port was reinitialized
	portAdminDisabled: the port was administratively disabled
	notTerminatedYet: the session has not been terminated
user tx octets	The number of octets transmitted in user data frames on this port during the session

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Label	Description
user rx octets	The number of octets received in user data frames on this port during the session
user tx frames	The number of user data frames transmitted on this port during the session
user rx frames	The number of user data frames received on this port during the session
802.1x Authentication Statistics	
tx frames	The number of EAPOL frames of any type that have been transmitted by this authenticator
tx req/id frames	The number of EAP-Request/ID frames that have been transmitted by this authenticator
tx request frames	The number of EAP request frames (other than Request/ID frames) that have been transmitted by this authenticator
rx start frames	The number of EAPOL-Start frames that have been received by this authenticator
rx unknown frame type	The number of EAPOL frames that have been received by this authenticator in which the frame type is not recognized
rx last version	The protocol version number carried in the most recently received EAPOL frame
rx frames	The number of valid EAPOL frames of any type that have been received by this authenticator
rx resp/id frames	The number of EAP-Response/ID frames that have been received by this authenticator
rx response frames	The number of valid EAP response frames (other than Resp/ID frames) that have been received by this authenticator
rx logoff frames	The number of EAP-Logoff frames that have been received by this authenticator
rx bad eap length	The number of EAPOL frames that have been received by this authenticator in which the packet body length field is invalid
rx last source mac	The source MAC address carried in the most recently received EAPOL frame
802.1x Authentication Diagnostics	

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Label	Description
Enters Connecting	Counts the number of times that the state machine transitions to the CONNECTING state from any other state
EapLogoffs While Connecting	Counts the number of times that the state machine transitions from CONNECTING to DISCONNECTED as a result of receiving an EAPOL-Logoff message
Success While Authenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to AUTHENTICATED, as a result of the backend authentication state machine indicating successful authentication of the supplicant (authSuccess = TRUE)
Timeouts While Authenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of the backend authentication state machine indicating authentication timeout (authTimeout = TRUE)
Failures While Authenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to HELD, as a result of the backend authentication state machine indicating authentication failure (authFail = TRUE)
Reauths While Authenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of a reauthentication request (reAuthenticate = TRUE)
EapStarts While Authenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of an EAPOL-Start message being received from the supplicant
EapLogoffs While Authenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of an EAPOL-Logoff message being received from the supplicant
Reauths While Authenticated	Counts the number of times that the state machine transitions from AUTHENTICATED to CONNECTING, as a result of a reauthentication request (reAuthenticate = TRUE)
EapStarts While Authenticated	Counts the number of times that the state machine transitions from AUTHENTICATED to CONNECTING, as a result of an EAPOL-Start message being received from the supplicant
EapLogoffs While Authenticated	Counts the number of times that the state machine transitions from AUTHENTICATED to DISCONNECTED,

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Label	Description
	as a result of an EAPOL-Logoff message being received from the supplicant
Backend Responses	Counts the number of times that the state machine sends an initial Access-Request packet to the authentication server (that is, executes sendRespToServer on entry to the RESPONSE state) Indicates that the authenticator attempted communication with the authentication server
Backend Access Challenges	Counts the number of times that the state machine receives an initial Access-Challenge packet from the authentication server (that is, aReq becomes TRUE, causing an exit from the RESPONSE state) Indicates that the authentication server has communication with the authenticator
Backend Requests To Supplicant	Counts the number of times that the state machine sends an EAP-Request packet (other than an Identity, Notification, Failure, or Success message) to the supplicant (that is, executes txReq on entry to the REQUEST state) Indicates that the authenticator chose an EAP-method
Backend Non Nak Responses	Counts the number of times that the state machine receives a response from the supplicant to an initial EAP-Request, and the response is something other than EAP-NAK (that is, rxResp becomes TRUE, causing the state machine to transition from REQUEST to RESPONSE, and the response is not an EAP-NAK) Indicates that the supplicant can respond to the authenticator's chosen EAP-method
Backend Auth Successes	Counts the number of times that the state machine receives an EAP-Success message from the authentication server (that is, aSuccess becomes TRUE, causing a transition from RESPONSE to SUCCESS) Indicates that the supplicant has successfully authenticated to the authentication server
Backend Auth Failures	Counts the number of times that the state machine receives an EAP-Failure message from the authentication server (that is, aFail becomes TRUE, causing a transition from RESPONSE to FAIL) Indicates that the supplicant has not authenticated to the authentication server

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Output example

```
*A:ALU-1># show port 1/4/1 description
===============================================================================
Port Descriptions on Slot 1
===============================================================================
Port Id        Description
-------------------------------------------------------------------------------
1/4/1          DS3/E3
===============================================================================
*A:ALU-1>
```

Table 100: Port description field descriptions

Label	Description
Port Id	The port identifier
Description	A text description of the port

Output example

```
*A:ALU-1># show port 1/5/1 associations
===============================================================================
Interface Table
===============================================================================
Router/ServiceId               Name                           Encap Val
-------------------------------------------------------------------------------
Router: Base                   if1000                         1000
Router: Base                   if2000                         2000
-------------------------------------------------------------------------------
Interfaces
===============================================================================
*A:ALU-1>
```

Table 101: Port associations field descriptions

Label	Description
Router/ServiceId	The service identifier
Name	The name of the IP interface
Encap Val	The dot1q, null, or qinq encapsulation value on the port for this IP interface

Output example

```
*A:ALU-1># show port 1/2/1.1 ima-link
===============================================================================
State Information
===============================================================================
Transmit Link Identifier: 0
Receive Link Identifier : 0
Near Rx Failure State   : IMA Link Failure
Far End Rx Failure State: IMA Link Failure
Near End Tx State       : Unusable - No given reason
```


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```
Near End Rx State       : Unusable - No given reason
Far End Tx State        : Unusable - No given reason
Far End Rx State        : Unusable - No given reason
Link Test State         : Disabled
Rx Test Pattern         : 0
===============================================================================
TC Sublayer Information
===============================================================================
TC Alarm State          : LCD Failure     Number OCD Events       : 0
HEC Errors (Dropped)    : 0               HEC Errors (Fixed)      : 0
===============================================================================
Statistical Information
===============================================================================
Num Violations          : 0               Num OIF Anomalies       : 0
NE Severely Err. Seconds: 0               FE Severely Err. Seconds: 0
NE Unavail. Seconds     : 0               FE Unavail. Seconds     : 0
NE Tx Unused Seconds    : 0               FE Tx Unused Seconds    : 0
NE Rx Unused Seconds    : 0               FE Rx Unused Seconds    : 0
NE Tx Num Failures      : 0               NE Rx Num Failures      : 0
FE Tx Num Failures      : 0               FE Rx Num Failures      : 0
Tx ICP Cell count       : 0               Rx ICP Cell count       : 0
Error ICP Cells Total   : 0               Rx Lost ICP Cells Total : 0
Relative Link Delay     : 0
===============================================================================
*A:ALU-1#
```

Table 102: Port IMA link field descriptions

Label	Description
State Information	
Transmit Link Identifier	The identifier of the IMA link used to transmit data
Receive Link Identifier	The identifier of the IMA link used to receive data
Near Rx Failure State	The failure state of the near-end receive link
Far End Rx Failure State	The failure state of the far-end receive link
Near End Tx State	The state of the near-end transmit link
Near End Rx State	The state of the near-end receive link
Far End Tx State	The state of the far-end transmit link
Far End Rx State	The state of the far-end receive link
Link Test State	The state of the link test procedure: Enabled or Disabled
Rx Test Pattern	The received test pattern in an IMA link loopback operation (0 to 255)
TC Sublayer Information	
TC Alarm State	The alarm state for the traffic class of the IMA link
HEC Errors (Dropped)	The number of HEC errors resulting in dropped packets

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Label	Description
Number OCD Events	The number of OCD events
HEC Errors (Fixed)	The number of HEC errors fixed
Statistical Information	
Num Violations	The number of violations (path, line, code, and length)
NE Severely Err. Seconds	The number of near-end severely errored seconds
NE Unavail. Seconds	The number of seconds that the near end has been unavailable
NE Tx Unused Seconds	The number of seconds that the near-end transmit link has been unused
NE Rx Unused Seconds	The number of seconds that the near-end receive link has been unused
NE Tx Num Failures	The number of near-end transmit link failures
FE Tx Num Failures	The number of far-end transmit link failures
Tx ICP Cell count	The number of ICP cells transmitted on the IMA link
Error ICP Cells Total	The total number of errored ICP cells on the IMA link
Relative Link Delay	The time delay, in seconds, between detection of a link activation/deactivation condition and acting upon it (going in/out of the Rx failure state on a link)
Num OIF Anomalies	The number of OIF anomalies for the IMA link
FE Severely Err. Seconds	The number of far-end severely errored seconds
FE Unavail. Seconds	The number of seconds that the far end has been unavailable
FE Tx Unused Seconds	The number of seconds that the far-end transmit link has been unused
FE Rx Unused Seconds	The number of seconds that the far end receive link has been unused
NE Rx Num Failures	The number of near-end receive link failures
FE Rx Num Failures	The number of far-end receive link failures
Rx ICP Cell count	The number of ICP cells received on the IMA link
Rx Lost ICP Cells Total	The total number of lost ICP cells received on the IMA link

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Output example

```
*A:ALU-1># show port 1/4/1.5 ppp
===============================================================================
PPP Protocols for 1/4/1.5
===============================================================================
Protocol  State         Last Change         Restart Count   Last Cleared
-------------------------------------------------------------------------------
lcp       initial       10/12/2007 20:15:54          0      10/12/2007 20:15:54
ipcp      initial       10/12/2007 20:15:54          0      10/12/2007 20:15:54
mplscp    initial       10/12/2007 20:15:54          0      10/12/2007 20:15:54
bcp       initial       10/12/2007 20:15:54          0      10/12/2007 20:15:54
osicp     initial       10/12/2007 20:15:54          0      10/12/2007 20:15:54
ipv6cp    initial       10/12/2007 20:15:54          0      10/12/2007 20:15:54
===============================================================================
===============================================================================
PPP Statistics
===============================================================================
Local Mac address  : 2001:db8::         Remote Mac address :
Local Magic Number : 0x0                 Remote Magic Number: 0x0
Local address      : 10.0.0.0            Remote address     : 10.0.0.0
Line Monitor Method: keepalive
Keepalive statistics
Request interval   : 10           Threshold exceeded : 0
Drop Count         : 3            In packets         : 0
Time to link drop  : 00h00m30s    Out packets        : 0
Last cleared time  : 10/12/2007 20:15:54
===============================================================================
*A:ALU-1>#
```

Table 103: Port PPP field descriptions

Label	Description
Protocol	The applicable protocols for the specified port
State	The current status of a PPP link. Values are initial, starting, closed, stopped, closing, stopping, requestSent, ack Received, ackSent, opened.
Last Change	The last time the PPP link state changed
Restart Count	The number of times that this Control Protocol has reached the open state
PPP Statistics	
Last Cleared	The date and time the restart count was set to zero
Local Mac address	The MAC address assigned to the local end of the PPP link
Remote Mac address	The Ethernet MAC address sent by the remote end of the PPP link
Local Magic Number	The local magic number to be sent to the peer. The magic number provides a method to detect loopbacks. If the value of the local magic number is the same as the value

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Label	Description
	of the remote magic number, then it is possible that the link might be looped back. If the two magic numbers do not match, the link is not looped back.
Remote Magic Number	The magic number sent by the peer. If the value of the remote magic number is the same as the value of the local magic number, then it is possible that the link might be looped back. If the two magic numbers do not match, the link is not looped back.
Local Address	The IP address at the local end of the link
Remote Address	The IP address at the remote end of the link
Line Monitor Method	The type of line monitoring packets being sent and received on this PPP link
Request Interval	The time interval in seconds at which keepalive requests are issued
Threshold exceeded	The number of times that the drop count was reached
Drop Count	The number of keepalive or LQR messages that were missed before the line was brought down
In packets	The number of echo-reply packets received
Time to link drop	The time remaining before the link will be declared dropped if a keepalive echo reply packet is not received
Out packets	The number of echo-request packets sent
Last cleared time	The time since the last clear

Output example

```
*A:ALU-1># show port cem
===============================================================================
Ports on Slot 1
===============================================================================
Port         Admin  Link   Port   Clock          Master           Clock
Id           State         State  Src            Port Id          State
-------------------------------------------------------------------------------
1/9/1.1.2    Up     No     Down   differential   1/9/1.1.2.1      hold-over
1/9/1.1.3    Up     No     Down   node-timed
1/9/1.1.4    Up     No     Down   node-timed
...
-------------------------------------------------------------------------------
```


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Table 104: Port CEM field descriptions

Label	Description
Port Id	The port ID, in the *slot/mda/port* format
Admin State	The administrative state of the interface connection
Link	Indicates whether the link is active
Port State	The state level of the port
Clock Src	The clock source
Master Port Id	The master port ID
Clock State	The clock state

Output example

```
*A:ALU-1# show port 1/2/32.1 frame-relay

===============================================================================
Frame Relay Info for 1/2/32.1
===============================================================================
Mode                    : dce           LMI Type                : itu
FR Interface Status     : fault
N391 DTE                : 6             N392 DCE                : 3
N392 DTE                : 3             N393 DCE                : 4
N393 DTE                : 4             T392 DCE                : 15
T391 DTE                : 10
FRF-12                  : Disabled
Link Identifier         : N/A

Tx Status Enquiry       : 1097          Rx Status Enquiry       : 0
Rx Status Messages      : 0             Tx Status Messages      : 0
Status Message Timeouts : 1096          Status Enquiry Timeouts : 0
Discarded Messages      : 0             Inv. RxSeqNum Messages  : 0
===============================================================================
===============================================================================
frame-relay statistics for port "1/2/32.1"
===============================================================================
                    Received                    Transmitted
-------------------------------------------------------------------------------
Frames              0                           0
Octets              0                           0
DEFrames            0                           0
DEOctets            0                           0
FECNFrames          0                           0
BECNFrames          0                           0
Invalid Dlci        0                           -
Last Invalid Dlci   -                           -
Crc Errors          0                           -
Alignment Errors    0                           -
Length Violations   0                           -
Illegal Header      0                           -
Underruns Errors    -                           0
Other Errors        0                           0
===============================================================================
```


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Table 105: Port frame relay field descriptions

Label	Description
Frame Relay Info for port identifier	
Mode	The frame relay mode: • dce – specifies the DCE mode • dte – specifies the DTE mode • bidir – the bidirectional mode for LMI types ANSI and ITU
LMI Type	The LMI type: • ansi – specifies ANSI T1.617 Annex D • itu – specifies ITU-T Q933 Annex A • none – frame relay LMI is disabled on the port/ channel • rev1 – specifies Rev 1 version of ANSI T1.617 Annex D
FR Interface Status	The status of the frame relay interface as determined by the performance of the DLCMI. If no DLCMI is running, the frame relay interface will stay in the running state indefinitely.
N391 DTE	The DTE full status polling interval for the frame relay LMI. The number specifies the frequency at which inquiries expect a full status report.
N392 DCE	The DCE error threshold for the frame relay LMI. The threshold specifies the number of errors needed to bring down a link.
N392 DTE	The DTE error threshold for the frame relay LMI. The threshold specifies the number of errors needed to bring down a link.
N393 DCE	The DCE monitored event count for the frame relay LMI
N393 DTE	The DTE monitored event count for the frame relay LMI
T392 DCE	The DCE keepalive timer for the frame relay LMI. The number specifies the interval at which the DCE checks for keepalive responses from the DTE.
T391 DTE	The DTE keepalive timer for the frame relay LMI. The number specifies the interval at which the DTE sends a keepalive response request to the DCE.

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Label	Description
FRF-12	Not supported
Link Identifier	The link associated with the frame relay port
Tx Status Enquiry	The number of status enquiries sent
Rx Status Enquiry	The number of status enquiries received
Rx Status Messages	The number of status messages received
Tx Status Messages	The number of status messages sent
Status Message Timeouts	The number of status message timeouts
Status Enquiry Timeouts	The number of status enquiry timeouts
Discard Messages	The number of status enquiry messages discarded due to errors
Inv. RxSeqNum Messages	The number of LMI messages received with an invalid sequence number
frame-relay statistics for port *port-identifier* **(input and output values)**	
Frames	The number of frames received or transmitted
Octets	The number of octets received or transmitted
DEFrames	The number of packets received or transmitted with the DE bit set
DEOctets	The number of octets received or transmitted with the discard eligibility (DE) bit set
FECNFrames	The number of frames received or transmitted with the forward explicit congestion notification bit set
BECNFrames	The number of frames received or transmitted with the backward explicit congestion notification bit set
Invalid Dlci	The number of invalid DLCIs
Last Invalid Dlci	The last time when an invalid DLCI was detected
Crc Errors	The number of cyclical redundancy check errors
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad frame check sequence with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets

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Label	Description
Length Violations	The number of packet length violations
Illegal Header	The number of header configuration errors
Underruns Errors	The number of frames that were unsuccessfully transmitted because transmission was not fast enough to maintain synchronization
Other Errors	The number of other unspecified errors

Output example

```
*A:ALU-1# show port 1/2/32.1 frame-relay dlci 16
===============================================================================
Frame Relay Info for 1/2/32.1
===============================================================================
Mode                    : dte           LMI Type                : ansi
FR Interface Status     : fault
N391 DTE                : 6             N392 DCE                : 3
N392 DTE                : 3             N393 DCE                : 4
N393 DTE                : 4             T392 DCE                : 15
T391 DTE                : 10
FRF-12                  : Disabled
Link Identifier         : N/A
Tx Status Enquiry       : 0             Rx Status Enquiry       : 0
Rx Status Messages      : 0             Tx Status Messages      : 0
Status Message Timeouts : 0             Status Enquiry Timeouts : 0
Discarded Messages      : 0             Inv. RxSeqNum Messages  : 0
===============================================================================
================================================
Frame Relay PVCs
================================================
Dlci      State     Type      Creation Time
------------------------------------------------
16        Inactive  Static    07/11/2011 15:27:27
------------------------------------------------
PVCs: 1
================================================
===============================================================================
frame-relay statistics for port "1/2/32.1" dlci "16"
===============================================================================
                    Input                         Output
-------------------------------------------------------------------------------
Frames              1077                          2920112
Octets              0                             4294967295
FECNs               32                            3247074
BECNs               4294967295                    1837088656
DE Frames           3621691                       68756528
DE Octets           1990621688                    1
Discards            1893384560                    2920112
Crc Discard         2                             -
Aborts              56295902                      -
Other Discard       1837088656                    -
===============================================================================
*A:ALU-1#
```


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Table 106: Port frame relay DLCI field descriptions

Label	Description
Frame Relay Info for *port-identifier*	
See Table 105: Port frame relay field descriptions	—
Frame Relay PVCs	
Dlci	The specified DLCI
State	The port state
Type	The port type
Creation Time	The time at which the port was created
PVCs	The number of PVCs
frame-relay statistics for port *port-identifier* **(input and output values)**	
Frames	The number of frames received or transmitted
Octets	The number of octets received or transmitted
DE Frames	The number of packets received or transmitted with the DE bit set
DE Octets	The number of octets received or transmitted with the discard eligibility bit set
Crc Discard	The number of cyclical redundancy check discards
Aborts	The number of aborts
Other Discard	The number of other discards

Output example

```
*A:7705:Dut-C#show port 1/10/9.1 detail
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/10/9.1
TimeSlots          : 2-32
Speed              : 64                      CRC                 : 16
Admin Status       : up                      Oper Status         : up
Last State Change  : 07/12/2011 08:17:15     Chan-Grp IfIndex    : 591691837

Configured mode    : access                  Encap Type          : hdlc
Admin MTU          : 1514                    Oper MTU            : 1514
Scramble           : false
Physical Link      : yes                     Bundle Number       : none
Idle Cycle Flags   : flags                   Load-balance-algo   : n/a
```


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```
Payload Fill Type  : n/a                     Payload Pattern      : N/A
Signal Fill Type   : n/a                     Signal Pattern       : N/A
Ing. Pool % Rate   : 100                     Egr. Pool % Rate     : 100
Egr. Sched. Pol    : N/A
===============================================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                             304520                301852
Packets                                              3310                  3281
Errors                                                  0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                              3310                  3281
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
*A:7705:Dut-C# configure port 1/10/9
```

```
*A:7705:Dut-C# show port detail 1/5/1.1
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/5/1.1
TimeSlots          : 2-32
Speed              : 64                      CRC                  : 16
Admin Status       : up                      Oper Status          : up
Last State Change  : 07/12/2011 08:17:18     Chan-Grp IfIndex     : 580943933

Configured mode    : access                  Encap Type           : cisco-hdlc
Admin MTU          : 1514                    Oper MTU             : 1514
Scramble           : false
Physical Link      : yes                     Bundle Number        : none
Idle Cycle Flags   : flags                   Load-balance-algo    : n/a
Payload Fill Type  : n/a                     Payload Pattern      : N/A
Signal Fill Type   : n/a                     Signal Pattern       : N/A
Ing. Pool % Rate   : 100                     Egr. Pool % Rate     : 100
Egr. Sched. Pol    : N/A
===============================================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                             301852                304520
Packets                                              3281                  3310
Errors                                                  0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                              3281                  3310
Discards                                                0                     0
Unknown Proto Discards                                  0
```


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```
===============================================================================
*A:7705:Dut-C# configure port 1/10/9
```

```
*A:7705:Dut-C# config>port>serial>x21>channel-group# show port 1/3/1.1
===============================================================================
Serial DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/3/1.1
CRC                : 16
Admin Status       : down                    Oper Status          : down
Last State Change  : 01/27/2012 14:32:01     Chan-Grp IfIndex     : 576749629
Configured Mode    : access                  Encap Type           : cisco-hdlc
Admin MTU          : 1514                    Oper MTU             : 1514
Physical Link      : No                      Bundle Number        : none
Idle Cycle Flags   : flags
Payload Fill Type  : n/a                     Payload Pattern      : n/a
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                             118222                30008
Packets                                              1640                 1364
Errors                                                  0                    0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                              1640                 1364
Discards                                                0                    0
Unknown Proto Discards                                  0
===============================================================================
```

