7710 SR OS
INTERFACE CONFIGURATION GUIDE

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Preface

About This Guide

This guide describes system concepts and provides configuration examples to provision input/output Control Forwarding modules (CFMs), also referred to as cards, Media Carrier Modules (MCMs), Media Dependent Adapters (MDAs), Compact Media Adapters (CMAs), and ports.

This document 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.

Audience

This manual is intended for network administrators who are responsible for configuring the 7710 SR-Series routers. It is assumed that the network administrators have an understanding of networking principles and configurations, routing processes, and protocols and standards, including:

- CLI concepts
- IOM, MDA, and port configuration
- QoS policies
- Services

List of Technical Publications

The 7710 SR documentation set is composed of the following books:

- 7710 SR OS Basic System Configuration Guide

  This guide describes basic system configurations and operations.
- 7710 SR OS System Management Guide

  This guide describes system security and access configurations as well as event logging and accounting logs.

- 7710 SR OS Interface Configuration Guide

  This guide describes card, Media Dependent Adapter (MDA), MCM (MDA Carrier Module), CMA (Compact Media Adapter), and port provisioning.
- 7710 SR OS Router Configuration Guide

  This guide describes logical IP routing interfaces and associated attributes such as an IP address, port, link aggregation group (LAG) as well as IP and MAC-based filtering, VRRP, and Cflowd.
- OS Routing Protocols Guide

  This guide provides an overview of routing concepts and provides configuration examples for RIP, OSPF, IS-IS, Multicast, BGP, and route policies.
- 7710 SR OS MPLS Guide

  This guide describes how to configure Multiprotocol Label Switching (MPLS) and Label Distribution Protocol (LDP).
- 7710 SR OS Services Guide

  This guide describes how to configure service parameters such as service distribution points (SDPs), customer information, and user services.
- 7710 SR OS OAM and Diagnostic Guide

  This guide describes how to configure service parameters such as service mirroring and Operations, Administration and Management (OAM) tools.
- 7710 SR OS Triple Play Guide

  This guide describes Triple Play services and support provided by the 7710 SR and presents examples to configure and implement various protocols and services.
- 7710 SR Quality of Service Guide

  This guide describes how to configure Quality of Service (QoS) policy management.

Technical Support

If you purchased a service agreement for your 7710 SR-series 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 an Alcatel-Lucent service agreement, contact your welcome center:

Web: http://www1.alcatel-lucent.com/comps/pages/carrier_support.jhtml

GETTING STARTED

In This Chapter

This chapter provides process flow information to configure cards, MCMs, MDAs, CMAs and ports.

Alcatel-Lucent 7710 SR Router Configuration Process

Table 1 lists the tasks necessary to provision input/output control forwarding modules (CFMs), also referred to as cards, Media Carrier Modules (MCMs), Media Dependent Adapters (MDAs), Compact Media Adapters (CMAs) and ports.

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	Chapter
Provisioning	Chassis slots and cards	Chassis Slots and Cards on page 16
	MCMs	MCMs on page 16
	MDAs	MDAs on page 14
	CMAs	CMAs on page 18
	Ports	Ports on page 28
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support on page 375

7710 SR-Series Interfaces

In This Chapter

This chapter provides information about configuring chassis slots, cards, and ports. Topics in this chapter include:

Configuration Overview

NOTE: This document uses the term *preprovisioning* in the context of preparing or preconfiguring entities such as chassis slots, line cards (or Control Forwarding Module (CFM/IOM) cards), MDA carrier modules (MCMs), media dependent adapters (MDAs), compact media adapters (CMAs), ports, and interfaces, prior to initialization. These entities can be installed but not enabled. When the entity is in a `no shutdown` state (administratively enabled), then the entity is considered to be *provisioned*.

Alcatel-Lucent 7710 SR routers provide the capability to configure chassis slots to accept specific line card and MDA 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 card(s) can be inserted into the appropriate chassis slots when required.

The following sections are discussed.

- Chassis Slots and Cards on page 16
- MCMs on page 16
- MDAs on page 17
- CMAs on page 18
- Ports on page 28

Chassis Slots and Cards

To preprovision a chassis slot, the line card type must be specified as well as the MDA/CMA type. System administrators or network operators can enter card type information for each slot, allowing a range of card types in particular slots. From the range of card types, a card and accompanying MDAs/CMAs are specified. When a card is installed in a slot and enabled, the system verifies that the installed card type matches the allowed card type. If the parameters do not match, the card remains offline. A preprovisioned slot can remain empty without conflicting with populated slots.

MCMs

An MCM (MDA Carrier Module) slot must be configured before an MDA (Media Dependant Adapter) can be provisioned. If you provisioning an MDA type before an MCM slot is configured, it is assumed you are provisioning a Compact Media Adapter (CMA). CMAs do not require MCM pre-configuration. Up to six MCMs may be provisioned on a 7710 SR-c12 and up to two on a 7710 SR-c4. Even numbered slots are invalid for MCM installation (MCMs physically span 2 slots; “mcm 1” spans slots 1 and 2)

Refer to the MCM Installation Guide, CMA Installation Guide(s) and MDA Installation Guide(s) for more information on the physical characteristics of each card.