```
*A:7705:Dut-C# config>port>serial>x21>channel-group# show port 1/3/8
===============================================================================
Serial RS-232 Physical Interface
===============================================================================
Description        : ozgur
Interface          : 1/3/8                 Port IfIndex         : 40108032
Admin Status       : up                    Oper Status          : up
Physical Link      : Yes
Type               : v35
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                 0                    0
Discards                                                0                    0
Unknown Proto Discards                                  0
===============================================================================
*A:7705:Dut-C# config>port>serial>x21>channel-group#

*A:7705:Dut-C# config>port>serial>x21>channel-group# show port 1/3/8.1 detail
===============================================================================
Serial DS0 Chan Group
===============================================================================
Description        : DS0GRP
```


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```
Interface          : 1/3/8.1
CRC                : 32
Admin Status       : up                      Oper Status          : up
Last State Change  : 01/27/2012 10:37:44     Chan-Grp IfIndex     : 576979019
Configured Mode    : access                  Encap Type           : hdlc
Admin MTU          : 1514                    Oper MTU             : 1514
Physical Link      : Yes                     Bundle Number        : none
Idle Cycle Flags   : flags
Payload Fill Type  : n/a                     Payload Pattern      : n/a
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                     0
Packets                                                0                     0
Errors                                                 0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
*A:7705:Dut-C# config>port>serial>x21>channel-group#
```

Output example

```
*A:ALU-1># show port 1/1/3
===============================================================================
TDM Data Physical Interface
===============================================================================
Description        : G.703 64kbps Codirectional
Interface          : 1/1/3                   Port IfIndex         : 39878656
Admin Status       : down                    Oper Status          : down
Physical Link      : No
Type               : codir
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
```

```
*A:ALU-1># show port 1/2/3.codir detail
===============================================================================
TDM Data Interface
===============================================================================
Description        : CODIR
Interface          : 1/2/3.codir
Type               : codir
Admin Status       : down                    Oper Status          : down
Physical Link      : no                      Clock Source         : node-timed
Timing 8khz        : Disabled
Last State Change  : 05/27/2013 12:42:10     Channel IfIndex      : 574717955
Loopback           : none
```


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```
Cfg Alarm          : ais los
Alarm Status       : los
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                     0
Packets                                                0                     0
Errors                                                 0                     0
============================
Codir Line
============================
Receive:
Data-slip  :             0
============================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                0                     0
Discards                                               0                     0
Unknown Proto Discards                                 0
===============================================================================
*A:ALU-1>#
```

Table 107: Port field descriptions (TDM codirectional or TPIF)

Label	Description
TDM Data Physical Interface **TDM Data Interface**	
Description	A text description of the port
Interface	The port ID displayed in the *slot/mda/port* format
Port IfIndex	The port interface's index number, which reflects its initialization sequence
Admin Status	up: the administrative state is up
	down: the administrative state is down
Oper Status	up: the operating state is up
	down: the operating state is down
Physical Link	yes: there is no alarm condition for the link
	no: there is an outstanding alarm condition for the link
Type	The type of interface: codirectional or TPIF
Clock Source	loop-timed: the link recovers the clock from the received data stream

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Label	Description
	node-timed: the link uses the internal clock when transmitting data adaptive: clocking is derived from the incoming pseudowire packets differential: clocking is derived from a common clock compared to differential clock recovery data in the RTP header in the TDM PW overhead
Timing 8khz	Indicates whether 8-kb/s timing on a codirectional interface is enabled or disabled
Last State Change	The last time the operational status of the port changed state
Channel IfIndex	The channel interface index number
Loopback	The loopback mode for the channel: internal-analog, internal-digital, or none
Cfg Alarm	The type of alarms to be logged and reported for the port
Alarm Status	The current alarm state
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Codir Line	

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Label	Description
Data-slip:	In a plesiochronous timing system, the number of data slips that have occurred in the receive direction
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

Output example

```
*A:ALU-1># show port 1/3/1

===============================================================================
GNSS Physical Interface
===============================================================================
Description       : GNSS Rx
Interface         : 1/3/1                 Port IfIndex         : 39878656
Admin Status      : up                    Oper Status          : up
Physical Link     : Yes
Type              : gps
Ant. Cable Delay  : 0                     Elev. Mask Angle     : 10
Antenna Status    : ok                    Visible Satellites   : 9
Sync Status       : locked                Used Satellites      : 7
Receiver Status   : Position Hold
Time              : 2014/04/23 18:47:38   Latitude             : +45.34811
UTC Offset        : 17                    Longitude            : -75.92142
                                          Altitude (m MSL)     : 90
===============================================================================
```

Table 108: Port field descriptions (GNSS)

Label	Description
Description	Specifies the GNSS RF port description

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Label	Description
Interface	Specifies the card, MDA, and port number of the GNSS RF port
Admin Status	up: the port is administratively up down: the port is administratively down
Physical Link	yes: an operational GNSS antenna is detected no: an operational GNSS antenna is not detected
Type	Specifies the type of satellite navigation system used
Ant. Cable Delay	Specifies the amount of time, in nanoseconds, compensated for signal delay due to cable length
Antenna Status	ok: valid antenna connection under-current: open condition. Previously, an under-current status caused the port operational status to be down. Currently, the port remains operationally up in the event that any GNSS splitters used do not provide a load. over-current: short circuit, or maximum power limits for the receiver have been exceeded no-bias voltage: antenna power disabled
Sync Status	locked: GNSS time is within alarm limits (1 µs) not locked: GNSS time is outside of the alarm limits and/or there is an insufficient number of tracked satellites
Receiver Status	Acquiring Satellites: GNSS receiver is attempting to track satellite Position Hold: GNSS receiver position is determined and GNSS receiver is no longer solving for position 2D Fix: GNSS receiver is attempting to get a 2D fix on a satellite 3D Fix: GNSS receiver is attempting to get a 3D fix on a satellite Unknown: default state on power-up Communication Lost: occurs after 30 s of no Channel/Data/Status messages from the GNSS receiver Communication Established: occurs after a successful re-establishment of communication following a Communication Lost status Self-Test Failed: occurs after a GNSS receiver startup failure

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Label	Description
Time	Specifies the GNSS system date and time
UTC Offset	Specifies the difference between GNSS time and UTC time *UTC time = GNSS time – UTC offset*
Port IfIndex	Specifies the GNSS interface index number, which reflects its initialization sequence
Oper Status	up: the port is operationally up (communication with the GNSS receiver is established, the self-test has passed, and the antenna status is OK) down: the port is operationally down (any of the up conditions have not been met)
Elev. Mask Angle	Specifies the configured elevation angle below which satellites are ignored. The default elevation mask angle is 10°.
Visible Satellites	Specifies the number of satellites that the GNSS receiver should see at the current time. This number can be 0 if the GNSS receiver has not yet downloaded an almanac, even if Used Satellites is more than 0. Five or more satellites must be in view of the GNSS receiver antenna at all times when the receiver is in the process of obtaining a position fix, and these satellites must be above the configured elevation mask angle.
Used Satellites	Specifies the number of tracked satellites
Latitude	Specifies the latitude of the GNSS antenna
Longitude	Specifies the longitude of the GNSS antenna
Altitude (m MSL)	Specifies the altitude of the GNSS antenna above mean sea level, in meters

Output example

```
*A:Sar8 Dut-A>show# port aps
===============================================================================
Ports on APS Groups
===============================================================================
Port          Admin Link Port    Cfg  Oper LAG/ Port Port Port   C/QS/S/XFP/
Id            State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
aps-1         Down  No   Ghost
===============================================================================
*A:Sar8 Dut-A>show#
```


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Table 109: Port field descriptions (APS)

Label	Description
Port Id	The port ID configured or displayed in the **aps**-*id* format
Admin State	Up: the administrative state is up
	Down: the administrative state is down
Link	Yes: a physical link is present
	No: a physical link is not present
Port State	Up: the port is physically present and has a physical link
	Down: the port is physically present but does not have a link
	Ghost: the port is not physically present
	None: the port is in its initial creation state or about to be deleted
	Link Up: the port is physically present and has a physical link. When Link Up appears at the lowest level of a TDM tributary, it means the physical connection is active but the port is waiting before data traffic can flow. It is a waiting state and indicates that data traffic will not flow until it transitions to the Up state.
	Link Down: the port is physically present but does not have a link
Cfg MTU	The configured MTU
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets
LAG/Bndl	The link aggregation group (LAG) or multilink bundle to which a TDM port is assigned
Port Mode	network: the port is configured for transport network use
	access: the port is configured for service access
	hybrid: the port is configured for hybrid use (transport network and service access per VLAN)
Port Encp	The encapsulation type on the port
Port Type	The type of port or optics installed

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Label	Description
C/QS/S/XFP/MDIMDX	The SFP type on the port

Output example

```
*A:Sar8 Dut-A>show# port aps-1
===============================================================================
SONET/SDH Interface
===============================================================================
Description        : APS Group
Interface          : aps-1                  Speed               : oc3
Admin Status       : down                   Oper Status         : down
Physical Link      : No                     Loopback Mode       : none
Single Fiber Mode  : No
Clock Source       : node                   Framing             : sonet
Last State Change  : 01/09/2019 20:50:16    Port IfIndex        : 1358987264
Configured Address : d6:64:ff:00:02:49
Hardware Address   : d6:64:ff:00:02:49
Last Cleared Time  : 01/24/2019 21:33:06
J0 String          : 0x01                   Section Trace Mode  : byte
Rx S1 Byte         : 0x00 (stu)             Rx K1/K2 Byte       : 0x00/0x00
Tx S1 Byte         : 0x00 (stu)             Tx DUS/DNU          : Disabled
Rx J0 String (Hex) : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Cfg Alarm          : loc lrdi lb2er-sf slof slos
Alarm Status       :
BER SD Threshold   : 6                      BER SF Threshold    : 3
Hold time up       : 500 milliseconds       Reset On Path Down  : Disabled
Hold time down     : 200 milliseconds
Transceiver Data
Transceiver Status : not-equipped
Hardware Address   : d6:64:ff:00:02:49
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                                 0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
```

Table 110: Port field descriptions (with APS ID)

Label	Description
SONET/SDH Interface	
Description	A description of the port
Interface	The APS interface name (the APS group port)
Speed	The speed of the SONET/SDH port
Admin Status	Specifies whether the APS circuit is administratively up or down

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Label	Description
Oper Status	Specifies whether the APS circuit is operationally up or down
Physical Link	Specifies whether a physical link is present
Loopback Mode	The loopback mode of the port
Single Fiber Mode	Specifies whether the port is operating in single-fiber mode
Clock Source	node: the link uses the internal clock when transmitting data loop: the link recovers the clock from the received data stream
Framing	sonet: the port is configured for SONET framing sdh: the port is configured for SDH framing
Last State Change	The last time that the operational status of the port changed state
Port IfIndex	The interface index number, which reflects its initialization sequence
Configured Address	The base chassis SONET/SDH MAC address
Hardware Address	The interface hardware- or system-assigned MAC address at its protocol sublayer
Last Cleared Time	The time since the last clear
J0 String	The section trace value that is sent to the far-end port
Section Trace Mode	byte: the section trace in the SONET section header is set in bytes string: a text string is used to identify the SONET section header increment-z0: an incremental STM ID is configured instead of a static value
Rx S1 Byte	The value of the SONET/SDH S1 byte received on the interface
Rx K1/K2 Byte	The value of the SONET/SDH K1/K2 byte received on the interface

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Label	Description
Tx S1 Byte	The value of the SONET/SDH S1 byte transmitted on the interface
Tx DUS/DNU	Indicates whether the transmission of the QL-DUS/DNU value in synchronization status messages is enabled or disabled on the port
Rx J0 String (Hex)	The hexadecimal value of the received J0
Cfg Alarm	The types of alarms to be logged and reported for the SONET/SDH port
Alarm Status	The current alarm state
BER SD Threshold	The configured threshold for line signal degradation BER error rate, that when crossed determines the signal degradation and signal failure
BER SF Threshold	The configured threshold for line signal failure BER error rate, that when crossed determines the signal degradation and signal failure
Hold time up	The link-up dampening time in seconds
Reset On Path Down	Specifies whether the port will be reset when the path transitions to the operationally down state
Hold time down	The link-down dampening time in seconds
Transceiver Data	The following information is provided for a configured SFP: • transceiver status • transceiver type • model number • TX laser wavelength • whether it is diagnostics-capable • connector code • vendor organizationally unique identifier (OUI) • manufacture date • media • serial number • part number

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Label	Description
	• optical compliance • link length support • whether it is Sync-E capable
Transceiver Status	The status of the transceiver
Hardware Address	The port hardware address
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast, multicast, or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts.

Output example

```
*A:Sar8 Dut-A>show# port lcr
===============================================================================
Ports on LCR Groups
===============================================================================
Port          Admin Link Port    Cfg  Oper LAG/ Port Port Port   C/QS/S/XFP/
Id            State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
lcr-1/1       Down  No   Ghost
lcr-1/2       Down  No   Ghost
lcr-1/3       Down  No   Ghost
lcr-1/4       Down  No   Ghost
lcr-1/5       Down  No   Ghost
```


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```
lcr-1/6       Down  No   Ghost
lcr-1/7       Down  No   Ghost
lcr-1/8       Down  No   Ghost
lcr-1/9       Down  No   Ghost
lcr-1/10      Down  No   Ghost
lcr-1/11      Down  No   Ghost
lcr-1/12      Down  No   Ghost
lcr-1/13      Down  No   Ghost
lcr-1/14      Down  No   Ghost
lcr-1/15      Down  No   Ghost
lcr-1/16      Down  No   Ghost
lcr-5/1       Down  No   Ghost
lcr-5/2       Down  No   Ghost
lcr-5/3       Down  No   Ghost
===============================================================================
```

Table 111: Port field descriptions (LCR)

Label	Description
Port Id	The port ID configured or displayed in the *slot/mda/port* format
Admin State	Up: the administrative state is up
	Down: the administrative state is down
Link	Yes: a physical link is present
	No: a physical link is not present
Port State	Up: the port is physically present and has a physical link
	Down: the port is physically present but does not have a link
	Ghost: the port is not physically present
	None: the port is in its initial creation state or about to be deleted
	Link Up: the port is physically present and has a physical link When Link Up appears at the lowest level of a TDM tributary, it means the physical connection is active but the port is waiting before data traffic can flow. It is a waiting state and indicates that data traffic will not flow until it transitions to the Up state.
	Link Down: the port is physically present but does not have a link
Cfg MTU	The configured MTU
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel specified in octets

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Label	Description
LAG/Bndl	The link aggregation group (LAG) or multilink bundle to which a TDM port is assigned
Port Mode	network: the port is configured for transport network use
	access: the port is configured for service access
	hybrid: the port is configured for hybrid use (transport network and service access per VLAN)
Port Encp	The encapsulation type on the port
Port Type	The type of port or optics installed
C/QS/S/XFP/MDIMDX	The SFP type on the port

Output example

```
*A:Sar8 Dut-A>show# port lcr-1/1
===============================================================================
TDM DS1 Physical Interface
===============================================================================
Description        : APS Group
Interface          : lcr-1/1               Port IfIndex         : 1367343104
Admin Status       : down                  Oper Status          : down
Physical Link      : No
Line Impedance     : 100
Line Encoding      : b8zs
Type               : ds1                   Buildout             : short
Length             : 133
Hardware Address   :
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Packets                                               0                     0
Discards                                              0                     0
Unknown Proto Discards                                0
===============================================================================
```

Table 112: Port field descriptions (with LCR port ID)

Label	Description
TDM DS1 Physical Interface	
Description	A text description of the LCR port
Interface	The LCR port ID displayed in the **lcr-***group-id*/*port*[.*channel*] format
Port Ifindex	The interface index number, which reflects its initialization sequence

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Label	Description
Admin Status	up: the LCR port is administratively up
	down: the LCR port is administratively down
Oper Status	up: the LCR port is operationally up
	down: the LCR port is operationally down
Physical Link	yes: a physical link is present
	no: a physical link is not present
Line Impedance	The line impedance configured for the port
Line Encoding	The line encoding configured for the physical DS1 (T1) port
Type	The type of interface
Buildout	The line buildout (cable length) configured for physical DS1 ports on the 16-port T1/E1 ASAP Adapter card or 32-port T1/E1 ASAP Adapter card
Length	The line length configured for the physical DS1 port on the 16-port T1/E1 ASAP Adapter card or 32-port T1/E1 ASAP Adapter card
Hardware Address	The port hardware address
Port Statistics	
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast, multicast, or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts.

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lldp

Syntax

lldp [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**]

Context

show>port>ethernet

Description

This command displays LLDP information.

Parameters

nearest-bridge

displays nearest bridge information

nearest-non-tpmr

displays nearest non-two-port MAC relay (TPMR) information

nearest-customer

displays nearest customer information

remote-info

displays remote information about the bridge MAC

detail

displays detailed LLDP information

Output

The following outputs are examples of LLDP information:

- LLDP (Output example, Table 113: Port LLDP field descriptions)
- LLDP Detail (Output example, Table 114: Port LLDP detail field descriptions)

Output example

```
*A:ALU-1># show port 1/2/2 ethernet lldp
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================

Port 1/2/2 Bridge nearest-bridge
-------------------------------------------------------------------------------
Admin State           : txAndRx       Notifications        : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs         : portDesc sysCap
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Enabled       Address              : 10.20.30.40
Index 2 (IPv6 system) : Disabled      Address              : ::

Port 1/2/2 Bridge nearest-non-tpmr
```


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```
-------------------------------------------------------------------------------
Admin State           : disabled      Notifications        : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled      Address              : 10.20.30.40
Index 2 (IPv6 system) : Disabled      Address              : ::

Port 1/2/2 Bridge nearest-customer
-------------------------------------------------------------------------------
Admin State           : disabled      Notifications        : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled      Address              : 10.20.30.40
Index 2 (IPv6 system) : Disabled      Address              : ::

===============================================================================
*A:ALU-1>#
```

Table 113: Port LLDP field descriptions

Label	Description
Admin State	The LLDP transmission/reception frame handling
Notifications	Indicates whether LLDP notifications are enabled
Tunnel Nearest Bridge	n/a
Transmit TLVs	The optional TLVs that are transmitted by this port
PortID TLV Subtype	Indicates the setting for the port ID subtype: tx-if-alias, tx-if-name, or tx-local
Management Address Transmit Configuration	
Index 1 (system) Index 2 (IPv6 system)	Details of the management address configuration. The 7705 SAR can only be configured to send or not send the system address. Enabled: the management address TLV is included in LLDPDUs sent by the port Disabled: the management address TLV is not included in LLDPDUs sent by the port
Address	The address transmitted by the port when tx-mgmt-address command is enabled

Output example

```
*A:ALU-1># show port 1/2/2 ethernet lldp nearest-bridge detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/2/2 Bridge nearest-bridge
```


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```
-------------------------------------------------------------------------------
Admin State           : txAndRx         Notifications        : Disabled
Transmit TLVs         : portDesc sysCap

Management Address Transmit Configuration:
Index 1 (system)      : Enabled         Address              : 10.20.30.40

Port LLDP Stats:
Tx Frames             : 13              Tx Length Err Frames : 0
Rx Frames             : 0               Rx Frame Discard     : 0
Rx Frame Errors       : 0               Rx TLV Discard       : 0
Rx TLV Unknown        : 0               Rx Ageouts           : 0
===============================================================================
*A:ALU-1>#


*A:ALU-1># show port 1/2/2 ethernet lldp nearest-bridge remote-info detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/2/2 Bridge nearest-bridge Remote Peer Information
-------------------------------------------------------------------------------
Remote Peer Index 2 at timestamp 12/02/2014 16:08:14:

Supported Caps       : bridge router
Enabled Caps         : bridge router
Chassis Id Subtype   : 4 (macAddress)
Chassis Id           : ac:fa:ff:00:00:00
PortId Subtype       : 1 (interfaceAlias)
Port Id              : 37814272
Port Description     : 2/1/2, 10/100 Gig Eth SFP, “remport1” (from ifDesc RFC2863)
System Name          : n/a
System Description   : n/a

Remote Peer Index 2 management addresses at time 12/02/2014 16:08:14:
No remote management addresses found
===============================================================================
*A:ALU-1>#
```

Table 114: Port LLDP detail field descriptions

Label	Description
Admin State	The LLDP transmission/reception frame handling
Notifications	Indicates whether LLDP notifications are enabled
Transmit TLVs	The optional TLVs that are transmitted by this port
Index 1 (system)	Details of the management address configuration. The 7705 SAR can only be configured to send or not send the system address. Enabled: the management address TLV is included in LLDPDUs sent by the port Disabled: the management address TLV is not included in LLDPDUs sent by the port

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Label	Description
Enabled Address	The address transmitted by the port when the management address TLV is included in LLDPDUs sent by the port
Port LLDP Stats	
Tx Frames	The number of LLDP frames transmitted
Tx Length Err Frames	The number of frames with LLDPDU length violations caused by too many TLVs selected by the network manager. The packets are sent containing the mandatory TLVs and the maximum number of optional TLVs that will fit in the LLDP frame.
Rx Frames	The number of LLDP frames received
Rx Frame Discard	The number of LLDP frames received by the LLDP agent that were discarded for any reason. This counter can provide an indication that LLDP header formatting problems may exist with the local LLDP agent in the sending system, or that LLDPDU validation problems may exist with the local LLDP agent in the receiving system.
Rx Frame Errors	The number of invalid LLDP frames received by the LLDP agent on the indicated port while the LLDP agent is enabled
Rx TLV Discard	The number of LLDP TLVs discarded for any reason by the LLDP agent on the indicated port
Rx TLV Unknown	The number of LLDP TLVs received that are not recognized by the LLDP agent
Rx Ageouts	The number of age-outs that have occurred on the port
Supported Caps	Describes the system capabilities supported by the remote peer
Enabled Caps	Describes the system capabilities enabled on the remote peer
Chassis Id Subtype	An integer value and text definition that indicates the basis for the chassis ID entity listed in the chassis ID field
Chassis Id	The chassis identifier of the chassis containing the Ethernet port that sent the LLDPDU
PortId Subtype	An integer value and text definition that indicates the basis for the port ID entity listed in the port ID field

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Label	Description
Port Id	The port identifier of the Ethernet port that sent the LLDPDU
Port Description	Describes the port that sent the LLDPDU and indicates that the description is the ifDescr object text string from RFC 2863 - IF MIB
System Name	The name of the system that sent the LLDPDU
System Description	Describes the system that sent the LLDPDU

3.15.2.1.7 Show ATM port commands

port

Syntax

port *port-id* **atm**

port *port-id* **atm connections**

port *port-id* **atm pvc** [*vpi/vci*] [**detail**]

port *port-id* **atm pvp** [*vpi*] [**detail**]

Context

show

Description

This command displays ATM port information.

If no command line options are specified, the command port displays summary information for all ports on provisioned adapter cards.

Parameters

port-id

specifies the physical port ID

Syntax *port-id* *slot*[*/mda*[*/port*]] or *slot*/*mda*/*port*[.*channel*], where:

slot 1

mda 1 to 6 (7705 SAR-8 Shelf V2)

1 to 12 (7705 SAR-18)

port 1 to 2 (2-port OC3/STM1 Channelized Adapter card ports)

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1 to 4 (4-port OC3/STM1 Clear Channel Adapter card ports or 4-port DS3/E3 Adapter card ports)

1 to 16 (16-port T1/E1 ASAP Adapter card ports)

1 to 32 (32-port T1/E1 ASAP Adapter card ports)

channel 1 to 24 (DS1) or 1 to 32 (E1)

atm

displays ATM information

connections

displays ATM connection information

pvc

displays ATM port PVC information

pvp

displays ATM port PVP information

vpi/vci

vpi: 0 to 4095 (NNI; not supported on SONET/SDH ports), 0 to 255 (UNI)

vci: 1, 2, 5 to 65534

detail

provides detailed information

Output

The following outputs are examples of ATM information:

- ATM (Output example, Table 115: Port ATM field descriptions)
- ATM Connections (Output example, Table 116: Port ATM connections field descriptions)
- ATM PVC (Output example, Table 117: Port ATM PVC field descriptions)
- ATM PVC VPI/VCI (Output example, Table 118: Port ATM PVC VPI/VCI field descriptions)
- ATM PVC VPI/VCI Detail (Output example, Table 119: Port ATM PVC VPI/VCI detail field descriptions)
- ATM PVP (Output example, Table 120: Port ATM PVP field descriptions)
- ATM PVP Detail (Output example, Table 121: Port ATM PVP detail field descriptions)

Output example

```
*A:ALU-1># show port 1/1/3.sts3 atm
===============================================================================
ATM Info for 1/1/3
===============================================================================
Cell Mode             : UNI               Mapping            : Direct
Configured VCs        : 0                 Configured VPs     : 0
Configured VTs        : 0                 Configured IFCs    : 0
Configured minimum VPI: 0
Last Unknown VPI/VCI  : none
===============================================================================
TC Sublayer Information
===============================================================================
TC Alarm State        : LCD Failure       Number OCD Events  : 0
```


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```
HEC Errors (Dropped)  : 0                HEC Errors (Fixed) : 0
===============================================================================
ATM Bandwidth Info
===============================================================================
                     kbps      %                              kbps      %
-------------------------------------------------------------------------------
Ingress CBR        : 0           0%      Egress CBR         : 0           0%
Ingress RT-VBR     : 0           0%      Egress RT-VBR      : 0           0%
Ingress NRT-VBR    : 0           0%      Egress NRT-VBR     : 0           0%
Ingress UBR        : 0           0%      Egress UBR         : 0           0%
-------------------------------------------------------------------------------
Ingress Total      : 0           0%      Egress Total       : 0           0%
ATM Link Bandwidth : 149760 kbps
Shaped Bandwidth   : 0 kbps
===============================================================================
```

Table 115: Port ATM field descriptions

Label	Description
Cell Mode	The cell format (UNI or NNI) that is used on the ATM interface (NNI is not supported on SONET/SDH ports)
Configured VCs	The number of configured VCs
Configured VTs	The number of configured VTs
Configured minimum VPI	The configured minimum allowable VPI value that can be used on the ATM interface for a VPC
Last Unknown VPI/VCI	The last unknown VPI/VCI that was received on this interface
Mapping	Direct: direct ATM cell mapping is used
Configured VPs	The number of configured VPs
Configured IFCs	The number of configured IFCs
TC Alarm State	The ATM interface notifications indicating that the TC sublayer is currently in the Loss of Cell Delineation (LCD) defect maintenance state or that the TC sublayer is currently not in the Loss of Cell Delineation (LCD) defect maintenance state
HEC Errors (Dropped)	The number of cells with uncorrectable HEC errors on this interface
Number OCD Events	The number of times the Out of Cell Delineation (OCD) events occurred
HEC Errors (Fixed)	The number of cells with correctable HEC errors on this interface
Ingress CBR	The total CBR bandwidth consumed on this interface in the ingress direction

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Label	Description
Ingress RT-VBR	The total real-time variable bit rate (rt-VBR) bandwidth consumed on this interface in the ingress direction
Ingress NRT-VBR	The total non-real-time variable bit rate (nrt-VBR) bandwidth consumed on this interface in the ingress direction
Ingress UBR	The total unspecified bit rate (UBR) bandwidth consumed on this interface in the ingress direction
Egress CBR	The total CBR bandwidth consumed on this interface in the egress direction
Egress RT-VBR	The total real-time variable bit rate (rt-VBR) bandwidth consumed on this interface in the egress direction
Egress NRT-VBR	The total non-real-time variable bit rate (nrt-VBR) bandwidth consumed on this interface in the egress direction
Egress UBR	The total unspecified bit rate (UBR) bandwidth consumed on this interface in the egress direction
Ingress Total	The total bandwidth of all service categories consumed on this interface in the ingress direction
Egress Total	The total bandwidth of all service categories consumed on this interface in the egress direction
ATM Link Bandwidth	The total ATM link bandwidth accepted on this interface
Shaped Bandwidth	The total shaped bandwidth consumed on this interface in the egress direction

Output example

```
A:ALU-1># show port 1/1/1.1 atm connections
===============================================================
ATM Connections, Port 1/1/1.1
===============================================================
           Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
---------------------------------------------------------------
0/100      SAP    PVC      101     201     up   up          up
0/101      SAP    PVC      101     201     up   up          up
0/102      SAP    PVC      101     201     up   up          up
0/103      SAP    PVC      101     201     up   up          up
0/104      SAP    PVC      101     201     up   up          up
0/105      SAP    PVC      101     201     up   up          up
0/106      SAP    PVC      101     201     up   up          up
0/107      SAP    PVC      101     201     up   up          up
0/108      SAP    PVC      101     201     up   up          up
0/109      SAP    PVC      101     201     up   up          up
0/110      SAP    PVC      101     201     up   up          up
0/111      SAP    PVC      101     201     up   up          up
0/112      SAP    PVC      101     201     up   up          up
```


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```
0/113       SAP    PVC      101     201     up   up          up
0/114       SAP    PVC      101     201     up   up          up
===============================================================
```

Table 116: Port ATM connections field descriptions

Label	Description
Owner	The system entity that owns a specific ATM connection
Type	The connection type
Ing. TD	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr. TD	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Adm	The administrative state of the interface connection
OAM	The OAM operational status of ATM connections: Up: the interface is operationally up ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Opr	The status of the ATM interface

Output example

```
*A:ALU-1># show port 1/1/1.1 atm pvc
===============================================================
ATM PVCs, Port 1/1/1.1
===============================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
---------------------------------------------------------------
0/32       SAP    PVC      1       1       up   ETE-AIS     dn
===============================================================
*A:ALU-1>
```

Table 117: Port ATM PVC field descriptions

Label	Description
VPI/VCI	The VPI/VCI values
Owner	The system entity that owns a specific ATM connection
Type	The connection type
Ing. TD	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr. TD	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection

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Label	Description
Adm	The administrative state of the interface connection
OAM	The OAM operational status of ATM connections: Up: the interface is operationally up ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Opr	The status of the ATM interface

Output example

```
*A:ALU-1># show port 1/1/1.1 atm pvc 0/32
===============================================================================
ATM PVC
===============================================================================
Port Id             : 1/1/1.1             VPI/VCI            : 0/32
Admin State         : up                  Oper state         : down
OAM State           : ETE-AIS             Encap Type         : n/a
Owner               : SAP                 AAL Type           : n/a
Endpoint Type       : PVC                 Cast Type          : P2P
Ing. Td Idx         : 1                   Egr. Td Idx        : 1
Last Changed        : 11/08/2007 17:02:36 ILMI Vpi/Vci Range : n/a
===============================================================================
*A:ALU-1>#
```

Table 118: Port ATM PVC VPI/VCI field descriptions

Label	Description
Port Id	The port ID configured or displayed in the *slot/mda/port* format
VPI/VCI	The VPI/VCI values
Admin State	The administrative state of the interface connection
Oper State	The status of the ATM interface
OAM State	The OAM operational status of ATM connections: Up: the interface is operationally up ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Encap Type	The encapsulation type
Owner	The system entity that owns a specific ATM connection
Endpoint Type	The endpoint type
Cast Type	The connection topology type

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Label	Description
Ing. TD Idx	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr. TD Idx	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection

Output example

```
*A:ALU-1># show port 1/1/1.1 atm pvc 0/32 detail
===============================================================================
ATM PVC
===============================================================================
Port Id            : 1/1/1.1             VPI/VCI            : 0/32
Admin State        : up                  Oper state         : down
OAM State          : up                  Encap Type         : n/a
Owner              : SAP                 AAL Type           : n/a
Endpoint Type      : PVC                 Cast Type          : P2P
Ing. Td Idx        : 1                   Egr. Td Idx        : 1
Last Changed       : 11/08/2007 17:02:36 ILMI Vpi/Vci Range : n/a
===============================================================================
===============================================================================
ATM Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Octets                                               1643                   1643
Cells                                                  31                     31
CLP=0 Cells                                            31                     31
Dropped CLP=0 Cells                                     0                      0
Dropped Cells (CLP=0+1)                                 0
Tagged Cells                                            0
===============================================================================
===============================================================================
ATM OAM Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Loopback                                                0                      0
OAM Cells (generated)                                   0
===============================================================================
```

Table 119: Port ATM PVC VPI/VCI detail field descriptions

Label	Description
Port Id	The port ID configured or displayed in the *slot/mda/port* format
VPI/VCI	The VPI/VCI values
Admin State	The administrative state of the interface connection
Oper State	The status of the ATM interface
OAM State	The OAM operational status of ATM connections: Up: the interface is operationally up

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Label	Description
	ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Encap Type	The encapsulation type
Owner	Identifies the system entity that owns a specific ATM connection
AAL Type	The ATM Adaptation Layer 5 (AAL5) information
Endpoint Type	The endpoint type
Cast Type	The connection topology type
Ing. Td Idx	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr. Td Idx	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Last Changed	The date and time that the interface connection entered its current operational state
Octets	The number of input and output octets HEC discarded cells are not included in the input octet numbers
Cells	The number of input and output cells HEC discarded cells are not included in the input cell numbers
CLP=0 Cells	The number of CLP=0 cells
Dropped CLP=0 Cells	The number of dropped CLP=0 cells
Dropped Cells (CLP=0+1)	The number of dropped CLP=0+1 cells
Tagged Cells	The number of tagged cells
Loopback	The number of loopback requests and responses transmitted and received on this connection for both end-to-end and segment
OAM Cells (generated)	The number of OAM cells generated at the endpoint and sent toward the network

Output example

```
*A:ALU-1>#  show port 1/1/1.1 atm pvp
===============================================================
ATM PVPs, Port 1/1/1.1
===============================================================
VPI        Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
```


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```
-------------------------------------------------------------
2          SAP    PVP      1       1       up   up          up
=============================================================
```

Table 120: Port ATM PVP field descriptions

Label	Description
VPI	The VPI value
Owner	The system entity that owns a specific ATM connection
Type	The type of connection
Ing.TD	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr.TD	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Adm	Up: the interface is administratively up
	Down: the interface is administratively down
OAM	The OAM operational status of ATM connections: Up: the interface is operationally up ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Opr	Up: the interface is operationally up
	Down: the interface is operationally down

Output example

```
*A:ALU-1>show port 1/1/1.1 atm pvp 11 detail
===============================================================================
ATM PVP
===============================================================================
Port Id             : 1/1/1.1             VPI                 : 11
Admin State         : up                  Oper state          : up
OAM State           : up
Owner               : SAP
Endpoint Type       : PVP                 Cast Type           : P2P
Ing. Td Idx         : 1                   Egr. Td Idx         : 1
Last Changed        : 02/01/2000 00:37:25 ILMI Vpi Range      : n/a
===============================================================================
===============================================================================
ATM Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                               1007                  1007
Cells                                                  19                    19
CLP=0 Cells                                            19                    19
Dropped CLP=0 Cells                                     0                     0
Dropped Cells (CLP=0+1)                                 0
```


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```
Tagged Cells                                              0
===============================================================================
===============================================================================
ATM OAM Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Loopback                                              0                     0
OAM Cells
(generated)                                           0
===============================================================================
*A:ALU-1>#
```

Table 121: Port ATM PVP detail field descriptions

Label	Description
Port Id	The port ID configured or displayed in the *slot/mda/port* format
VPI	The VPI values
Admin State	The administrative state of the interface connection
Oper State	The status of the ATM interface
OAM State	The OAM operational status of ATM connections: Up: the interface is operationally up ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Owner	The system entity that owns a specific ATM connection
Endpoint Type	The endpoint type
Cast Type	The connection topology type
Ing. Td Idx	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr. Td Idx	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Last Changed	The date and time that the interface connection entered its current operational state
Octets	The number of input and output octets HEC discarded cells are not included in the input octet numbers
Cells	The number of input and output cells HEC discarded cells are not included in the input cell numbers

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Label	Description
CLP=0 Cells	The number of CLP=0 cells
Dropped CLP=0 Cells	The number of dropped CLP=0 cells
Dropped Cells (CLP=0+1)	The number of dropped CLP=0+1 cells
Tagged Cells	The number of tagged cells
Loopback	The number of loopback requests and responses transmitted and received on this connection for both end-to-end and segment
OAM Cells (generated)	The number of OAM cells generated at the endpoint and sent toward the network

3.15.2.1.8 Show port-tree commands

port-tree

Syntax

port-tree *port-id*

Context

show

Description

This command displays the tree for SONET/SDH ports or channels.

Note: The same **show>port-tree** display is used for both SONET and SDH. The SONET nomenclature is used to show both SONET and SDH hierarchies.

Parameters

port-id

specifies the physical port ID

Syntax *slot*[*/mda*[*/port*]] or *slot*/*mda*/*port*[.*channel*]

Output

The following output is an example of port-tree information, and Table 122: Port-tree field descriptions describes the fields.

Output example

```
*A:ALU-A# show port-tree 1/5/1
ifIndex    type, sonet-sdh-index (* = provisioned)
```


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```
========   ======================================
 44072960  Port, N/A *
580943873      STS3, none
580943933          STS1, sts1-1
N/A                    VTG, 1.1
580943945                  VT2, vt2-1.1.1
580943946                      E1, 1.1.1
580943979                  VT2, vt2-1.1.2
580943980                      E1, 1.1.2
580944013                  VT2, vt2-1.1.3
580944014                      E1, 1.1.3

...
N/A                    VTG, 3.7
580946003                  VT2, vt2-3.7.1
580946004                      E1, 3.7.1
580946037                  VT2, vt2-3.7.2
580946038                      E1, 3.7.2
580946071                  VT2, vt2-3.7.3
580946072                      E1, 3.7.3
*A:ALU-A#
```

Table 122: Port-tree field descriptions

Label	Description
IfIndex	Displays the interface number of the index, which reflects its initialization sequence
type	Specifies the OC3 bandwidth subdivision
sonet-sdh-index	Specifies the sonet-sdh-index
*	Indicates that the port or channel is provisioned

3.15.2.1.9 Show LAG commands

lag

Syntax

lag [*lag-id*] [**detail**] [**statistics**]

lag *lag-id* **associations**

lag *lag-id* **bfd**

lag [*lag-id*] **description**

lag *lag-id* [**detail**] **lacp-partner**

lag [*lag-id*] **port**

Context

show

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Description

This command displays link aggregation group (LAG) information.

If no command line options are specified, a summary listing of all LAGs is displayed.

Parameters

lag-id

displays information about the specified LAG

Values 1 to 32

detail

displays detailed LAG information

Default displays summary LAG information

statistics

displays LAG statistics information

associations

displays a list of current router interfaces with which the LAG is associated

bfd

displays LAG BFD information

description

displays a list of all LAGs and LAG ports and their descriptions

lacp-partner

displays information about the LACP partner (**detail** keyword provides detailed information)

port

displays information about the specified LAG port or all LAG ports

Output

The following outputs are examples of LAG information:

- Summary (Output example, Table 123: LAG summary field descriptions)
- Detail (Output example, Table 124: LAG detailed field descriptions)
- Statistics (Output example, Table 125: LAG statistics field descriptions)
- Associations (Output example, Table 126: LAG associations field descriptions)
- BFD (Output example, Table 127: LAG BFD field descriptions)
- Description (Output example, Table 128: LAG description field descriptions)
- LACP partner (Output example, Table 129: LAG LACP partner field descriptions)
- LACP partner (detail) (Output example, Table 130: LAG detailed LACP partner field descriptions)
- Port (Output example, Table 131: LAG port field descriptions)

Output example

```
*A:ALU-1># show lag
===============================================================================
```


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```
Lag Data
===============================================================================
Lag-id         Adm     Opr     Port-Threshold   Up-Link-Count   MC Act/Stdby
-------------------------------------------------------------------------------
1              up      down    0                0               N/A
2              up      down    1                0               N/A
3              up      up      0                1               N/A
-------------------------------------------------------------------------------
Total Lag-ids: 3       Single Chassis: 3        MC Act: 0       MC Stdby: 0
===============================================================================
*A:ALU-1>#
```

Table 123: LAG summary field descriptions

Label	Description
Lag-id	The LAG identifier
Adm	Up: the LAG is administratively up
	Down: the LAG is administratively down
Opr	Up: the LAG is operationally up
	Down: the LAG is operationally down
Port-Threshold	The number of operational links at or below which the LAG is considered to be operationally down
Up-Link-Count	The number of ports that are physically present and have physical links present
MC Act/Stdby	N/A

Output example

```
*A:ALU-1># show lag 2 detail
===============================================================================
LAG Details
===============================================================================
Description        : LAG2
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 2                     Mode                 : access
Adm                 : up                    Opr                  : down
Thres. Exceeded Cnt : 0                     Port Threshold       : 1
Thres. Last Cleared : 08/19/2011 14:35:28   Threshold Action     : down
Dynamic Cost        : false                 Encap Type           : null
Configured Address  : 2001:db8::            Lag-IfIndex          : 1342177282
Hardware Address    : 2001:db8::52:0:1      Adapt Qos            : N/A
Hold-time Down      : 0.0 sec               Port Type            : standard
LACP                : enabled               Mode                 : active
LACP Transmit Intvl : fast                  LACP xmit stdby      : enabled
Selection Criteria  : highest-count         Slave-to-partner     : disabled
Number of sub-groups: 2                     Forced               : -
System Id           : a4:58:ff:00:00:00     System Priority      : 32768
Admin Key           : 32769                 Oper Key             : 32769
Prtr System Id      :                       Prtr System Priority : 0
```


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```
Prtr Oper Key       : 0
-------------------------------------------------------------------------------
Port-id        Adm     Act/Stdby Opr     Primary   Sub-group     Forced  Prio
-------------------------------------------------------------------------------
1/4/3          up      active    down    yes       1             -       1
1/5/3          up      standby   down              2             -       2
-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
-------------------------------------------------------------------------------
1/4/3          actor     Yes   Yes   No    No    No    Yes   Yes      Yes
1/4/3          partner   Yes   Yes   No    No    No    No    Yes      No
1/5/3          actor     Yes   Yes   No    No    No    Yes   Yes      Yes
1/5/3          partner   Yes   Yes   No    No    No    No    Yes      No
===============================================================================
*A:ALU-1>#
```

The following example displays LAG details with MC-LAG output

```
*A:ALU-1># show lag 2 detail
===============================================================================
LAG Details
===============================================================================
Description        : LAG2
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 2                     Mode                : access
Adm                 : up                    Opr                 : down
Thres. Exceeded Cnt : 0                     Port Threshold      : 1
Thres. Last Cleared : 08/19/2011 14:35:28    Threshold Action    : down
Dynamic Cost        : false                 Encap Type          : null
Configured Address  : 2001:db8::            Lag-IfIndex         : 1342177282
Hardware Address    : 2001:db8::52:0:1      Adapt Qos           : N/A
Hold-time Down      : 0.0 sec               Port Type           : standard
LACP                : enabled               Mode                : active
LACP Transmit Intvl : fast                  LACP xmit stdby     : enabled
Selection Criteria  : highest-count         Slave-to-partner    : disabled
Number of sub-groups: 2                     Forced              : -
System Id           : a4:58:ff:00:00:00     System Priority     : 32768
Admin Key           : 32769                 Oper Key            : 32769
Prtr System Id      :                       Prtr System Priority : 0
Prtr Oper Key       : 0