MDAs

A chassis slot, card type and MCM must be specified and provisioned before an MDA can be preprovisioned. An MDA is provisioned when a type designated from the allowed MDA type is inserted. A preprovisioned MDA slot can remain empty without conflicting with populated slots. Up to six MDAs may be provisioned on a 7710 SR-c12 and up to two on a 7710 SR-c4. Even numbered slots are invalid for MDA installation (MDAs physically span 2 slots; "mda 1" spans slots 1 and 2).

MDA output displays an "m" in the name of the card. The following displays a `show card state` command. In this example, an **m60-10/100eth-tx** MDA is installed in slot 1.

```
A:7710-3>config>card# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-12g          iom-12g          up    up                  12
1/1    mcm-v1           mcm-v1           up    up
1/3                     mcm-v1           up    unprovisioned
1/1    m60-10/100eth-tx m60-10/100eth-tx up    up
1/5    c8-10/100eth-tx  c8-10/100eth-tx  up    up
1/6                     c1-1gb-sfp       up    unprovisioned
1/7                     c8-chds1         up    unprovisioned
1/8                     c4-ds3           up    unprovisioned
1/9                     c8-10/100eth-tx  up    unprovisioned
1/10                    c1-1gb-sfp       up    unprovisioned
1/11                    c8-chds1         up    unprovisioned
1/12                    c4-ds3           up    unprovisioned
A      cfm-12g          cfm-12g          up    up                      Active
B      cfm-12g                           up    down                    Standby
===============================================================================
A:7710-3>config>card#
```

Once installed and enabled, the system verifies that the installed MDA type matches the configured parameters. If the parameters do not match, the MDA remains offline.

IPv6

The following MDA types and encapsulations are supported for IPv6:

- ASAP MDA for FR, C-HDLC encapsulations.
- ATM MDA (LLC-SNAP and VC MUX) for both bridged and routed encapsulations.

CMAs

CMAs (Compact Media Adapter) are configured and provisioned in the same manner as MDAs (Media Dependent Adapter). Up to 8 CMAs may be provisioned on a 7710 SR-c12 and up to 4 on a 7710 SR-c4. CMA output displays a “c” in the name of the card. The following displays a `show card state` command. In this example, a **c8-10/100eth-tx** CMA is installed in slot 5.

```
A:7710-3# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned       Equipped         Admin Operational    Num   Num Comments
ID     Type              Type             State State          Ports MDA
-------------------------------------------------------------------------------
1      iom-12g           iom-12g            up    up                 12
1/5    c8-10/100eth-tx   c8-10/100eth-tx    up    up           8
1/6    c8-10/100eth-tx   c8-10/100eth-tx    up    up           8
1/7                      c8-chds1           up    unprovisioned
1/8                      c4-ds3             up    unprovisioned
1/9                      c8-10/100eth-tx    up    unprovisioned
1/10                     c1-1gb-sfp         up    unprovisioned
1/11                     c8-chds1           up    unprovisioned
1/12                     c4-ds3             up    unprovisioned
A      cfm-12g           cfm-12g            up    up                       Active
B      cfm-12g                              up    provisioned              Standby
===============================================================================
A:7710-3#
```

A preprovisioned CMA slot can remain empty without conflicting with populated slots.

Once installed and enabled, the system verifies that the installed CMA type matches the configured parameters. If the parameters do not match, the CMA remains offline.

Note: On the E3 CMA, bit stuffing is not supported in G.751 framing mode. All of the 12 justification service bits and the 4 justification bits contain valid data on the transmitted signal. Incoming bitstreams should contain valid data in the 12 justification service bits and 4 justification bits, otherwise the link will not function.

Future sections and discussions on configuration and provisioning of MDAs also apply to CMAs.

Oversubscribed Ethernet MDAs

The 7710 SR-Series supports oversubscribed Ethernet MDAs/CMAs. These have more bandwidth towards the user than the 5.4 Gbps capacity between the MDA/CMA and CFM.

A traffic management function is implemented on the MDA/CMA to control the data entering the CFM. This function consists of two parts:

- Rate limiting
- Packet classification and scheduling

Rate Limiting

The oversubscribed MDA/CMA limits the rate at which traffic can enter the MDA/CMA on a per port basis. If a port exceeds its configured limits then the excess traffic will be discarded, and 802.3x flow control frames (pause frames) are generated.

Packet Classification and Scheduling

The classification and scheduling function implemented on the oversubscribed MDA/CMA ensures that traffic is correctly prioritized when the bus from the MDA/CMA to the CFM is overcommitted. This could occur if the policing parameters configured are such that the sum of the traffic being admitted into the MDA/CMA is greater than 10 Gbps.