MC Peer Address     : 10.10.10.4            MC Peer Lag-id      : 1
MC System ID        : 11.11.11.11:11:11     MC System Priority  : 3
MC Admin Key        : 12                    MC Active/Standby   : active
MC Lacp ID in use   : true                  MC extended timeout : false
MC Selection Logic  : peer timed out, selected local subgroup
MC Config Mismatch  : no mismatch
-------------------------------------------------------------------------------
Port-id        Adm     Act/Stdby Opr     Primary   Sub-group     Forced  Prio
-------------------------------------------------------------------------------
1/4/3          up      active    down    yes       1             -       1
1/5/3          up      standby   down              2             -       2
-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
-------------------------------------------------------------------------------
1/4/3          actor     Yes   Yes   No    No    No    Yes   Yes      Yes
1/4/3          partner   Yes   Yes   No    No    No    No    Yes      No
1/5/3          actor     Yes   Yes   No    No    No    Yes   Yes      Yes
1/5/3          partner   Yes   Yes   No    No    No    No    Yes      No
===============================================================================
*A:ALU-1>#
```


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Table 124: LAG detailed field descriptions

Label	Description
Lag-id	The LAG identifier
Mode	The mode of the LAG: access or network
Adm	Up: the LAG is administratively up
	Down: the LAG is administratively down
Opr	Up: the LAG is operationally up
	Down: the LAG is operationally down
Thres. Exceeded Cnt	The number of times that the drop count was reached
Port Threshold	The number of operational links at or below which the LAG is regarded as operationally down
Thres. Last Cleared	The last time that keepalive statistics were cleared
Threshold Action	Action to take when the number of operational links is equal to or below the port threshold
Dynamic Cost	n/a
Encap Type	The encapsulation method used to distinguish customer traffic on a LAG
Configured Address	The base chassis Ethernet MAC address
Lag-IfIndex	A unique number assigned to this interface
Hardware Address	The hardware address
Adapt Qos	The configured QoS mode
Hold-time Down	The hold-time, in tenths of seconds, before a failure is reported to higher levels
Port Type	Standard: standard Ethernet port types are supported
LACP	Enabled: LACP is enabled
	Disabled: LACP is disabled
Mode	Active: LACP operates in active mode
	Passive: LACP operates in passive mode
Role	Actor: local device (7705 SAR) participating in LACP negotiation

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Label	Description
	Partner: remote device participating in LACP negotiation
LACP Transmit Intvl	LACP timeout signaled to peer
LACP xmit stdby	LACP transmit on standby links enabled or disabled
Selection Criteria	Configured subgroup selection criteria
Slave-to-partner	Slave-to-partner flag enabled or disabled
Number of sub-groups	Total subgroups in LAG
Forced	n/a
System Id	System ID used by actor in LACP messages
System Priority	System priority used by actor in LACP messages
Admin Key	Configured LAG key
Oper Key	Key used by actor in LACP messages
Prtr System Id	System ID used by partner in LACP messages
Prtr System Priority	System priority used by partner in LACP messages
Prtr Oper Key	Key used by partner in LACP messages
MC Peer Address	IP address of the MC-LAG peer
MC Peer Lag-id	The LAG identifier of the MC-LAG peer
MC System Id	System ID used by the MC-LAG actor in LACP messages
MC System Priority	System priority used by the MC-LAG actor in LACP messages
MC Admin Key	Configured MC-LAG key
MC Active/Standby	Indicates whether the port is in active or standby mode
MC Lacp ID in use	Indicates whether MC-LAG values such as system-id, system priority, and lacp-key are advertised to the LACP peer
MC extended timeout	Indicates whether the system is using a larger value than the value configured as the MC-LAG hold-on-neighbor-failure value
MC Selection Logic	The current state of the MC-LAG protocol, indicating which of the two MC-LAG redundancy systems is the master

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Label	Description
MC Config Mismatch	Indicates whether there is a LAG configuration mismatch between redundancy systems, and what is mismatched
Port-id	The member physical port ID expressed in *slot/mda/port* format
Adm	Up: the member port is administratively up
	Down: the member port is administratively down
Act/Stdby	Active: the member port is active
	Standby: the member port is on standby
Opr	Up: the member port is operationally up
	Down: the member port is operationally down
Primary	Indicates whether the member port is the primary port
Sub-group	The member port subgroup
Prio	The member port priority

Output example

```
*A:ALU-1># show lag 2 statistics
===============================================================================
LAG Statistics
===============================================================================
Description        : LAG2
Port-id   Input       Input       Output      Output      Input      Output
          Bytes       Packets     Bytes       Packets     Errors     Errors
-------------------------------------------------------------------------------
1/4/3     0           9968        0           9833        0          0
1/5/3     0           435         0           401         0          0
-------------------------------------------------------------------------------
Totals    0           10403       0           10234       0          0
===============================================================================
*A:ALU-1>#
```

Table 125: LAG statistics field descriptions

Label	Description
Port-id	The member physical port ID expressed in *slot/mda/port* format
Input Bytes	The number of inbound bytes for the LAG on a per-port basis
Input Packets	The number of inbound packets for the LAG on a per-port basis

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Label	Description
Output Bytes	The number of outbound bytes for the LAG on a per-port basis
Output Packets	The number of outbound packets for the LAG on a per-port basis
Input Errors	The number of inbound packets (for packet-oriented interfaces) or inbound transmission units (for character-oriented or fixed-length interfaces) that contained errors preventing them from being delivered to higher layers
Output Errors	The number of outbound packets (for packet-oriented interfaces) or outbound transmission units (for character-oriented or fixed-length interfaces) that could not be transmitted because of errors

Output example

```
*A:ALU-1># show lag 1 associations
===============================================================================
Interface Table
===============================================================================
Router/ServiceId                Name                            Encap Val
-------------------------------------------------------------------------------
Router: Base                    ies-337-30.30.30.1              104
-------------------------------------------------------------------------------
Interfaces
===============================================================================
*A:ALU-1>#
```

Table 126: LAG associations field descriptions

Label	Description
Router/ServiceId	The service associated with the LAG
Name	The name of the IP interface
Encap Val	The dot1q or qinq values of the port for the IP interface

Output example

```
A:7705:Dut-A# show lag 2 bfd
===============================================================================
LAG BFD
===============================================================================
Disable soft reset extension: false
===============================================================================

===============================================================================
LAG BFD IP address families
===============================================================================
ipv4
-------------------------------------------------------------------------------
```


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```
Administrative state        : enabled
Local IP address            : 12.1.2.2
Remote IP address           : 12.1.2.1
Transmit interval (ms)      : 100
Receive interval (ms)       : 100
Multiplier                  : 3
Max admin down time (s)     : 0
Max set-up time (ms)        : infinite
BFD on distributing         : false
Last management change      : 03/16/2022 11:34:25
===============================================================================

===============================================================================
LAG 2 member ports BFD
===============================================================================
Port                        State           Session    Remaining     Remaining
                                                       admin-down(s) set-up(ms)
-------------------------------------------------------------------------------
1/1/4                       up              up         0             0
1/1/19                      up              up         0             0
===============================================================================
A:7705:Dut-A#
```

Table 127: LAG BFD field descriptions

Label	Description
Disable soft reset extension	Displays whether the disable soft reset extension function is enabled (true) or disabled (false) (not applicable for the 7705 SAR)
LAG BFD IP address families	
ipv4	
Administrative state	The administrative state of the micro-BFD session, either enabled or disabled
Local IP address	The IPv4 address of the BFD source
Remote IP address	The IPv4 address of the BFD destination
Transmit interval (ms)	The transmit interval time used for micro-BFD sessions over the associated LAG links, in milliseconds
Receive interval (ms)	The receive interval time used for micro-BFD sessions over the associated LAG links, in milliseconds
Multiplier	The detect multiplier used for a micro-BFD session over the associated LAG links
Max admin down time (s)	The maximum length of time, in seconds, that the router continues to forward traffic over a link after the micro-BFD session has transitioned to a down state
Max set-up time (ms)	The maximum length of time, in milliseconds, that the router forwards traffic over a link that has transitioned

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Label	Description
	from standby to active before the micro-BFD session is fully established (up state)
BFD on distributing	Displays whether the **bfd-on-distributing-only** function is enabled (true) or disabled (false)
Last management change	The date and time of the last management change
LAG *x* member ports BFD	
Port	The LAG BFD member port
State	The administrative state of the LAG BFD member port, either up or down
Session	The administrative state of the micro-BFD session, either up or down
Remaining admin-down (s)	The **max-admin-down-time** remaining, in seconds, that the router continues to forward traffic over a link after the micro-BFD session has transitioned to a down state
Remaining set-up (ms)	The **max-setup-time** remaining, in milliseconds, that the router forwards traffic over a link that has transitioned from standby to active before the micro-BFD session is fully established (up state)

Output example

```
*A:ALU-1># show lag description
===============================================================================
Lag Port States
LACP Status: e - Enabled, d - Disabled
===============================================================================
Lag-id Port-id   Adm   Act/Stdby Opr   Description
-------------------------------------------------------------------------------
1(e)             up              down  N/A
       1/1/7     up    standby   down  10/100/Gig Ethernet SFP
       1/6/1     up    active    down  10/100/Gig Ethernet SFP
2(e)             up              down  N/A
       1/6/3     up    active    down  10/100/Gig Ethernet SFP
       1/7/3     up    standby   down  10/100/Gig Ethernet SFP
===============================================================================
*A:ALU-1>#
```

Table 128: LAG description field descriptions

Label	Description
Lag Port States	
LACP Status	Indicates whether LACP is enabled or disabled

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Label	Description
Lag-id	The LAG identifier and LACP status code
Port-id	The member physical port ID
Adm	Indicates the administrative state of the member port: up or down
Act/Stdby	Indicates whether the port is in active or standby mode
Opr	Indicates the operational state of the member port: up or down
Description	The description strings configured for the LAG and member ports

Output example

```
*A:ALU-1># show lag 1 lacp-partner
===============================================================================
LAG Partner information
===============================================================================
Partner system ID           : ea:3e:ff:00:00:00
Partner system priority     : 32768
Partner operational key     : 2
===============================================================================
===============================================================================
LAG 1 Ports Partner operational information
===============================================================================
Port                        Actor Port  Prio  Key
                            port
-------------------------------------------------------------------------------
1/1/7                       33863 33864 5     2
1/6/1                       34177 34178 7     2
===============================================================================
===============================================================================
LAG 1 Ports Partner operational state information
===============================================================================
Port                        Exp  Def  Dist Col  Syn  Aggr Time Act
                                                       out
-------------------------------------------------------------------------------
1/1/7                       No   No   Yes  Yes  Yes  Yes  Yes  Yes
1/6/1                       No   No   Yes  Yes  Yes  Yes  Yes  Yes
===============================================================================
*A:ALU-1>#
```

Table 129: LAG LACP partner field descriptions

Label	Description
LAG Partner information	
Partner system ID	The system ID of the partner (remote device)
Partner system priority	The system priority used by the partner in LACP messages

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Label	Description
Partner operational key	The key used by the partner in LACP messages
LAG 1 Ports Partner operational information	
Port	The member physical port ID
Actor port	The actor (local device) port associated with the member port
Port	The partner port associated with the member port
Prio	The partner port priority associated with the member port
Key	The partner operational key associated with the member port
LAG 1 Ports Partner operational state information	
Port	The member physical port ID
Exp	(Expired) – indicates whether the partner is in the Expired state; if Yes, the LAG is not operational
Def	(Default) – indicates whether the partner information (system priority, key, port priority, and state of the partner) is the default information that is configured administratively or is information received through LACPDUs. Default partner information is used if LACPDUs were not received on time.
Dist	(Distributing) – indicates whether the distribution of outgoing frames is enabled or disabled on the link
Col	(Collecting) – indicates whether the collection of incoming frames is enabled or disabled on the link
Syn	(Synchronization) – indicates whether the link is allocated to the correct LAG
Aggr	(Aggregation) – indicates whether link aggregation is enabled or disabled on the port
Time out	Indicates whether a timeout value is set for the port
Act	(Activity) – indicates whether the link is active (port can send and receive LACPDU messages) or passive (port does not initiate LACP messages but will respond to LACP messages)

Output example

```
*A:ALU-1># show lag 1 detail lacp-partner
===============================================================================
```


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```
LAG Partner information
===============================================================================
Partner system ID           : de:41:ff:00:00:00
Partner system priority     : 32768
Partner operational key     : 32768
===============================================================================
-------------------------------------------------------------------------------
LAG port 1/1/7 partner information
-------------------------------------------------------------------------------
Actor port                  : 33863
Partner admin system prio   : 32768
Partner oper system prio    : 32768
Partner admin system ID     : 00:00:00:00:00:00
Partner oper system ID      : de:41:ff:00:00:00
Partner admin key           : 0
Partner oper key            : 32768
Partner admin port          : (Not Specified)
Partner oper port           : 33864
Partner admin port prio     : 32768
Partner oper port prio      : 32768
Partner admin state         : (Not Specified)
Partner oper state          : lacp-timeout, aggregation synchronization
                              collecting distributing
-------------------------------------------------------------------------------
LAG port 1/6/1 partner information
-------------------------------------------------------------------------------
Actor port                  : 34177
Partner admin system prio   : 32768
Partner oper system prio    : 32768
Partner admin system ID     : 00:00:00:00:00:00
Partner oper system ID      : de:41:ff:00:00:00
Partner admin key           : 0
Partner oper key            : 32768
Partner admin port          : (Not Specified)
Partner oper port           : 34178
Partner admin port prio     : 32768
Partner oper port prio      : 32768
Partner admin state         : (Not Specified)
Partner oper state          : lacp-timeout, aggregation synchronization
                              collecting distributing
-------------------------------------------------------------------------------
*A:ALU-1>#
```

Table 130: LAG detailed LACP partner field descriptions

Label	Description
LAG Partner information	
Partner system ID	The system ID of the partner (remote device)
Partner system priority	The system priority used by the partner in LACP messages
Partner operational key	The key used by the partner in LACP messages
LAG port *port-id* **partner information**	
Actor port	The actor (local device) port associated with the member port

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Label	Description
Partner admin system prio	The partner administrative system priority associated with the member port
Partner oper system prio	The partner operational system priority associated with the member port
Partner admin system ID	The partner administrative system ID associated with the member port
Partner oper system ID	The partner operational system ID associated with the member port
Partner admin key	The partner administrative key associated with the member port
Partner oper key	The partner operational key associated with the member port
Partner admin port	The partner administrative port associated with the member port
Partner oper port	The partner operational port associated with the member port
Partner admin port prio	The partner administrative port priority associated with the member port
Partner oper port prio	The partner operational port priority associated with the member port
Partner admin state	The administrative state of the partner
Partner oper state	The operational state of the partner

Output example

```
*A:ALU-1># show lag 1 port
===============================================================================
Lag Port States
LACP Status: e - Enabled, d - Disabled
===============================================================================
Lag-id Port-id   Adm   Act/Stdby Opr   Primary  Sub-group     Forced  Priority
-------------------------------------------------------------------------------
1(e)   1/1/7     up    standby   down  yes      2             -       32768
       1/6/1     up    active    down           1             -       32768
===============================================================================
*A:ALU-1>#
```

Table 131: LAG port field descriptions

Label	Description
Lag Port States	

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Label	Description
LACP status	Indicates whether LACP is enabled or disabled
Lag-id	The LAG identifier and LACP status code
Port-id	The member physical port ID
Adm	Indicates the administrative state of the member port: up or down
Act/Stdby	Indicates whether the member port is in active or standby mode
Opr	Indicates the operational state of the member port: up or down
Primary	Indicates whether the member port is the primary port
Sub-group	The member port sub-group
Forced	n/a
Priority	The member port priority

3.15.2.1.10 Show MACsec commands

connectivity-association

Syntax

connectivity-association [*ca-name*] [**detail**]

connectivity-association [**detail**] **type** {**anysec** | **macsec**}

Context

show>macsec

Description

This command displays MACsec or ANYsec connectivity association (CA) information.

Parameters

ca-name

displays MACsec or ANYsec information for the specified CA name, up to 256 characters

detail

displays detailed information about the CA

anysec

displays information about ANYsec CAs only

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macsec

displays information about MACsec CAs only

Output

The following outputs are examples of MACsec and ANYsec CA information, and Table 132: CA field descriptions describes the fields.

Output example

```
A:Dut-C# show macsec connectivity-association
===============================================================================
ca-name            : dut_B_C_128_01
ca-name            : dut_B_C_256_01
ca-name            : dut_B_C_128_xpn_01
ca-name            : dut_B_C_256_xpn_01
ca-name            : to_Juniper_1_1_2__1
ca-name            : abcdefghijklmnoprstuvxyz@!
===============================================================================
```

Output example

```
A:Dut-C# show macsec connectivity-association "abcdefghijklmnoprstuvxyz@!"
===============================================================================
Connectivity Association "abcdefghijklmnoprstuvxyz@!"
===============================================================================
Admin State        : Up
Description        : MACsec test
Delay Protection   : Disabled
Replay Protection  : Disabled
Replay Window Size : 0
Macsec Encrypt     : Enabled
Clear Tag Mode     : dual-tag
Cipher Suite       : gcm-aes-256
Encryption Offset  : 30
Assigned ports     : 2/1/9 2/1/10
-------------------------------------------------------------------------------
Static Cak
-------------------------------------------------------------------------------
MKA Key Server Priority      : 16
Hello Interval               : 2
Active Pre-Shared-Key Index  : 1
Active Pre-Shared-Key CKN    : aabbccddeeff00112233445566778899
Encryption Type              : aes-128-cmac
Primary Keychain             : abc
===============================================================================
```

Output example

```
*A:7705:Dut-C# show macsec connectivity-association type anysec detail

===============================================================================
Connectivity Association "isisCA"
===============================================================================
Admin State        : Up
Description        : (Not Specified)
Cipher Suite       : gcm-aes-xpn-128
Encryption Offset  : 0
Encryption Group   : isisCA

-------------------------------------------------------------------------------
```


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```
Static Cak
-------------------------------------------------------------------------------
MKA Key Server Priority      : 16
Active Pre-Shared-Key Index  : 1
Hello Interval               : 5
Active Pre-Shared-Key CKN    : A111F111ABCDEF00
Encryption Type              : aes-128-cmac
===============================================================================

===============================================================================
Connectivity Association "ospfCA"
===============================================================================
Admin State        : Up
Description        : (Not Specified)
Cipher Suite       : gcm-aes-xpn-128
Encryption Offset  : 0
Encryption Group   : ospfCA

-------------------------------------------------------------------------------
Static Cak
-------------------------------------------------------------------------------
MKA Key Server Priority      : 16
Active Pre-Shared-Key Index  : 1
Hello Interval               : 5
Active Pre-Shared-Key CKN    : B111F111ABCDEF00
Encryption Type              : aes-128-cmac
===============================================================================
*A:7705:Dut-C#
```

Table 132: CA field descriptions

Label	Description
ca-name	The CA name
Admin State	The administrative state of the CA Up – the CA is administratively up Down – the CA is administratively down If MACsec is shut down on the Ethernet port, the admin state will be down. Otherwise, the admin state is up.
Description	The user-configured description for this CA
Replay Protection	Enabled – replay protection is enabled Disabled – replay protection is disabled
Replay Window Size	Number of packets set for the replay window
Macsec Encrypt	Enabled – MACsec is enabled Disabled – MACsec is disabled
Clear Tag Mode	The clear tag mode: single-tag or dual-tag
Cipher Suite	The cipher suite used for encrypting the SAK: gcm-aes-128, gcm-aes-256, gcm-aes-xpn-128, or gcm-aes-xpn-256

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Label	Description
Encryption Offset	The encryption offset configured on this node: 0, 30, or 50
Encryption Group	Specifies the encryption group for this CA
Assigned ports	Indicates all ports that contain this CA
Static Cak	
MKA Key Server Priority	The MKA key server priority: 0 to 255 (default 16)
Active Pre-Shared-Key Index	The active pre-shared key index: 1 or 2 (default 1)
Hello Interval	The MKA hello interval, in seconds
Active Pre-Shared Key-CKN	The active PSK CAK name
Encryption Type	The type of encryption for the SAK
Primary Keychain	The name of the MACsec primary keychain

mka-session

Syntax

mka-session [**port** *port-id*] [**sub-port** *sub-port*]

mka-session [**port** *port-id*] [**sub-port** *sub-port*] **detail**

mka-session [**port** *port-id*] [**sub-port** *sub-port*] **statistics**

Context

show>macsec

Description

This command displays MACsec MKA session information.

Parameters

port-id

specifies the port ID, up to 17 characters

sub-port

specifies the subport, from 1 to 1023 characters

detail

displays detailed MACsec MKA session information

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statistics

displays MACsec MKA session statistical information

Output

The following outputs are examples of MACsec MKA session information:

- MKA session information for a specified port (Output example, Table 133: MACsec MKA session port field descriptions)
- detailed MKA session information for a specified port (Output example, Table 134: MACsec MKA session port detail field descriptions)

Output example

```
A:Dut-C# show macsec mka-session port 1/1/3
===============================================================================
MKA Session for port 1/1/3: sub-port 1 encap untagged
===============================================================================
Security Zone      : 3
===============================================================================
===============================================================================
Live Peer List
===============================================================================
Member Identifier         Mesg Num  Rx-SCI            LPN               KS prio
-------------------------------------------------------------------------------
b2aa55156219f47c6fd99d968  10693     90ece38fa38a0001  1                  255
===============================================================================
===============================================================================
Potential Peer List
===============================================================================
Member Identifier         Mesg Num  Rx-SCI            LPN               KS prio
-------------------------------------------------------------------------------
===============================================================================
```

Table 133: MACsec MKA session port field descriptions

Label	Description
MKA Session for port	The MKA session information for the current port, including subport identifier and traffic encapsulation type
Security Zone	The security zone to which the port belongs
Live Peer List	The peers (participants) that have provided their MI and MN via the MKA
Member Identifier	The MI of the peer entry
Mesg Num	The latest message number of the peer entry
Rx-SCI	The Rx secure channel identifier for the peer
LPN	The received latest packet number
KS-prio	The key server priority for the peer

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Label	Description
Potential Peer List	All the peers (participants) that have transmitted an MKPDU that has been directly received by the participant or the peers that were included in the live peers list of an MKPDU transmitted by a peer that has proved liveness (an MKAPDU).

Output example

```
A:Dut-C# show macsec mka-session port 1/1/3  detail
===============================================================================
MKA Session for port 1/2/5: sub-port 1 encap untagged
===============================================================================
Security Zone      : 5
CA Name            : ca_03
CAK Name           : 11223344556677889900112233445523
CAK Type           : static-cak-keychain
MKA Oper State     : in-service
Oper Cipher Suite  : gcm-aes-xpn-128
Oper Encrypt Offset: 0
MKA Member ID      : 122af96a43a11151387e4c84
Transmit Interval  : 6000
Outbound SCI       : 90ece38fa3220001
MKA Encapsulation  : untagged
Message Number     : 960
Key Number         : 1
Key Server         : yes
Key Server Priority: 25
Latest SAK AN      : 0
Latest SAK KI      : 122af96a43a11151387e4c8400000001
Latest SAK LPN     : 1151614
Latest SAK Rx      : yes
Latest SAK Tx      : yes
Previous SAK AN    : 0
Previous SAK KI    : 00000000000000000000000000000000
Previous SAK LPN   : 0
Previous SAK Rx    : no
Previous SAK Tx    : no
Principal Actor    : yes
Encoding AN        : 0
===============================================================================

===============================================================================
Live Peer List
===============================================================================
Member Identifier         Mesg Num  Rx-SCI           LPN               KS prio
-------------------------------------------------------------------------------
2aa55156219f47c6fd99d968  10720     90ece38fa38a0001  1                 255
===============================================================================

===============================================================================
Potential Peer List
===============================================================================
Member Identifier         Mesg Num  Rx-SCI           LPN               KS prio
-------------------------------------------------------------------------------
===============================================================================

===============================================================================
MKA Session Statistics for port 1/1/3: subport 1
===============================================================================
Peer Removed Due to Timeout  : 0
```


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```
CKN Not Found                : 0
New Live peer                : 1
SAK Generated by Server      : 1
SAK Installed for TX         : 1
SAK Installed for RX         : 1
PDU Too Small                : 0
PDU Too Big                  : 0
PDU Not Quad Size            : 0
PDU Message Number Invalid   : 0
PDU Param Set Size Invalid   : 0
PDU Liveness Check Fail      : 0
Param Set Not Quad Size      : 0
Unsupported Agility          : 0
Invalid CAK Name Length      : 0
ICV Check Failed             : 0
Peer Using Same MID          : 0
SAK From Non-Live Peer       : 0
SAK From Non-Key Server      : 0
SAK Decrypt Fail             : 0
SAK Encrypt Fail             : 0
Key Number Invalid           : 0
SAK Installation Failed      : 0
CAK Info Missing             : 0
Max Peers Set as Zero        : 0
Invalid MKA Header           : 0
===============================================================================
```

Table 134: MACsec MKA session port detail field descriptions

Label	Description
MKA Session for port	The MKA session information for the current port, including subport identifier and traffic encapsulation type
Security Zone	The security zone to which the port belongs
CA Name	The name of the MACsec CA
CAK Name	The name of the CAK in use by this MKA
CAK Type	The type of the CAK in use by this MKA
MKA Oper State	The operational state of the MKA participants on this port. The operational MKA state is up if MKA hellos are received on this port and have a valid session.
Oper Cipher Suite	The operational encryption algorithm used for data path PDUs when all parties in the CA have the security association key (SAK). This value is specified by the key server: gcm-aes-128, gcm-aes-256, gcm-aes-xpn-128, or gcm-aes-xpn-256.
Oper Encrypt Offset	The operational encryption offset used for the data path PDUs when all parties in the CA have the SAK. This value is specified by the key server: 0, 30, or 50.
MKA Member ID	The member identifier (MI) for the MKA instance

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Label	Description
Transmit Interval	The time interval, in ms, at which the MKA broadcasts its liveness to its peers. This interval is non-configurable.
Outbound SCI	The secure channel identifier (SCI) information for transmitting MACsec frames. The SCI consists of the outgoing port MAC address and a port identifier.
MKA Encapsulation	The MKA encapsulation type
Message Number	The current count of MKA messages that are attached to MKA PDUs
Key Number	The number of the currently assigned CAK. When a new CAK is generated, this number is incremented. An SAK is identified by a 128-bit key identifier (KI) and a 32-bit key number (KN).
Key Server	Indicates whether this server is the highest-priority server in the peer group: yes or no
Key Server Priority	The priority of the active key server: 0 to 255 (default 16)
Latest SAK AN	The association number (AN) of the latest secure association key (SAK). This number is concatenated with an SCI to identify a secure association (SA). The 7705 SAR supports two SAKs.
Latest SAK KI	The key identifier (KI) of the latest SAK. This number is derived from the MI of the key server and the key number.
Latest SAK LPN	The transmitted latest packet number with the latest SAK
Latest SAK Rx	Indicates whether the latest SAK was received
Latest SAK Tx	Indicates whether the latest SAK was transmitted
Previous SAK AN	The AN of the previous SAK. This number is concatenated with an SCI to identify an SA.
Previous SAK KI	The KI of the previous SAK. This number is derived from the MI of the key server and the key number.
Previous SAK LPN	The transmitted latest packet number with the previous SAK
Previous SAK Rx	Indicates whether the previous SAK was received
Previous SAK Tx	Indicates whether the previous SAK was transmitted
Principal Actor	The MKA participant that is allowed to install and distribute the SAK
Encoding AN	The Association Number of the SAK that the principal actor is transmitting with
Live Peer List	

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Label	Description
Member Identifier	The MI of the live peer entry
Mesg Num	The latest message number of the live peer entry
Rx-SCI	The Rx secure channel identifier for the live peer entry
LPN	The received latest packet number for the live peer entry
KS prio	The key server priority for the live peer entry
Potential Peer List	
Member Identifier	The MI of the potential peer entry
Mesg Num	The latest message number of the potential peer entry
Rx-SCI	The Rx secure channel identifier for the potential peer entry
LPN	The received latest packet number for the potential peer entry
KS prio	The key server priority for the potential peer entry
MKA Session Statistics for port	
Peer Removed Due to Timeout	The number of peers removed from the live peers list or potential peers list as a result of not receiving an MKPDU within the MKA live time (6.0 s), which is not configurable
CKN Not Found	The number of MKPDUs received with a CKN that does not match the CA configured for the port
New Live peer	The number of validated peers that have been added to the live peers list
SAK Generated by Server	The number of SAKs generated by this MKA instance
SAK Installed for TX	The number of SAKs installed for transmitting
SAK Installed for RX	The number of SAKs installed for receiving
PDU Too Small	The number of MKPDUs received that are less than 32 octets
PDU Too Big	The number of MKPDUs received where the EAPOL header indicates a size larger than the received packet
PDU Not Quad Size	The number of MKPDUs received with a size that is not a multiple of 4 octets
PDU Message Number Invalid	The number of MKPDUs received out of order as indicated by the message number

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Label	Description
PDU Param Set Size Invalid	The number of MKPDUs received that contain a parameter set body length that exceeds the remaining length of the MKPDU
PDU Liveness Check Fail	The number of MKPDUs received that contain an MN that is not acceptably recent
Param Set Not Quad Size	The number of MKPDUs received that contain a parameter set that is not a multiple of 4 octets
Unsupported Agility	The number of MKPDUs received that contain an unsupported algorithm agility value
Invalid CAK Name Length	The number of MKPDUs received that contain a CAK name that exceeds the maximum CAK name length
ICV Check Failed	The number of MKPDUs received that contain an ICV value that does not authenticate
Peer Using Same MID	The number of MKPDUs received that contain a peers list with an MI entry that conflicts with the local MI
SAK From Non-Live Peer	The number of SAKs received from a peer that is not a member of the live peers list
SAK From Non-Key Server	The number of SAKs received from an MKA participant that has not been designated as the key server
SAK Decrypt Fail	The number of AES key wrap SAK decryption failures that have occurred
SAK Encrypt Fail	The number of AES key wrap SAK encryption failures that have occurred
Key Number Invalid	The number of SAKs received with an invalid key number
SAK Installation Failed	The number of SecY SAK installation failures that have occurred
CAK Info Missing	The number of times internal CAK data is not available for the generation of the SAK
Max Peers Set as Zero	The number of SecY SAK installations that have failed because the max peer entry is set to 0
Invalid MKA Header	The number of MKA packets with an invalid header

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3.15.2.1.11 Show multilink bundle and IMA group commands

multilink-bundle

Syntax

multilink-bundle [*bundle-id* | *slot/mda* | **type** {**mlppp** | **ima-grp**}] [**detail**]

multilink-bundle [{*bundle-id* | *slot/mda*} | [**ppp** [**multiclass**] | **ima**]]

Context

show

Description

This command displays multilink bundle information. An operator can display:

- all bundles on the system/adapter card or all bundles of a given type on the system by specifying the value of type filter to be either mlppp or ima-grp
- bundle-specific information in summary (no detail option) or detailed format (detail option specified) for one or more bundles
- protocol-specific information (for example, PPP or IMA) for the specified bundle

Parameters

bundle-id

the multilink (PPP or IMA) bundle identifier. The command syntax must be used as follows:

Syntax: bundle-*type-slot/mda.bundle-num*

bundle-ppp-slot/mda.bundle-num (a multilink PPP bundle)

bundle-ima-slot/mda.bundle-num (an IMA group bundle)

bundle: keyword

slot: MDA slot numbers

bundle-num: 1 to 32

ppp

displays PPP bundle information

ppp multiclass

displays multiclass MLPPP information

ima, ima-grp

displays IMA-type groups

mlppp

displays MLPPP-type groups

detail

provides detailed information

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Output

The following outputs are examples of multilink bundle information:

- Multilink bundle (Output example, Table 135: Multilink bundle field descriptions)
- Multilink bundle IMA group (Output example, Table 136: Multilink bundle IMA group field descriptions)
- Multilink bundle IMA group detailed (Output example, Table 137: Multilink bundle IMA group detailed field descriptions)
- Multilink bundle MLPPP (Output example, Table 138: Multilink bundle MLPPP field descriptions)
- Multilink bundle multiclass (Output example, Table 138: Multilink bundle MLPPP field descriptions)
- Multilink bundle MLPPP detailed (Output example, Table 139: Multilink bundle MLPPP detailed field descriptions)

Output example

```
*A:ALU-1># show multilink-bundle
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ppp-1/1.1     mlppp   Down      Down      Ghost     1      0/0
bundle-ppp-1/4.8     mlppp   Up        Down      Ghost     1      0/0
bundle-ima-1/6.3     ima-grp Down      Down      Ghost     1      0/0
-------------------------------------------------------------------------------
Bundles : 3
===============================================================================
*A:ALU-1>
```

Table 135: Multilink bundle field descriptions

Label	Description
Bundle Id	The port ID for this bundle
Type	The type of this multilink bundle: mlppp: the bundle is of type MLPPP ima: the bundle is of type IMA group
Admin State	Up: the bundle is administratively up
	Down: the bundle is administratively down
Oper State	Up: the bundle is operationally up
	Down: the bundle is operationally down
Port State	The state level of the port: none: the port is either in its initial creation state or is just about to be deleted

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Label	Description
	ghost: no member links are configured as part of this bundle
	down: all member links are in "none", "ghost", or "down" state
	linkUp: at least one member link is in port state "link up" but the bundle protocol is not yet operationally up (due to the bundle protocol still coming up; for example, due to insufficient number of member links in "link up" state yet or to bundle being shut down)
	Up: the bundle is ready to pass some kinds of traffic as the bundle protocol has come up (at least "minimum links" member links are in the port state up and the bundle protocol is up)
Min Links	The minimum number of links that must be active for a bundle to be active. If the number of links drop below the given minimum, then the multilink bundle will transition to an operation down state.
Total Links	The total number active of member links configured for this bundle
Active Links	The total number of active links for the bundle

Output example

```
*A:ALU-1># show multilink-bundle type ima-grp
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ima-1/6.3     ima-grp Down      Down      Ghost     1      0/0
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
*A:ALU-1>#
*A:ALU-1># show multilink-bundle bundle-ima-1/6.3
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ima-1/6.3     ima-grp Down      Down      Ghost     1      0/0
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
*A:ALU-1>
```


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Note: The **ima-grp** command shows all bundles in the IMA group. The **bundle-ima** command shows information about the specified bundle. The fields for both commands are the same.

Table 136: Multilink bundle IMA group field descriptions

Label	Description
Bundle Id	The port ID for this bundle
Type	The type of this multilink bundle: ima: the bundle is of type IMA group
Admin State	Up: the bundle is administratively up
	Down: the bundle is administratively down
Oper State	Up: the bundle is operationally up
	Down: the bundle is operationally down
Port State	The state level of the port: none: the port is either in its initial creation state or is just about to be deleted
	ghost: no member links are configured as part of this bundle
	down: all member links are in "none", "ghost", or "down" state
	linkUp: at least one member link is in port state "link up" but the bundle protocol is not yet operationally up (due to the bundle protocol still coming up; for example, due to insufficient number of member links in "link up" state yet or to bundle being shut down)
	Up: the bundle is ready to pass some kinds of traffic as the bundle protocol has come up (at least "minimum links" member links are in the port state up and the bundle protocol is up)
Min Links	The minimum number of links that must be active for a bundle to be active. If the number of links drop below the given minimum, then the multilink bundle will transition to an operation down state.
Total Links	The total number active of member links configured for this bundle
Active Links	The total number of active links for the bundle
Bundles	The number of bundles on the port

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Output example

```
*A:ALU-1># show multilink-bundle type ima-grp detail
===============================================================================
Bundle bundle-ima-1/6.3 Detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-ima-1/6.3   Type               : ima-grp
Admin Status       : down               Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 583012355
Total Links        : 0                  Active Links       : 0
Red Diff Delay     : 25                 Yellow Diff Delay  : N/A
Red Diff Delay Act : down               MRRU               : N/A
Short Sequence     : N/A                Oper MRRU          : N/A
Oper MTU           : 1524               Fragment Threshold : 128 bytes
Up Time            : N/A                Bandwidth          : 0 KBit
PPP Input Discards : N/A                Primary Member Port: None
Mode               : access
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                     0
Multicast Packets                                       0                     0
Broadcast Packets                                       0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
*A:ALU-1>
*A:ALU-1># show multilink-bundle bundle-ima-1/6.3 detail
===============================================================================
Bundle bundle-ima-1/6.3 Detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-ima-1/6.3   Type               : ima-grp
Admin Status       : down               Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 583012355
Total Links        : 0                  Active Links       : 0
Red Diff Delay     : 25                 Yellow Diff Delay  : N/A
Red Diff Delay Act : down               MRRU               : N/A
Short Sequence     : N/A                Oper MRRU          : N/A
Oper MTU           : 1524               Fragment Threshold : 128 bytes
Up Time            : N/A                Bandwidth          : 0 KBit
PPP Input Discards : N/A                Primary Member Port: None
Mode               : access
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0
===============================================================================
Port Statistics
```


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```
===============================================================================
                                                 Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                      0                      0
Multicast Packets                                    0                      0
Broadcast Packets                                    0                      0
Discards                                             0                      0
Unknown Proto Discards                               0
===============================================================================
*A:ALU-1>
```

Note: The **ima-grp detail** command shows all bundles in the IMA group. The **bundle-ima detail** command shows information about the specified bundle. The fields for both commands are the same.

Table 137: Multilink bundle IMA group detailed field descriptions

Label	Description
Description	The configured description for this bundle
Bundle Id	The port ID for this bundle
Admin Status	Up: the bundle is administratively up
	Down: the bundle is administratively down
Minimum Links	The minimum number of links that must be active for a bundle to be active. If the number of links drop below the given minimum, then the multilink bundle will transition to an operation down state.
Total Links	The total number of active member links configured for this bundle
Red Diff Delay	The maximum acceptable differential delay for individual circuits within this multilink bundle. If the delay exceeds this threshold, a trap is issued.
Red Diff Delay Act	The action that will be taken on the IMA group once the Red Diff Delay is exceeded
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel, specified in octets
Mode	network: the port is configured for transport network use
	access: the port is configured for service access
Type	Indicates that this bundle is of type IMA group
Oper Status	The operational port status of a member link
Bundle IfIndex	The bundle's interface index number, which reflects its initialization sequence

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Label	Description
Active Links	The total number of active links for the bundle
Bandwidth	The bandwidth configured for this IMA group bundle in kb/s
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Unicast packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent.

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Label	Description
Broadcast packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/ Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts.

Output example

```
*A:ALU-1># show multilink-bundle type mlppp
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ppp-1/1.1     mlppp   Down      Down      Ghost     1      0/0
bundle-ppp-1/4.8     mlppp   Up        Down      Ghost     1      0/0
-------------------------------------------------------------------------------
Bundles : 2
===============================================================================
*A:ALU-1>#

*A:ALU-1># show multilink-bundle bundle-ppp-1/4.8
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ppp-1/4.8     mlppp   Up        Down      Ghost     1      0/0
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
*A:ALU-1>#

A:ALU-1# show multilink-bundle bundle-ppp-1/1.13 ppp multiclass
===============================================================================
MLPPP Per Class Traffic Statistics for bundle-ppp-1/1.13
===============================================================================
                                                  Input                Output
```


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```
-------------------------------------------------------------------------------
Class  0
  Octets                                    2993101300            2993220860
  Packets                                      3054185               3054307
  Errors                                             0                     0
Class  1
  Octets                                    2987258540            2993219880
  Packets                                      3048223               3054306
  Errors                                             0                     0
Class  2
  Octets                                    2987255600            2993220860
  Packets                                      3048220               3054307
  Errors                                             0                     0
Class  3
  Octets                                    2987257560            2993220860
  Packets                                      3048222               3054307
  Errors                                             0                     0
===============================================================================
```

Note: The **mlppp** command shows all bundles in the MLPPP group. The **bundle-ppp** command shows information about the specified bundle. The fields for both commands are the same.

Table 138: Multilink bundle MLPPP field descriptions

Label	Description
Bundle Id	The port ID for this bundle
Type	The type of this multilink bundle: mlppp: the bundle is of type MLPPP
Admin State	Up: the bundle is administratively up
	Down: the bundle is administratively down
Oper State	Up: the bundle is operationally up
	Down: the bundle is operationally down
Port State	The state level of the port: none: the port is either in its initial creation state or is just about to be deleted
	ghost: no member links are configured as part of this bundle
	down: all member links are in the "none", "ghost", or "down" state
	linkUp: at least one member link is in the port state "link up" but the bundle protocol is not yet operationally up (due to the bundle protocol still coming up; for example, due to an insufficient number of member links in the "link up" state or to the bundle being shut down)
	Up: the bundle is ready to pass some kinds of traffic as the bundle protocol has come up (at least "minimum links" member links are in the port state up and the bundle protocol is up)

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Label	Description
Min Links	The minimum number of links that must be active for a bundle to be active. If the number of links drops below the given minimum, then the multilink bundle will transition to an operation down state.
Total Links	The total number of active member links configured for this bundle
Active Links	The total number of active links for the bundle
Bundles	Number of bundles on the port
Class	The MC-MLPPP service class
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The total number of packets received and transmitted on the port
Errors Input/Output	The number of packets that contained errors preventing them from being deliverable

Output example

```
*A:ALU-1># show multilink-bundle type mlppp detail
===============================================================================
Bundle bundle-ppp-1/1.1 Detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-ppp-1/1.1   Type               : mlppp
Admin Status       : down               Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 572522497
Total Links        : 0                  Active Links       : 0
Red Diff Delay     : 0                  Yellow Diff Delay  : 0
Red Diff Delay Act : none               MRRU               : 1524
Short Sequence     : false              Oper MRRU          : 1524
Oper MTU           : 1526               Fragment Threshold : 128 bytes
Up Time            : N/A                Bandwidth          : 0 KBit
PPP Input Discards : 0                  Primary Member Port: None
Mode               : network            Net. Egr. Queue Pol:
===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Octets                                               0                     0
Packets                                              0                     0
Errors                                               0                     0
===============================================================================
Port Statistics
===============================================================================
                                                  Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                      0                     0
Multicast Packets                                    0                     0
Broadcast Packets                                    0                     0
Discards                                             0                     0
Unknown Proto Discards                               0
```


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```
===============================================================================

*A:ALU-1># show multilink-bundle bundle-ppp-1/4.8 detail
===============================================================================
Bundle bundle-ppp-1/4.8 Detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-ppp-1/4.8   Type               : mlppp
Admin Status       : up                 Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 578813960
Total Links        : 0                  Active Links       : 0
Red Diff Delay     : 0                  Yellow Diff Delay  : 0
Red Diff Delay Act : none               MRRU               : 1524
Short Sequence     : false              Oper MRRU          : 1524
Oper MTU           : 1526               Fragment Threshold : 128 bytes
Up Time            : N/A                Bandwidth          : 0 KBit
PPP Input Discards : 0                  Primary Member Port: None
Mode               : network            Net. Egr. Queue Pol:
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                                0                      0
Errors                                                 0                      0
===============================================================================
Port Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                        0                      0
Multicast Packets                                      0                      0
Broadcast Packets                                      0                      0
Discards                                               0                      0
Unknown Proto Discards                                 0
===============================================================================
*A:ALU-1>#
```

Note: The **mlppp detail** command shows all bundles in the MLPPP group. The **bundle-ppp detail** command shows information about the specified bundle. The fields for both commands are the same.

Table 139: Multilink bundle MLPPP detailed field descriptions

Label	Description
Description	The configured description for this bundle
Bundle Id	The port ID for this bundle
Admin Status	Up: the bundle is administratively up
	Down: the bundle is administratively down
Minimum Links	The minimum number of links that must be active for a bundle to be active. If the number of links drop below the given minimum, then the multilink bundle will transition to an operation down state.

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Label	Description
Total Links	The total number of active member links configured for this bundle
Red Diff Delay	The maximum acceptable differential delay for individual circuits within this multilink bundle. If the delay exceeds this threshold, a trap is issued.
Red Diff Delay Act	The action that will be taken on the MLPPP bundle once the Red Diff Delay is exceeded
Short Sequence	Indicates whether the MLPPP bundle uses short (12 bit) sequence numbers instead of the default 24-bit sequence number
Oper MTU	The negotiated size of the largest packet that can be sent on the port or channel, specified in octets
Mode	network: the port is configured for transport network use
	access: the port is configured for service access
Type	The bundle type
Oper Status	The operational port status of a member link
Bundle IfIndex	The bundle's interface index number, which reflects its initialization sequence
Active Links	The total number of active links for the bundle
Yellow Diff Delay	The yellow warning threshold for the differential delay for members within a multilink bundle
MRRU	The configured maximum frame size that can be reconstructed from multilink fragments
Oper MRRU	The operating maximum frame size that can be reconstructed from multilink fragments
Bandwidth	The bandwidth configured for this MLPPP bundle in kb/s
Traffic and Port statistics	The traffic and port statistics information displayed for bundles when the detail option is selected is the same as information displayed for physical ports
Traffic Statistics	
Octets Input/Output	The total number of octets received and transmitted on the port
Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total

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Label	Description
	number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Port Statistics	
Unicast packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sublayer, including those that were discarded or not sent.
Broadcast packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub) layer, which were not addressed to a unicast or multicast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown proto discards Input/ Output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol

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Label	Description
	multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. Unknown proto discards do not show up in the packet counts.

3.15.2.1.12 Show ATM IMA group commands

multilink-bundle

Syntax

multilink-bundle *bundle-id* **ima atm** [**detail**]

multilink-bundle *bundle-id* **ima atm connections**

multilink-bundle *bundle-id* **ima atm pvc** [*vpi*/*vci*] [**detail**]

multilink-bundle *bundle-id* **ima atm pvp** [*vpi*] [**detail**]

Context

show

Description

This command displays ATM port information for IMA group bundles. The information displayed is equivalent to that displayed for the show port (atm) command.

Parameters

bundle-id

specifies the IMA port ID

atm

displays ATM information

connections

displays ATM connection information

pvc

displays ATM port PVC information

pvp

displays ATM port PVP information

vpi/vci

displays the VPI/VCI values

Values vpi: 0 to 4095 (NNI)

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0 to 255

vci: 1, 2, 5 to 65534

detail

provides detailed information

Output

The following outputs are examples of IMA ATM information:

- Multilink Bundle IMA ATM (Output example, Table 140: Multilink bundle IMA ATM field descriptions)
- Multilink Bundle IMA ATM Connections (Output example, Table 141: Multilink bundle IMA ATM connections field descriptions)
- Multilink Bundle IMA ATM PVC (Output example, Table 142: Multilink bundle IMA ATM PVC field descriptions)
- Multilink Bundle IMA ATM PVP (Output example, Table 143: Multilink bundle IMA ATM PVP field descriptions)

Output example

```
*A:ALU-1># show multilink-bundle bundle-ima-1/6.3 ima atm
===============================================================================
ATM Info for bundle-ima-1/6.3
===============================================================================
Cell Mode             : UNI               Mapping            : n/a
Configured VCs        : 0                 Configured VPs     : 0
Configured VTs        : 0                 Configured IFCs    : 0
Configured minimum VPI: 0
Last Unknown VPI/VCI  : none
===============================================================================
```

Table 140: Multilink bundle IMA ATM field descriptions

Label	Description
Cell Mode	The cell format (UNI or NNI) that is used on the ATM interface
Configured VCs	The number of configured VCs
Configured VTs	The number of configured VTs
Configured minimum VPI	The minimum VPI configured for this bundle
Last Unknown VPI/VCI	The last unknown VPI/VCI that was received on this interface
Configured VPs	The number of configured VPs

Output example

```
*A:ALU-1># show multilink-bundle bundle-ima-1/6.3 ima atm connections
===============================================================
ATM Connections, Port bundle-ima-1/6.3
```


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```
===============================================================
           Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
---------------------------------------------------------------
1/100      SAP    PVC      2       2       up   up          up
===============================================================
*A:ALU-1>#
```

Table 141: Multilink bundle IMA ATM connections field descriptions

Label	Description
Owner	The system entity that owns a specific ATM connection
Type	The type of connection
Ing.TD	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr.TD	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Adm	Up: the bundle is administratively up
	Down: the bundle is administratively down
OAM	The OAM operational status of ATM connections: Up: the interface is operationally up
	ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Opr	Up: the bundle is operationally up
	Down: the bundle is operationally down

Output example

```
*A:ALU-1># show multilink-bundle bundle-ima-1/6.3 ima atm pvc
===============================================================
ATM PVCs, Port bundle-ima-1/6.3
===============================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
---------------------------------------------------------------
1/100      SAP    PVC      2       2       up   up          up
===============================================================
*A:ALU-1>#

*A:ALU-1># show multilink-bundle bundle-ima-1/6.3 ima atm pvc detail
===============================================================
ATM PVCs, Port bundle-ima-1/6.3
===============================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
---------------------------------------------------------------
1/100      SAP    PVC      2       2       up   up          up
===============================================================================
ATM Statistics
===============================================================================
                                                 Input                 Output
```


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```
-------------------------------------------------------------------------------
Octets                                                0                     0
Cells                                                 0                     0
===============================================================================
===============================================================================
AAL-5 Packet Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Packets                                               0                     0
Dropped Packets                                       0                     0
CRC-32 Errors                                         0
Reassembly Timeouts                                   0
Over Sized SDUs                                       0
===============================================================================
===============================================================================
ATM OAM Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Loopback                                              0                     0
OAM Cells
(generated)                                           0
===============================================================================
*A:ALU-1>#
```

Table 142: Multilink bundle IMA ATM PVC field descriptions

Label	Description
VPI/VCI	The VPI/VCI value
Owner	The system entity that owns a specific ATM connection
Type	The type of connection
Ing.TD	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr.TD	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Adm	Up: the bundle is administratively up
	Down: the bundle is administratively down
OAM	The OAM operational status of ATM connections: Up: the interface is operationally up
	ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Opr	Up: the bundle is operationally up
	Down: the bundle is operationally down

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Output example

```
*A:ALU-1># show multilink-bundle bundle-ima-1/6.3 ima atm pvp
===============================================================
ATM PVPs, Port bundle-ima-1/6.3
===============================================================
VPI        Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
---------------------------------------------------------------
2          SAP    PVP      1       1       up   up          up
===============================================================
*A:ALU-1>#
```

Table 143: Multilink bundle IMA ATM PVP field descriptions

Label	Description
VPI	The VPI value
Owner	The system entity that owns a specific ATM connection
Type	The type of connection
Ing.TD	The ATM traffic descriptor profile that applies to the receive direction of the interface connection
Egr.TD	The ATM traffic descriptor profile that applies to the transmit direction of the interface connection
Adm	up: the bundle is administratively up
	down: the bundle is administratively down
OAM	The OAM operational status of ATM connections: Up: the interface is operationally up
	ETE-AIS: the endpoint is down and is generating end-to-end AIS OAM cells to alert the far end that it is down
Opr	up: the bundle is operationally up
	down: the bundle is operationally down

3.15.2.1.13 Show SCADA commands

scada

Syntax

scada [*bridge_id*] [**detail**]

scada [*bridge_id*] **description**

scada [*bridge_id*] [**detail**] **statistics**

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Context

show

Description

This command displays SCADA bridge information.

Parameters

detail

displays detailed information

bridge-id

specifies the bridge ID, in the format *slot/mda/bridge-id*, where *bridge-id* is 1 to 16

description

displays the descriptions that have been configured for each bridge

statistics

displays statistics information pertaining to bridges and branches

Output

The following outputs are examples of SCADA information:

- SCADA bridge detail (Output example, Table 144: SCADA bridge detail field descriptions)
- specific SCADA bridge detail (Output example, Table 145: Specific SCADA bridge detail field descriptions)

Output example

```
A:ALU-1>#  show scada detail
=======================================================
Scada Bridges on Slot 1
=======================================================
Bridge      Admin Link Bridge  Port Port Bridge Branch
Id          State      State   Mode Encp Type   Type
-------------------------------------------------------
1/8/1       Up    Yes  Up      accs cem  mddb   master
1/8/1.1     Up    Yes  Up      accs cem  mddb   master
1/8/1.2     Up    Yes  Up      accs cem  mddb   slave
1/8/1.3     Up    Yes  Up      accs cem  mddb   slave
1/8/1.4     Up    Yes  Up      accs cem  mddb   slave
1/8/1.5     Up    Yes  Up      accs cem  mddb   slave
1/8/2       Down  No   Down
1/8/3       Down  No   Down
1/8/4       Down  No   Down
1/8/5       Down  No   Down
1/8/6       Down  No   Down
1/8/6.5     Down  No   Down    accs cem  mddb   slave
1/8/7       Down  No   Down
1/8/8       Down  No   Down
1/8/8.4     Down  No   Down    accs cem  mddb   slave
1/8/8.5     Down  No   Down    accs cem  mddb   slave
1/8/8.6     Down  No   Down    accs cem  mddb   slave
1/8/9       Down  No   Down
1/8/10      Down  No   Down
1/8/10.10   Down  No   Down    accs cem  mddb   slave
1/8/11      Down  No   Down
1/8/11.11   Down  No   Down    accs cem  mddb   slave
```


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```
1/8/11.22   Down  No   Down    accs cem  mddb   slave
1/8/12      Down  No   Down
1/8/13      Down  No   Down
1/8/14      Down  No   Down
1/8/14.14   Down  No   Down    accs cem  mddb   slave
1/8/15      Down  No   Down
1/8/16      Down  No   Down
1/8/16.32   Down  No   Down    accs cem  mddb   slave
===============================================
```

Table 144: SCADA bridge detail field descriptions

Label	Description
Scada Bridges on Slot 1	
Bridge Id	The bridge/branch ID (the bridge ID is in the format *slot/mda/bridge-id*, where *bridge-id* is 1 to 16; the branch ID is in the format *slot/mda/bridge-id.branch-id*, where *branch-id* is 1 to 32)
Admin State	The administrative state of the bridge, either Up or Down
Link	Indicates whether there is an active link on the bridge, either Yes or No
Bridge State	The operational state of the bridge, either Up or Down
Port Mode	The operational mode of the bridge (always accs – access)
Port Encp	The encapsulation type of the bridge (always cem – circuit emulation)
Bridge Type	The bridge type: mddb, pcm, or vcb
Branch Type	The type of device connected to the bridge, either master or slave (for MDDB and PCM applications) or N/A (for the VCB application)

Output example

```
A:ALU-1># show scada 1/8/14 detail
===============================================================================
Scada Info
===============================================================================
Description      : SCADA bridge 14
Bridge Id        : 1/8/14                Type             : Mddb
Admin Status     : down                  Oper Status      : down
Squelch          : enabled               Squelch Timeout  : 120(s)
Squelch Recovery : manual                Recovery Timeout : N/A
Squelch Status   : 0x0                   Force-active     : 1
Redundant Mode   : manual
Report Alarms    : hcmOof hcmRai         Speed            : 2400
===============================================================================
Bridge Members
-------------------------------------------------------------------------------
```


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```
Identifier      Multidrop   AdminState  OperState   AlarmStatus       Squelched
-------------------------------------------------------------------------------
1/8/14.14       slave       up          down                          N
===============================================================================
Scada Bridge Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Packets                                               0                      0
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================
```

Table 145: Specific SCADA bridge detail field descriptions

Label	Description
Scada Info	
Description	The description configured for the bridge
Bridge Id	The bridge ID in the format *slot/mda/bridge-id*, where *bridge-id* is 1 to 16
Type	The bridge type: Mddb, pcm, or vcb
Admin Status	The administrative state of the bridge, either up or down
Oper Status	The operational state of the bridge, either up or down
Squelch	Indicates whether the squelch function has been enabled (applies only to MDDB and PCM)
Squelch Timeout	The configured squelch timeout (applies only to MDDB and PCM)
Squelch Recovery	The squelch recovery mode: manual or auto (applies only to MDDB and PCM)
Recovery Timeout	The configured time after which the branch will automatically be put back in the normal state (applies only to MDDB and PCM) Applicable only if recovery mode is auto; if recovery mode is manual, the field displays N/A
Squelch Status	The bitmap (32 bits) of the branches that are squelched (applies only to MDDB and PCM). A value of 0x0 means that no branch is squelched.
Force-active	The master branch (1 or 2) to which the **force-active** command has been applied (applies only to MDDB and PCM)
Redundant Mode	The redundancy mode for the master inputs: manual or auto (applies only to MDDB and PCM)

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Label	Description
Report Alarms	The configured type of alarms to be reported to the bridge (applies only to MDDB)
Speed	The configured speed of the bridge (applies only to MDDB)
Bridge Members	
Identifier	The branch ID in the format *bridge-id.branch-id*, where *bridge-id* is 1 to 16 and *branch-id* is 1 to 32
Multidrop	The type of device connected to the bridge, either master or slave (applies only to MDDB and PCM)
AdminState	The administrative state of the branch, either up or down
OperState	The operational state of the branch, either up or down
AlarmStatus	The current alarm state of the branch
Squelched	Indicates whether the squelch function has been enabled
Scada Bridge Statistics	
Packets Input/Output	The total number of packets that were delivered by this sublayer to a higher (sub) layer and that were not addressed to a multicast or broadcast address at this sublayer The total number of packets that higher-level protocols requested to be transmitted and that were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent
Discards Input/Output	The number of inbound/outbound packets chosen to be discarded to possibly free up buffer space
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received at the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received at the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.

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3.15.2.2 Monitor commands

fabric-profile

Syntax

fabric-profile mda {*mda-id* | **with-stats-enabled**} {**dest-mda** | **source-mda**} [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Context

monitor

Description

This command enables monitoring of adapter card fabric profile statistics. The specified adapter card statistical information displays and automatically refreshes at the configured interval.

Parameters

mda-id

the slot number of the adapter card

with-stats-enabled

if used, this keyword replaces the *mda-id* parameter, in which case the adapter card that has fabric-stats-enabled configured will be the one that is monitored, that is, the command will be **monitor fabric-profile mda with-stats-enabled dest-mda** | **source-mda**. If there are no adapter cards that have fabric-stats-enabled configured, no statistics will be displayed.

dest-mda

displays network and access ingress statistics for all adapter cards going toward the fabric and destined for the specific destination adapter card. The following are also displayed: global fabric statistics, fabric firewall statistics, and the fabric port statistics if the destination adapter card has the collection of fabric statistics enabled. The sum of traffic forwarded or dropped is also displayed.

source-mda

displays network and access ingress traffic statistics from the specified adapter card going toward the fabric and toward a destination adapter card. Fabric firewall statistics and the sum of traffic forwarded or dropped are also displayed.

seconds

specifies the interval for each display in seconds

Values 3 to 60

Default 10

repeat

specifies how many times the command is repeated

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Values 1 to 999

Default 10

absolute

the raw statistics are displayed without processing. No calculations are performed on the delta or rate statistics.

rate

the rate per second for each statistic is displayed instead of the delta

lag

Syntax

lag *lag-id* [*lag-id*...(up to 5 max)] [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Context

monitor

Description

This command enables monitoring of traffic statistics for link aggregation group (LAG) ports. Statistical information for the specified LAG is shown at the configured interval until the configured count is reached.

The first screen displays the current statistics related to the specified LAG. The subsequent statistical information listed for each interval is displayed as a delta to the previous screen. When the keyword **rate** is specified, the rate per second for each statistic is displayed instead of the delta.

Monitor commands are similar to **show** commands but only statistical information is shown. Monitor commands display the selected statistics according to the configured number of times at the interval specified.

Parameters

lag-id

the LAG ID

Values 1 to 32

seconds

specifies the interval for each display in seconds

Values 3 to 60

Default 10

repeat

specifies how many times the command is repeated

Values 1 to 999

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Default 10

absolute

the raw statistics are displayed without processing. No calculations are performed on the delta or rate statistics.

rate

the rate per second for each statistic is displayed instead of the delta

Output

The following output is an example of LAG monitoring statistics.

Output example

```
A:Dut-B# monitor lag 1 interval 3 repeat 1
===============================================================================
Monitor statistics for LAG ID 1
===============================================================================
Port-id      Input packets                    Output packets
             Input bytes                      Output bytes
             Input errors [Input util %]      Output errors [Output util %]
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
1/2/1        24                               25
             2224                             2294
             0                                0
1/2/2        25                               8
             2170                             776
             0                                0
-------------------------------------------------------------------------------
Totals       49                               33
             4394                             3070
             0                                0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Delta)
-------------------------------------------------------------------------------
1/2/1        3                                3
             306                              306
             0                                0
1/2/2        0                                0
             0                                0
             0                                0
-------------------------------------------------------------------------------
Totals       3                                3
             306                              306
             0                                0
===============================================================================


A:Dut-B# monitor lag 1 interval 3 repeat 1 bytes
===============================================================================
Monitor statistics for LAG ID 1
===============================================================================
Port-id      Input bytes                      Output bytes
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
1/2/1        6100                             6170
```


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```
1/2/2        2514                              1120
-------------------------------------------------------------------------------
Totals       8614                              7290
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Delta)
-------------------------------------------------------------------------------
1/2/1        306                               306
1/2/2        0                                 0
-------------------------------------------------------------------------------
Totals       306                               306
===============================================================================
```

port

Syntax

port *port-id* [*port-id*...(up to 5 total)] [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**] [**multiclass**]

port *port-id* [*port-id*...(up to 5 total)] **atm** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

port *port-id* **atm aal-5** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

port *port-id* **atm pvc** *vpi/vci* [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

port *port-id* **atm pvc** *vpi/vci* **aal-5** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

port *port-id* **atm pvc** *vpi/vci* **oam** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

port *port-id* **atm pvp** *vpi* [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

port *port-id* **atm pvp** *vpi* **oam** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Context

monitor

Description

This command enables port traffic monitoring. The specified port's statistical information is shown at the configured interval until the configured count is reached.

The first screen displays the current statistics related to the specified ports. The subsequent statistical information listed for each interval is displayed as a delta to the previous screen.

When the keyword **rate** is specified, the rate per second for each statistic is displayed instead of the delta.

Monitor commands are similar to **show** commands, but only statistical information is shown. Monitor commands display the selected statistics according to the configured number of times at the interval specified.

Parameters

port-id

the port identifier

Syntax *port-id* *slot*[*/mda*[*/port*]] or *slot*/*mda*/*port*[*.channel*]

bundle-id: bundle-*type-slot/mda.bundle-num*

bundle keyword

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bundle-num: 1 to 32

type ima, ppp

bpgrp-id: bpgrp-*type-bpgrp-num*

bpgrp keyword

bpgrp-num: 1 to 24

type ima, ppp

aps-id: aps-*group-id*[.channel]

aps keyword

group-id: 1 to 24

lcr-port-id: lcr-*group-id*/port[.channel]

lcr keyword

group-id: 1 to 6

seconds

specifies the interval for each display in seconds

Values 3 to 60

Default 10

repeat

specifies how many times the command is repeated

Values 1 to 999

Default 10

absolute

the raw statistics are displayed without processing. No calculations are performed on the delta or rate statistics.

rate

the rate per second for each statistic is displayed instead of the delta

multiclass

displays statistics for multiclass MLPPP bundles

atm

monitors ATM statistics

aal-5

monitors the AAL-5 statistics for the port

pvc *vpi/vci*

monitors ATM PVC statistics

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Values vpi: 0 to 4095 (NNI)
0 to 255 (UNI)
vci: 1 | 2 | 5 to 65535

oam

monitors ATM PVC/PVP OAM statistics

pvp *vpi*

monitors ATM PVP statistics

Values vpi: 0 to 4095 (NNI) 0 to 255 (UNI)

Output

The following outputs are examples of port monitoring information.

Output example

```
*A:ALU-1# monitor port 1/1/1.1 interval 3 repeat 3 absolute
===============================================================================
Monitor statistics for Port 1/1/1.1
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                          330161274             330161274
Packets                                           6229458               6229458
Errors                                                  0                     0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                          330162917             330162917
Packets                                           6229489               6229489
Errors                                                  0                     0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                          330164560             330164560
Packets                                           6229520               6229520
Errors                                                  0                     0
-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                          330166203             330166203
Packets                                           6229551               6229551
Errors                                                  0                     0
===============================================================================
*A:ALU-1#
A:ALU-1# monitor port bundle-ppp-1/1.13 interval 5 repeat 2 rate multiclass
===============================================================================
Monitor multiclass statistics for Bundle bundle-ppp-1/1.13
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Class 0
```


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```
    Octets                                  2990779680            2990899240
    Packets                                    3051816               3051938
    Errors                                           0                     0
Class 1
    Octets                                  2984941820            2990898260
    Packets                                    3045859               3051937
    Errors                                           0                     0
Class 2
    Octets                                  2984939860            2990899240
    Packets                                    3045857               3051938
    Errors                                           0                     0
Class 3
    Octets                                  2984940840            2990899240
    Packets                                    3045858               3051938
    Errors                                           0                     0
-------------------------------------------------------------------------------
At time t = 5 sec (Mode: Rate)
-------------------------------------------------------------------------------
Class 0
    Octets                                       9408                  9408
    Packets                                        10                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.89                  1.89
Class 1
    Octets                                       9408                  9408
    Packets                                        10                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.89                  1.89
Class 2
    Octets                                       9212                  9408
    Packets                                         9                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.85                  1.89
Class 3
    Octets                                       9408                  9408
    Packets                                        10                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.89                  1.89
-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Rate)
-------------------------------------------------------------------------------
Class 0
    Octets                                       9408                  9408
    Packets                                        10                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.89                  1.89
Class 1
    Octets                                       9408                  9408
    Packets                                        10                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.89                  1.89
Class 2
    Octets                                       9408                  9408
    Packets                                        10                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.89                  1.89
Class 3
    Octets                                       9212                  9408
    Packets                                         9                    10
    Errors                                          0                     0
Utilization (% of port capacity)                 1.85                  1.89
===============================================================================
A:ALU-1#
```


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scada

Syntax

scada *scada-id* [*scada-id*...(up to 5 total)] [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Context

monitor

Description

This command enables traffic monitoring for a SCADA bridge or branch. The statistical information for the specified bridge or branch is shown at the configured interval until the configured count is reached.

The first screen displays the current statistics related to the specified bridge or branch. The subsequent statistical information listed for each interval is displayed as a delta to the previous screen.

When the keyword **rate** is specified, the rate per second for each statistic is displayed instead of the delta.

Monitor commands are similar to **show** commands, but only statistical information is shown. Monitor commands display the selected statistics according to the configured number of times at the interval specified.

Parameters

scada-id

specifies a *bridge-id* or a *branch-id*

Values bridge-id: *slot/mda/bridge-id*, where *bridge-id* is 1 to 16

branch-id: *slot/mda/bridge-id.branch-id*, where *bridge-id* is 1 to 16 and *branch-id* is 1 to 32

seconds

specifies the interval for each display in seconds

Values 3 to 60

Default 10

repeat

specifies how many times the command is repeated

Values 1 to 999

Default 10

absolute

the raw statistics are displayed without processing. No calculations are performed on the delta or rate statistics.

rate

the rate per second for each statistic is displayed instead of the delta

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3.15.2.3 Clear commands

external-alarms

Syntax

external-alarms alarm [**all** | *alarm-id*]

Context

clear

Description

This command clears remote site external alarm information.

Parameters

all

clears the status for all alarms

alarm-id

clears the status for a specific alarm

Values 1 to 2147483647

lag

Syntax

lag *lag-id* **statistics**

Context

clear

Description

This command clears statistics for the specified LAG.

Parameters

lag-id

the LAG identifier, expressed as a decimal integer

Values 1 to 32

statistics

specifies that statistics are cleared for the specified LAG

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mda

Syntax

mda *mda-id*

mda *mda-id* **statistics** {**source-mda** | **destination-mda** | **fabric-port** | **fabric-global** | **fabric-firewall** | **all**}

mda *mda-id* **ring** {**all** | **mac** *ieee-address* | **port** *port-id*}

mda *mda-id* **statistics ip-transport**

mda *mda-id* **statistics security** [**encryption** | **firewall**]

mda *mda-id* **statistics mirror**

mda *mda-id* **statistics cflowd**

mda all

Context

clear

Description

The **clear mda** form of this command reinitializes the specified adapter card and clears all the collected fabric statistics related to the card. The **clear mda statistics** form of this command clears all the collected fabric statistics related to the specified adapter card. The **clear mda ring** form of this command clears the dynamic FDB entries related to the specified ring adapter card.

The **clear mda all** form of this command applies only to the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-M, 7705 SAR-H, 7705 SAR-Hc, and 7705 SAR-Wx and is equivalent to clearing all adapter cards using all keywords above (**source-mda**, **destination-mda**, **fabric-port**, and **fabric-global**)

Parameters

mda-id

the slot number of the specified adapter card

statistics

specifies that fabric statistics will be cleared for the specified adapter card

source-mda

clears all the network and access ingress traffic statistics in the fabric direction from the specified adapter card toward all other destination adapter cards

destination-mda

clears all the network and access ingress traffic statistics toward the specified adapter card fabric port, from all other adapter cards

fabric-port

clears the fabric port statistics toward the specified destination adapter card, if the specified adapter card has fabric-stats-enabled. If the specified adapter card does not have fabric-stats-enabled, no statistics will be cleared.

fabric-global

clears global fabric statistics collected for all egress traffic from the fabric

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fabric-firewall
clears fabric firewall statistics collected for all egress traffic from the fabric

security
clears only security statistics for the specified adapter card

encryption
specifies that encryption statistics will be cleared for the specified adapter card

firewall
specifies that firewall statistics will be cleared for the specified adapter card

ip-transport
specifies that IP transport statistics will be cleared for the specified adapter card

mirror
specifies that mirror statistics will be cleared for the specified adapter card

cflowd
clears cflowd queue statistics on the 7705 SAR-8 Shelf V2, 7705 SAR-18, or 7705 SAR-X

mda-id **all**
clears all the collected fabric statistics related to the specified adapter card. This command is equivalent to clearing the specified adapter card using all keywords above (**source-mda**, **destination-mda**, **fabric-port**, **fabric-global**).

ring all
clears the entire dynamic FDB

ieee-address
clears the dynamic FDB entry for the specified MAC address

port-id
clears the dynamic FDB entries for the specified port

all
clears all the collected fabric statistics across all adapter cards or modules

mka-session

Syntax

macsec mka-session [*port-id*]

Context

clear

Description

This command clears MACsec MKA session information.

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Parameters

port-id

specifies the physical port identifier, in the format *slot*/*mda*/*port*

Values *slot* = 1

mda = 1 to 6 (7705 SAR-8 Shelf V2) or 1 to 12 (7705 SAR-18)

port = 1 to 6

mw

Syntax

mw

Context

clear

Description

This command enables the context to clear microwave link parameters.

link

Syntax

link *mw-link-id* **statistics**

Context

clear mw

Description

This command clears microwave link statistics.

Parameters

mw-link-id

specifies the microwave link ID number, using the form **mw-link-***id*

Values *id* = 1 to 24

radio

Syntax

radio *port-id*

radio *radio* **perfmon** [**all** | **g826** | **acm** | **power**]

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Context

clear mw

Description

This command reboots managed microwave devices or resets their performance monitoring statistics.

Note: This command brings down the microwave link; traffic will not pass over it while the radio is rebooting.

Parameters

port-id

specifies the physical port ID associated with the MPR-e radio, in the format *slot/mda/port* (where *port* = 1 through 4)

radio

specifies the MWA performance monitoring radio

acm

resets the adaptive coding and modulation (ACM) level MWA performance monitoring statistics to 0

all

resets all MWA performance monitoring statistics to 0

g826

resets the G.286 MWA performance monitoring statistics to 0

power

resets the radio power MWA performance monitoring statistics to 0

rsl-history

Syntax

rsl-history *port-id*

Context

clear mw

Description

This command clears the RSL history for the specified MPR-e radio.

Parameters

port-id

specifies the physical port ID associated with the MPR-e radio, in the format *slot/mda/port* (where *port* = 1 through 4)

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port

Syntax

port *port-id* **statistics**

port *port-id* **statistics bert**

port *port-id* **atm pvc** [*vpi*[*/vci*]] **statistics**

port *port-id* **atm pvp** [*vpi*] **statistics**

port *port-id* **frame-relay dlci** *dlci*

port *port-id* **macsec** *sub-port-id* **statistics**

Context

clear

Description

This command clears the statistics for the specified port or channel group.

Parameters

port-id

specifies the physical port ID

Syntax *port-id* *slot*[*/mda*[*/port*]] or *slot*/*mda*/*port*[.*channel*]

bundle-id bundle-*type-slot/mda.bundle-num*

bundle keyword

bundle-num: 1 to 32

type ima, ppp

statistics

specifies that port statistics will be cleared

atm

specifies that ATM port statistics will be cleared

vpi

specifies the ATM network virtual path identifier (VPI) for this PVC

vci

specifies the ATM network virtual channel identifier (VCI) for this PVC

pvc

clears PVC statistics

pvp

clears PVP statistics

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frame-relay dlci

clears circuit-level frame relay statistics

dlci

specifies the frame relay virtual circuit identifier

The **clear port** *port-id* **statistics frame-relay dlci** *dlci* command differs from the **clear port** *port-id* **statistics** command in the sense that the former clears the circuit-level SAP statistics whereas the latter clears the frame relay port statistics.

macsec

clears MACsec port statistics

bert

clears port BERT statistics

scada

Syntax

scada *bridge-id* **statistics**

Context

clear

Description

This command clears the statistics for all or specified bridges or branches.

Parameters

bridge-id

specifies the bridge ID or branch ID (the bridge ID is in the format *slot/mda/bridge-id*, where *bridge-id* is 1 to 16; the branch ID is in the format *slot/mda/bridge-id.branch-id*, where *branch-id* is 1 to 32)

statistics

specifies that bridge or branch statistics will be cleared

3.15.2.4 Debug commands

lag

Syntax

lag [**lag-id** *lag-id* [**port** *port-id*]] [**all**]

lag [**lag-id** *lag-id* [**port** *port-id*]] [**sm**] [**pkt**] [**cfg**] [**red**] [**iom-upd**] [**port-state**] [**timers**] [**sel-logic**] [**mc**] [**mc-pkt**]

no lag [**lag-id** *lag-id*]

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Context

debug

Description

This command enables debugging for a LAG.

The **no** form of the command disables debugging for a LAG.

Parameters

lag-id

specifies the LAG identifier, expressed as a decimal integer

Values 1 to 32

port-id

specifies the physical port ID in the *slot/mda/port* format

all

traces all LAG and LACP parameters

sm

traces the LACP state machine

pkt

traces LACP packets

cfg

traces the LAG configuration

red

traces LAG high availability

iom-upd

traces LAG IOM updates

port-state

traces LAG port state transitions

timers

traces LAG timers

sel-logic

traces LACP selection logic

mc

traces multi-chassis parameters

mc-pkt

traces received MC-LAG control packets with valid authentication

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4 List of acronyms

Table 146: Acronyms

Acronym	Expansion
2G	second-generation wireless telephone technology
3DES	triple DES (data encryption standard)
3G	third-generation mobile telephone technology
6VPE	IPv6 on virtual private edge router
7705 SAR	7705 Service Aggregation Router
7750 SR	7750 Service Router
8 PSK	eight phase shift keying
16 QAM	16-state quadrature amplitude modulation
32 QAM	32-state quadrature amplitude modulation
64 QAM	64-state quadrature amplitude modulation
128 QAM	128-state quadrature amplitude modulation
256 QAM	256-state quadrature amplitude modulation
ABR	area border router available bit rate
AC	alternating current attachment circuit
ACK	acknowledge
ACL	access control list
ACR	adaptive clock recovery
AD	auto-discovery
ADC	asymmetric delay control
ADM	add/drop multiplexer
ADP	automatic discovery protocol
AES	advanced encryption standard

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Acronym	Expansion
AFI	authority and format identifier
AIGP	accumulated IGP
AIS	alarm indication signal
ALG	application level gateway
AMP	active multipath
AN	association number
ANSI	American National Standards Institute
Apipe	ATM VLL
APS	automatic protection switching
ARP	address resolution protocol
A/S	active/standby
AS	autonomous system
ASAP	any service, any port
ASBR	autonomous system boundary router
ASM	any-source multicast autonomous system message
ASN	autonomous system number
ATM	asynchronous transfer mode
ATM PVC	ATM permanent virtual circuit
AU	administrative unit
AUG	administrative unit group
B3ZS	bipolar with three-zero substitution
Batt A	battery A
B-bit	beginning bit (first packet of a fragment)
BBE	background block errors
Bc	committed burst size
Be	excess burst size
BECN	backward explicit congestion notification

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Acronym	Expansion
Bellcore	Bell Communications Research
BFD	bidirectional forwarding detection
BGP	border gateway protocol
BGP-LS	border gateway protocol link state
BGP-LU	border gateway protocol labeled unicast
BITS	building integrated timing supply
BTCA	best timeTransmitter clock algorithm
BMU	broadcast, multicast, and unknown traffic Traffic that is not unicast. Any nature of multipoint traffic: • broadcast (that is, all 1s as the destination IP to represent all destinations within the subnet) • multicast (that is, traffic typically identified by the destination address, uses special destination address); for IP, the destination must be 224.0.0.0 to 239.255.255.255 • unknown (that is, the destination is typically a valid unicast address but the destination port/interface is not yet known; therefore, traffic needs to be forwarded to all destinations; unknown traffic is treated as broadcast)
BNM	bandwidth notification message
BOF	boot options file
BoS	bottom of stack
BPDU	bridge protocol data unit
BRAS	Broadband Remote Access Server
BSC	Base Station Controller
BSM	bootstrap message
BSR	bootstrap router
BSTA	Broadband Service Termination Architecture
BTS	base transceiver station
CA	certificate authority connectivity association
CAK	connectivity association key

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Acronym	Expansion
CAS	channel associated signaling
CBN	common bonding networks
CBS	committed buffer space
CC	continuity check control channel
CCM	continuity check message
CCTV	closed-circuit television
CE	circuit emulation customer edge
CEM	circuit emulation
CES	circuit emulation services
CESoPSN	circuit emulation services over packet switched network
CFM	connectivity fault management
cHDLC	Cisco high-level data link control protocol
CIDR	classless inter-domain routing
CIR	committed information rate
CKN	connectivity association key name
CLI	command line interface
CLP	cell loss priority
CMP	certificate management protocol
CMV	Cryptographic Module version
C-multicast	customer multicast
CoS	class of service
CPE	customer premises equipment
Cpipe	circuit emulation (or TDM) VLL
CPM	Control and Processing Module (CPM is used instead of CSM when referring to CSM filtering to align with CLI syntax used with other SR products). CSM management ports are referred to as CPM management ports in the CLI.

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Acronym	Expansion
CPROTO	C prototype
CPU	central processing unit
C/R	command/response
CRC	cyclic redundancy check
CRC-32	32-bit cyclic redundancy check
CRL	certificate revocation list
CRON	a time-based scheduling service (from chronos = time)
CRP	candidate RP
CSM	Control and Switching Module
CSNP	complete sequence number PDU
CSPF	constrained shortest path first
C-tag	customer VLAN tag
CV	connection verification customer VLAN (tag)
CW	control word
CWDM	coarse wavelength-division multiplexing
DA/FAN	distribution automation and field area network
DC	direct current
DC-C	DC return - common
DCE	data communications equipment
DC-I	DC return - isolated
DCO	digitally controlled oscillator
DCR	differential clock recovery
DDoS	distributed DoS
DE	discard eligibility
DER	distinguished encoding rules
DES	data encryption standard
DF	do not fragment

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Acronym	Expansion
	designated forwarder
DH	Diffie-Hellman
DHB	decimal, hexadecimal, or binary
DHCP	dynamic host configuration protocol
DHCPv6	dynamic host configuration protocol for IPv6
DIS	designated intermediate system
DLCI	data link connection identifier
DLCMI	data link connection management interface
DM	delay measurement
DNS	domain name server
DNU	do not use
DoS	denial of service
dot1p	IEEE 802.1p bits, in Ethernet or VLAN ingress packet headers, used to map traffic to up to eight forwarding classes
dot1q	IEEE 802.1q encapsulation for Ethernet interfaces
DPD	dead peer detection
DPI	deep packet inspection
DPLL	digital phase locked loop
DR	designated router
DS	digital signature
DSA	digital signal algorithm
DSCP	differentiated services code point
DSL	digital subscriber line
DSLAM	digital subscriber line access multiplexer
DTE	data termination equipment
DU	downstream unsolicited
DUID	DHCP unique identifier
DUS	do not use for synchronization

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Acronym	Expansion
DV	delay variation
DVMRP	distance vector multicast routing protocol
e911	enhanced 911 service
EAP	Extensible Authentication Protocol
EAPOL	EAP over LAN
E-bit	ending bit (last packet of a fragment)
E-BSR	elected BSR
ECMP	equal cost multipath
EE	end entity
EFM	Ethernet in the first mile
EGP	exterior gateway protocol
EIA/TIA-232	Electronic Industries Alliance/Telecommunications Industry Association Standard 232 (also known as RS-232)
EIR	excess information rate
EJBCA	Enterprise Java Beans Certificate Authority
E-LAN	Ethernet local area network
E-Line	Ethernet virtual private line
EL	entropy label
eLER	egress label edge router
ELI	entropy label indicator
E&M	ear and mouth earth and magneto exchange and multiplexer
eMBMS	evolved MBMS
EOP	end of packet
EPC	evolved packet core
EPD	early packet discard
Epipe	Ethernet VLL

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Acronym	Expansion
EPL	Ethernet private line
EPON	Ethernet Passive Optical Network
EPS	equipment protection switching
ERO	explicit route object
ES	Ethernet segment errored seconds
ESD	electrostatic discharge
ESI	Ethernet segment identifier
ESMC	Ethernet synchronization message channel
ESN	extended sequence number
ESP	encapsulating security payload
ESPI	encapsulating security payload identifier
ESV	Entropy Source version
ETE	end-to-end
ETH-BN	Ethernet bandwidth notification
ETH-CFM	Ethernet connectivity fault management (IEEE 802.1ag)
EVC	Ethernet virtual connection
EVDO	evolution - data optimized
EVI	EVPN instance
EVPL	Ethernet virtual private link
EVPN	Ethernet virtual private network
EXP bits	experimental bits (currently known as TC)
FC	forwarding class
FCS	frame check sequence
FD	frequency diversity
FDB	forwarding database
FDL	facilities data link
FEAC	far-end alarm and control

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Acronym	Expansion
FEC	forwarding equivalence class
FECN	forward explicit congestion notification
FeGW	far-end gateway
FEP	front-end processor
FF	fixed filter
FFD	fast fault detection
FIB	forwarding information base
FIFO	first in, first out
FIPS	Federal Information Processing Standard
FM	fault management
FNG	fault notification generator
FOM	figure of merit
Fpipe	frame relay VLL
FPV	FIPS Provider version
FQDN	fully qualified domain name
FR	frame relay
FRG bit	fragmentation bit
FRR	fast reroute
FTN	FEC-to-NHLFE
FTP	file transfer protocol
FXO	foreign exchange office
FXS	foreign exchange subscriber
GFP	generic framing procedure
GigE	Gigabit Ethernet
GLONASS	Global Navigation Satellite System (Russia)
GNSS	global navigation satellite system (generic)
GPON	Gigabit Passive Optical Network

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Acronym	Expansion
GPRS	general packet radio service
GPS	Global Positioning System
GRE	generic routing encapsulation
GRT	global routing table
GSM	Global System for Mobile Communications (2G)
GTP-U	GPRS tunneling protocol user plane
GW	gateway
HA	high availability
HCM	high capacity multiplexing
HDB3	high density bipolar of order 3
HDLC	high-level data link control protocol
HEC	header error control
HMAC	hash message authentication code
Hpipe	HDLC VLL
H-QoS	hierarchical quality of service
HSB	hot standby
HSDPA	high-speed downlink packet access
HSPA	high-speed packet access
H-VPLS	hierarchical virtual private line service
IANA	Internet Assigned Numbers Authority
IBN	isolated bonding networks
ICB	inter-chassis backup
ICK	integrity connection value key
ICMP	Internet control message protocol
ICMPv6	Internet control message protocol for IPv6
ICP	IMA control protocol cells
ICV	integrity connection value
IDS	intrusion detection system

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Acronym	Expansion
IDU	indoor unit
IED	intelligent end device
IEEE	Institute of Electrical and Electronics Engineers
IEEE 1588v2	Institute of Electrical and Electronics Engineers standard 1588-2008
IES	Internet enhanced service
IETF	Internet Engineering Task Force
IGMP	Internet group management protocol
IGP	interior gateway protocol
IID	instance ID
IKE	Internet key exchange
iLER	ingress label edge router
ILM	incoming label map
IMA	inverse multiplexing over ATM
IMET-IR	inclusive multicast Ethernet tag—ingress replication
INVARP	inverse address resolution protocol
IOM	input/output module
IP	Internet protocol
IPCP	Internet protocol control protocol
IPIP	IP in IP
Ipipe	IP interworking VLL
I-PMSI	inclusive PMSI
IPoATM	IP over ATM
IPS	intrusion prevention system
IPSec	Internet protocol security
IR	ingress replication
IRB	integrated routing and bridging
ISA	integrated services adapter

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Acronym	Expansion
ISAKMP	Internet security association and key management protocol
IS-IS	Intermediate System-to-Intermediate System
IS-IS-TE	IS-IS-traffic engineering (extensions)
ISO	International Organization for Standardization
IW	interworking
JP	join prune
KEK	key encryption key
KG	key group
LB	loopback
lbf-in	pound force inch
LBM	loopback message
LBO	line buildout
LBR	loopback reply
LCP	link control protocol
LDP	label distribution protocol
LER	label edge router
LFA	loop-free alternate
LFIB	label forwarding information base
LIB	label information base
LLDP	link layer discovery protocol
LLDPDU	link layer discovery protocol data unit
LLF	link loss forwarding
LLID	loopback location ID
LM	loss measurement
LMI	local management interface
LOS	line-of-sight loss of signal
LSA	link-state advertisement

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Acronym	Expansion
LSDB	link-state database
LSP	label switched path link-state PDU (for IS-IS)
LSPA	LSP attributes
LSR	label switching router link-state request
LSU	link-state update
LT	linktrace
LTE	long term evolution line termination equipment
LTM	linktrace message
LTN	LSP ID to NHLFE
LTR	link trace reply
MA	maintenance association
MAC	media access control
MACsec	media access control security
MA-ID	maintenance association identifier
MBB	make-before-break
MBGP	multicast BGP multiprotocol BGP multiprotocol extensions for BGP
MBMS	multimedia broadcast multicast service
MBS	maximum buffer space maximum burst size media buffer space
MBSP	mobile backhaul service provider
MCAC	multicast connection admission control
MC-APS	multi-chassis automatic protection switching
MC-MLPPP	multiclass multilink point-to-point protocol

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Acronym	Expansion
MCS	multicast server multi-chassis synchronization
MCT	MPT craft terminal
MD	maintenance domain
MD5	message digest version 5 (algorithm)
MDA	media dependent adapter
MDDB	multidrop data bridge
MDL	maintenance data link
MDT	multicast distribution tree
ME	maintenance entity
MED	multi-exit discriminator
MEF	Metro Ethernet Forum
MEG	maintenance entity group
MEG-ID	maintenance entity group identifier
MEN	Metro Ethernet network
MEP	maintenance association endpoint
MFC	multi-field classification
MHD	multi-homed device
MHF	MIP half function
MHN	multi-homed network
MI	member identifier
MIB	management information base
MI-IS-IS	multi-instance IS-IS
MIR	minimum information rate
MKA	MACsec key agreement
MLD	multicast listener discovery
mLDP	multicast LDP
MLPPP	multilink point-to-point protocol

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Acronym	Expansion
mLSP	multicast LSP
MoFRR	multicast-only fast reroute
MP	merge point multilink protocol multipoint
MP-BGP	multiprotocol border gateway protocol
MPLS	multiprotocol label switching
MPLSCP	multiprotocol label switching control protocol
MPP	MPT protection protocol
MPR	see Wavence
MPR-e	Microwave Packet Radio (standalone mode)
MPT-HC V2/9558HC	Microwave Packet Transport, High Capacity version 2
MPT-HLC	Microwave Packet Transport, High-Capacity Long-Haul Cubic (ANSI)
MPT-HQAM	Microwave Packet Transport, High Capacity (MPT-HC-QAM) or Extended Power (MPT-XP-QAM) with 512/1024 QAM
MPT-MC	Microwave Packet Transport, Medium Capacity
MPT-XP	Microwave Packet Transport, High Capacity (very high power version of MPT-HC V2/9558HC)
MRAI	minimum route advertisement interval
MRRU	maximum received reconstructed unit
MRU	maximum receive unit
MSDP	Multicast Source Discovery Protocol
MSDU	MAC Service Data Unit
MSK	master session key
MSO	multi-system operator
MS-PW	multi-segment pseudowire
MSS	maximum segment size Microwave Service Switch

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Acronym	Expansion
MTIE	maximum time interval error
MTSO	mobile trunk switching office
MTU	maximum transmission unit multi-tenant unit
M-VPLS	management virtual private line service
MVPN	multicast VPN
MVR	multicast VPLS registration
MW	microwave
MWA	microwave awareness
N·m	newton meter
NAT	network address translation
NAT-T	network address translation traversal
NBMA	non-broadcast multiple access (network)
ND	neighbor discovery
NDcPP	Network Device Protection Profile
NE	network element
NET	network entity title
NFM-P	Network Functions Manager - Packet (formerly 5620 SAM)
NGE	network group encryption
NG-MVPN	next generation MVPN
NH	next hop
NHLFE	next hop label forwarding entry
NHOP	next-hop
NIAP	National Information Assurance Partnership
NLOS	non-line-of-sight
NLPID	network level protocol identifier
NLRI	network layer reachability information
NNHOP	next next-hop

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Acronym	Expansion
NNI	network-to-network interface
Node B	similar to BTS but used in 3G networks — term is used in UMTS (3G systems) while BTS is used in GSM (2G systems)
NOC	network operations center
NPAT	network port address translation
NRC-F	Network Resource Controller - Flow
NRC-P	Network Resource Controller - Packet
NRC-T	Network Resource Controller - Transport
NRC-X	Network Resource Controller - Cross Domain
NSAP	network service access point
NSD	Network Services Director
NSP	native service processing Network Services Platform
NSSA	not-so-stubby area
NTP	Network Time Protocol
NTR	network timing reference
OADM	optical add/drop multiplexer
OAM	operations, administration, and maintenance
OAMPDU	OAM protocol data units
OC3	optical carrier level 3
OCSP	online certificate status protocol
ODU	outdoor unit
OIF	outgoing interface
OLT	optical line termination
OMC	optical management console
ONT	optical network terminal
OOB	out-of-band
OPX	off premises extension

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Acronym	Expansion
ORF	outbound route filtering
OS	operating system
OSI	Open Systems Interconnection (reference model)
OSINLCP	OSI Network Layer Control Protocol
OSPF	open shortest path first
OSPF-TE	OSPF-traffic engineering (extensions)
OSS	operations support system
OSSP	organization specific slow protocol
OTP	one time password
OWAMP	one-way active measurement protocol
P2MP	point to multipoint
PADI	PPPoE active discovery initiation
PADR	PPPoE active discovery request
PAE	port authentication entities
PSB	path state block
PBO	packet byte offset
PBR	policy-based routing
PBX	private branch exchange
PCAP	packet capture
PCC	path computation client
PCE	path computation element
PCEP	Path Computation Element Communication Protocol
PCM	pulse code modulation
PCP	priority code point
PCR	proprietary clock recovery
PDU	power distribution unit protocol data units
PDV	packet delay variation

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Acronym	Expansion
PDVT	packet delay variation tolerance
PE	provider edge router
PEAPv0	protected extensible authentication protocol version 0
PEM	privacy enhanced mail
PFoE	power feed over Ethernet
PFS	perfect forward secrecy
PHB	per-hop behavior
PHP	penultimate hop popping
PHY	physical layer
PIC	prefix independent convergence
PID	protocol ID
PIM SSM	protocol independent multicast—source-specific multicast
PIR	peak information rate
PKCS	public key cryptography standards
PKI	public key infrastructure
PLAR	private line automatic ringdown
PLCP	Physical Layer Convergence Protocol
PLR	point of local repair
PLSP	path LSP
PM	performance monitoring
PMSI	P-multicast service interface
P-multicast	provider multicast
PN	packet number
PoE	power over Ethernet
PoE+	power over Ethernet plus
POH	path overhead
POI	purge originator identification

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Acronym	Expansion
PoP	point of presence
POS	packet over SONET
PPP	point-to-point protocol
PPPoE	point-to-point protocol over Ethernet
PPS	pulses per second
PRC	primary reference clock
PRS	primary reference source
PRTC	primary reference time clock
PSE	power sourcing equipment
PSK	pre-shared key
PSN	packet switched network
PSNP	partial sequence number PDU
PTA	PMSI tunnel attribute
PTM	packet transfer mode
PTP	performance transparency protocol Precision Time Protocol
PuTTY	an open-source terminal emulator, serial console, and network file transfer application
PVC	permanent virtual circuit
PVCC	permanent virtual channel connection
PW	pseudowire
PWE	pseudowire emulation
PWE3	pseudowire emulation edge-to-edge
Q.922	ITU-T Q-series Specification 922
QL	quality level
QoS	quality of service
QPSK	quadrature phase shift keying
RADIUS	Remote Authentication Dial In User Service

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Acronym	Expansion
RAN	radio access network
RBS	robbed bit signaling
RD	route distinguisher
RDI	remote defect indication
RED	random early discard
RESV	reservation
RIB	routing information base
RIP	routing information protocol
RJ45	registered jack 45
RMON	remote network monitoring
RNC	radio network controller
RP	rendezvous point
RPF RTM	reverse path forwarding RTM
RPS	radio protection switching
RPT	rendezvous-point tree
RR	route reflector
RRO	record route object
RS-232	Recommended Standard 232 (also known as EIA/TIA-232)
RSA	Rivest, Shamir, and Adleman (authors of the RSA encryption algorithm)
RSHG	residential split horizon group
RSTP	rapid spanning tree protocol
RSVP-TE	resource reservation protocol - traffic engineering
RT	receive/transmit
RTC	route target constraint
RTM	routing table manager
RTN	battery return
RTP	real-time protocol

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Acronym	Expansion
R&TTE	Radio and Telecommunications Terminal Equipment
RTU	remote terminal unit
RU	rack unit
r-VPLS	routed virtual private LAN service
SA	security association source-active
SAA	service assurance agent
SAFI	subsequent address family identifier
SAK	security association key
SAP	service access point
SAToP	structure-agnostic TDM over packet
SCADA	supervisory control and data acquisition
SC-APS	single-chassis automatic protection switching
SCI	secure channel identifier
SCP	secure copy
SCTP	Stream Control Transmission Protocol
SD	signal degrade space diversity
SDH	synchronous digital hierarchy
SDI	serial data interface
SDN	software defined network
SDP	service destination point
SE	shared explicit
SeGW	secure gateway
SES	severely errored seconds
SETS	synchronous equipment timing source
SF	signal fail
SFP	small form-factor pluggable (transceiver)

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Acronym	Expansion
SFTP	SSH file transfer protocol
(S,G)	(source, group)
SGT	self-generated traffic
SHA-1	secure hash algorithm
SHG	split horizon group
SID	Segment ID
SIR	sustained information rate
SL	short length
SLA	service-level agreement
SLARP	serial line address resolution protocol
SLID	subscriber location identifier of a GPON module
SLM	synthetic loss measurement
SNMP	Simple Network Management Protocol
SNPA	subnetwork point of attachment
SNR	signal to noise ratio
SNTP	simple network time protocol
SONET	synchronous optical networking
S-PE	switching provider edge router
SPF	shortest path first
SPI	security parameter index
S-PMSI	selective PMSI
SPT	shortest path tree
SR	Service Router (7750 SR) segment routing
SRGB	segment routing global block
SRLG	shared risk link group
SRP	stateful request parameter
SRRP	subscriber routed redundancy protocol

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Acronym	Expansion
SR-ISIS	segment routing IS-IS
SR-MPLS	segment routing with MPLS data plane
SR-OSPF	segment routing OSPF
SR-TE	segment routing traffic engineering
SSH	secure shell
SSM	source-specific multicast synchronization status messaging
SSU	system synchronization unit
S-tag	service VLAN tag
STM	synchronous transport module
STM1	synchronous transport module, level 1
STP	spanning tree protocol
STS	synchronous transport signal
SVC	switched virtual circuit
SVEC	synchronization vector
SYN	synchronize
TACACS+	Terminal Access Controller Access-Control System Plus
TC	traffic class (formerly known as EXP bits)
TCI	tag control information
TCP	transmission control protocol
TCP-AO	TCP Authentication Option
TDA	transmit diversity antenna
TDEV	time deviation
TDM	time division multiplexing
TE	traffic engineering
TEDB	traffic engineering database
TEID	tunnel endpoint identifier
TEP	tunnel endpoint

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Acronym	Expansion
TFTP	trivial file transfer protocol
T-LDP	targeted LDP
TLS	transport layer security
TLV	type length value
TM	traffic management
ToD	time of day
ToS	type of service
T-PE	terminating provider edge router
TPID	tag protocol identifier
TPIF	IEEE C37.94 teleprotection interface
TPMR	two-port MAC relay
TPS	transmission protection switching
TSoP	transparent SDH/SONET over packet
TTL	time to live
TTLS	tunneled transport layer security
TTM	tunnel table manager
TU	tributary unit
TUG	tributary unit group
TWAMP	two-way active measurement protocol
U-APS	unidirectional automatic protection switching
UAS	unavailable seconds
UBR	unspecified bit rate
UDP	user datagram protocol
UFD	unidirectional forwarding detection
UMH	upstream multicast hop
UMTS	Universal Mobile Telecommunications System (3G)
UNI	user-to-network interface

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Acronym	Expansion
uRPF	unicast reverse path forwarding
V.11	ITU-T V-series Recommendation 11
V.24	ITU-T V-series Recommendation 24
V.35	ITU-T V-series Recommendation 35
VC	virtual circuit
VCB	voice conference bridge
VCC	virtual channel connection
VCCV	virtual circuit connectivity verification
VCI	virtual circuit identifier
VID	VLAN ID
VLAN	virtual LAN
VLL	virtual leased line
VM	virtual machine
VoIP	voice over IP
Vp	peak voltage
VP	virtual path
VPC	virtual path connection
VPI	virtual path identifier
VPLS	virtual private LAN service
VPN	virtual private network
VPRN	virtual private routed network
VPWS	virtual private wire service
VRF	virtual routing and forwarding table
VRRP	virtual router redundancy protocol
V-SAP	virtual service access point
VSE	vendor-specific extension
VSI	virtual switch instance

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Acronym	Expansion
VSO	vendor-specific option
VT	virtual trunk virtual tributary
VTG	virtual tributary group
Wavence	formerly 9500 MPR (Microwave Packet Radio)
WCDMA	wideband code division multiple access (transmission protocol used in UMTS networks)
WRED	weighted random early discard
WTR	wait to restore
X.21	ITU-T X-series Recommendation 21
XOR	exclusive-OR
XRO	exclude route object

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5 Supported standards and protocols

This chapter lists the 7705 SAR compliance with security and telecom standards, the protocols supported, and proprietary MIBs.

5.1 Security standards

FIPS 140-3—Federal Information Processing Standard publication 140-3, Security Requirements for Cryptographic Modules

5.2 Telecom standards

ANSI/TIA/EIA-232-C—Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

IEEE 802.1AB-2016—IEEE Standard for Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery

IEEE 802.1ad—IEEE Standard for Local and Metropolitan Area Networks–Virtual Bridged Local Area Networks

IEEE Std 802.1AE-2006 Media Access Control (MAC) Security

IEEE Std 802.1AEbw-2013—Media Access Control (MAC) Security Amendment 2: Extended Packet Numbering

IEEE 802.1ag—Service Layer OAM

IEEE 802.1p/q—VLAN Tagging

IEEE 802.1x-2010—IEEE Standard for Local and Metropolitan Area Networks–Port-based Network Access Control

IEEE 802.3—10BaseT

IEEE 802.3ab—1000BaseT

IEEE 802.3ah—Ethernet OAM

IEEE 802.3u—100BaseTX

IEEE 802.3x —Flow Control

IEEE 802.3z—1000BaseSX/LX

IEEE 802.3-2008—Revised base standard

IEEE 802.1AX-2008—Link Aggregation Task Force (transferred from IEEE 802.3ad)

IEEE C37.94-2017—N Times 64 Kilobit Per Second Optical Fiber Interfaces Between Teleprotection and Multiplexer Equipment

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ITU-T G.704—Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels

ITU-T G.707—Network node interface for the Synchronous Digital Hierarchy (SDH)

ITU-T G.826—End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections

ITU-T G.8032 — Ethernet Ring Protection Switching

ITU-T G.984.1—Gigabit-capable passive optical networks (GPON): general characteristics

ITU-T Y.1564—Ethernet service activation test methodology

ITU-T Y.1731—OAM functions and mechanisms for Ethernet-based networks

5.3 Protocol support

5.3.1 ATM

AF-PHY-0086.001—Inverse Multiplexing for ATM (IMA)

af-tm-0121.000—Traffic Management Specification Version 4.1, March 1999

GR-1113-CORE—Bellcore, Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements, Issue 1, July 1994

GR-1248-CORE—Generic Requirements for Operations of ATM Network Elements (NEs). Issue 3 June 1996

ITU-T Recommendation I.432.1—B-ISDN user-network interface - Physical layer specification: General characteristics

ITU-T Recommendation I.610—B-ISDN Operation and Maintenance Principles and Functions version 11/95

RFC 2514—Definitions of Textual Conventions and OBJECT_IDENTITIES for ATM Management, February 1999

RFC 2515—Definition of Managed Objects for ATM Management, February 1999

RFC 2684—Multiprotocol Encapsulation over ATM Adaptation Layer 5

5.3.2 BFD

RFC 7130—Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces

RFC 7881—Seamless Bidirectional Forwarding Detection (S-BFD) for IPv4, IPv6, and MPLS

draft-ietf-bfd-mib-00.txt—Bidirectional Forwarding Detection Management Information Base

draft-ietf-bfd-base-o5.txt—Bidirectional Forwarding Detection

draft-ietf-bfd-v4v6-1hop-06.txt—BFD IPv4 and IPv6 (Single Hop)

draft-ietf-bfd-multihop-06.txt—BFD for Multi-hop Paths

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5.3.3 BGP

RFC 1397—BGP Default Route Advertisement

RFC 1997—BGP Communities Attribute

RFC 2385—Protection of BGP Sessions via the TCP MD5 Signature Option

RFC 2439—BGP Route Flap Dampening

RFC 2545—Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing

RFC 2918—Route Refresh Capability for BGP-4

RFC 3107—Carrying Label Information in BGP-4

RFC 3392—Capabilities Advertisement with BGP-4

RFC 4271—BGP-4 (previously RFC 1771)

RFC 4360—BGP Extended Communities Attribute

RFC 4364—BGP/MPLS IP Virtual Private Networks (VPNs) (previously RFC 2574bis BGP/MPLS VPNs)

RFC 4456—BGP Route Reflection: Alternative to Full-mesh IBGP (previously RFC 1966 and RFC 2796)

RFC 4486—Subcodes for BGP Cease Notification Message

RFC 4684—Constrained Route Distribution for Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs)

RFC 4724—Graceful Restart Mechanism for BGP - GR Helper

RFC 4760—Multi-protocol Extensions for BGP (previously RFC 2858)

RFC 4893—BGP Support for Four-octet AS Number Space

RFC 4798—Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE)

RFC 5549—Advertising IPv4 Network Layer Reachability Information with an IPv6 Next Hop

RFC 5925—The TCP Authentication Option

RFC 5926—Cryptographic Algorithms for the TCP Authentication Option (TCP-AO)

RFC 6513—Multicast in MPLS/BGP IP VPNs

RFC 6514—BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs

RFC 7311—The Accumulated IGP Metric Attribute for BGP

RFC 7606—Revised Error Handling for BGP UPDATE Messages

draft-ietf-idr-add-paths-04.txt—Advertisement of Multiple Paths in BGP

draft-ietf-idr-add-paths-guidelines-00.txt—Best Practices for Advertisement of Multiple Paths in BGP

draft-weis-esp-group-counter-cipher-00.txt—Using Counter Modes with Encapsulating Security Payload (ESP) and Authentication Header (AH) to Protect Group Traffic

5.3.4 DHCP/DHCPv6

RFC 1534—Interoperation between DHCP and BOOTP

RFC 2131—Dynamic Host Configuration Protocol (REV)

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RFC 2132—DHCP Options and BOOTP Vendor Extensions

RFC 3046—DHCP Relay Agent Information Option (Option 82)

RFC 3315—Dynamic Host Configuration Protocol for IPv6

RFC 3736—Stateless Dynamic Host Configuration Protocol (DHCP) Service for IPv6

5.3.5 Differentiated services

RFC 2474—Definition of the DS Field in the IPv4 and IPv6 Headers

RFC 2597—Assured Forwarding PHB Group

RFC 2598—An Expedited Forwarding PHB

RFC 3140—Per-Hop Behavior Identification Codes

5.3.6 Digital data network management

V.35

RS-232 (also known as EIA/TIA-232)

X.21

5.3.7 ECMP

RFC 2992—Analysis of an Equal-Cost Multi-Path Algorithm

5.3.8 Ethernet VPN (EVPN)

RFC 7432—BGP MPLS-Based Ethernet VPN

draft-ietf-bess-evpn-vpws—Virtual Private Wire Service support in Ethernet VPN

draft-ietf-rabadan-bess-evpn-pref-pdf—Preference-based EVPN DF Election

5.3.9 Frame relay

ANSI T1.617 Annex D—Signalling Specification For Frame Relay Bearer Service

ITU-T Q.922 Annex A—Digital Subscriber Signalling System No. 1 (DSS1) data link layer - ISDN data link layer specification for frame mode bearer services

FRF.1.2—PVC User-to-Network Interface (UNI) Implementation Agreement

RFC 2427—Multiprotocol Interconnect over Frame Relay

5.3.10 GRE

RFC 2784—Generic Routing Encapsulation (GRE)

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5.3.11 Internet protocol (IP) – version 4

RFC 768—User Datagram Protocol

RFC 791—Internet Protocol

RFC 792—Internet Control Message Protocol

RFC 793—Transmission Control Protocol

RFC 826—Ethernet Address Resolution Protocol

RFC 854—Telnet Protocol Specification

RFC 1350—The TFTP Protocol (Rev. 2)

RFC 1812—Requirements for IPv4 Routers

RFC 3021—Using 31-Bit Prefixes on IPv4 Point-to-Point Links

5.3.12 Internet protocol (IP) – version 6

RFC 2460—Internet Protocol, Version 6 (IPv6) Specification

RFC 2462—IPv6 Stateless Address Autoconfiguration

RFC 2464—Transmission of IPv6 Packets over Ethernet Networks

RFC 3587—IPv6 Global Unicast Address Format

RFC 3595—Textual Conventions for IPv6 Flow Label

RFC 4007—IPv6 Scoped Address Architecture

RFC 4193—Unique Local IPv6 Unicast Addresses

RFC 4291—IPv6 Addressing Architecture

RFC 4443—Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 Specification

RFC 4649—DHCPv6 Relay Agent Remote-ID Option

RFC 4861—Neighbor Discovery for IP version 6 (IPv6)

RFC 5095—Deprecation of Type 0 Routing Headers in IPv6

RFC 5952—A Recommendation for IPv6 Address Text Representation

5.3.13 IPSec

ITU-T X.690 (2002)—ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)

PKCS #12 Personal Information Exchange Syntax Standard

RFC 2315—PKCS #7: Cryptographic Message Syntax

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RFC 1195—Use of OSI IS-IS for routing in TCP/IP & dual environments

RFC 2763—Dynamic Hostname Exchange for IS-IS

RFC 2966—Domain-wide Prefix Distribution with Two-Level IS-IS

RFC 2973—IS-IS Mesh Groups

RFC 3373—Three-Way Handshake for Intermediate System to Intermediate System (IS-IS) Point-to-Point Adjacencies

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RFC 3719—Recommendations for Interoperable Networks using IS-IS

RFC 3784—Intermediate System to Intermediate System (IS-IS) Extensions for Traffic Engineering (TE)

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RFC 5304—IS-IS Cryptographic Authentication

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RFC 5309—Point-to-Point Operation over LAN in Link State Routing Protocols

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RFC 6232—Purge Originator Identification TLV for IS-IS

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5.3.15 LDP

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RFC 5350—-IANA Considerations for the IPv4 and IPv6 Router Alert Options

RFC 5443—LDP IGP Synchronization

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RFC 6829—Label Switched Path (LSP) Ping for Pseudowire Forwarding Equivalence Classes (FECs) Advertised over IPv6

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RFC 5286—Basic Specification for IP Fast Reroute: Loop-Free Alternates

RFC 7490—Remote Loop-Free Alternate (LFA) Fast Reroute (FRR)

5.3.17 MPLS

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RFC 3032—MPLS Label Stack Encoding

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5.3.18 MPLS – OAM

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RFC 8029—Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures

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RFC 2206—RSVP-MIB

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RFC 2575—SNMP-VIEW-BASED ACM-MIB

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RFC 3509—Alternative Implementations of OSPF Area Border Routers

RFC 3623—Graceful OSPF Restart (support for Helper mode)

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5.3.22 OSPFv3

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5.3.27 RSVP-TE and FRR

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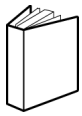

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