The classification function uses the bits set in the DSCP or dot1p fields of the customer packets to perform classification. It can also identify locally addressed traffic arriving on network ports as Network Control packets. This classification on the oversubscribed MDA/CMA uses following rules:

- If the service QoS policy for the SAP (port or VLAN) uses the default classification policy, all traffic will be classified as Best Effort (`be`).
- If the service QoS policy for the SAP contains a dot1p classification, the dot1p field in the customer packets is used for classification on the MDA/CMA.
- If the service QoS policy for the SAP contains a DSCP classification, the DSCP field in the customer packets is used for classification on the MDA/CMA.
- If a mix of dot1p and DSCP classification definitions are present in the service QoS policy then the field used to perform classification will be the type used for the highest priority definition. For example, if High Priority 1 is the highest priority definition and it specifies that the DSCP field should be used, then the DSCP field will be used for classification on the MDA/CMA and the dot1p field ignored.

- If the service QoS policy for the SAP specifies IP or MAC filters for forwarding class identification, then traffic will be treated as Best Effort. Full MAC or IP classification is not possible on the MDA/CMA (but is possible on the CFM).
- The packet is classified into 16 classes. Typically, these are the eight forwarding classes and each packet is assigned one priority per forwarding class. After classification, the packet is offered to the MDA queuing model. This queuing model is limited to three queues each having four thresholds. These thresholds define whether an incoming packet, after classification, is accepted in the queue or not. Table 2 displays typical mapping of classes onto queues/threshold.

Table 2: Typical Mapping Of Classes Onto Queues/Threshold

Counter	{Queue	Threshold	Traffic Class }
0	{2	3	"fc-nc / in-profile"}
1	{2	2	"fc-nc / out-profile"}
2	{2	1	"fc-h1 / in-profile"}
3	{2	0	"fc-h1 / out-profile"}
4	{1	3	"fc-ef / in-profile"}
5	{1	2	"fc-ef / out-profile"}
6	{1	1	"fc-h2 / in-profile"}
7	{1	0	"fc-h2 / out-profile"}
8	{0	3	"fc-l1 / in-profile"}
9	{0	3	"fc-l1 / out-profile"}
10	{0	2	"fc-af / in-profile"}
11	{0	2	"fc-af / out-profile"}
12	{0	1	"fc-l2 / in-profile"}
13	{0	1	"fc-l2 / out-profile"}
14	{0	0	"fc-be / in-profile"}
15	{0	0	"fc-be / out-profile"}

A counter is associated with each mapping. Note that the above is an example and is dependent on the type of classification (such as dscp-exp, dot1p, etc.).

When the threshold of a particular class is reached, packets belonging to that class will not be accepted in the queue. The packets will be dropped and the associated counter will be incremented.

The scheduling of the three queues is done in a strict priority, highest priority basis is associated with queue 0. This means that scheduling is done at queue level, not on the class that resulted from the classification. As soon as a packet has been accepted by the queue there is no way to differentiate it from other packets in the same queue (for example, another classification result not exceeding its threshold). All packets queued in the same queue will have the same priority from a scheduling point of view.

DS-3/E-3

Each 4-port or 12-port channelized DS-3/E-3 media dependent adapter (MDA) supports channelization down to digital signal level 0 (DS-0) using a maximum of 8 or 24 (respectively) 1.0/2.3 coaxial connectors. Each port consists of one receive (RX) coaxial connector and one transmit (TX) coaxial connector.

Each physical DS-3 connection can support a full clear-channel DS-3, or it can be channelized into independent DS-1/E-1 data channels. Each DS1/E1 channel can then be further channelized down to DS-0s. E-3 ports do not support channelization. They only support clear channel operation.

Each DS-3/E-3 MDA supports 512 channels with DS-0 timeslots that are used in the DS-1/E-1 channel-group.

Channelized OC-12/STM-4

Each 1-port channelized OC-12/STM-4 MDA supports channelization down to DS-0 and accepts one OC-12/STM-4 SFP small form factor pluggable (SFP) module. The same SFP optics used on Alcatel-Lucent's SONET/SDH cards can be used on the channelized OC-12/STM-4 MDA.

Each channelized OC-12/STM-4 supports 512 channels with DS-0 timeslots that are used in the DS-1/E-1 channel-group. DS-3 TDM channels can be further channelized to DS-1/E-1 channel groups. An E3 TDM channel cannot be channelized and can only be configured in clear channel operation.

Channelized DS-3/E-3 ASAP MDA (4-Port)

The 4-port MDA provides 4 ports configurable as DS-3 or E-3. The MDA has eight (8) 1.0/2.3 connectors and accepts up to eight (8) DS-3/E-3 coax patch cables.

Each physical DS-3 connection can support a full clear-channel DS-3, or it can be channelized into independent DS-1/E-1 data channels. Each DS-1/E-1 channel can then be further channelized down to DS-0s. E-3 ports do not support channelization, only clear channel operation.

Channelized MDA/CMA Support

Channelized DS1/E1

Each 8-port channelized DS1/E1 CMA supports channelization down to DS0. Each 8-port channelized DS1/E1 CMA supports 64 channel groups.

Channelized CHOC-3/STM-1

Each 1-port channelized OC-3/STM-1 MDA supports channelization down to DS-0 and accepts one OC-3/STM-1 SFP small form factor pluggable (SFP) module. The same SFP optics used on Alcatel-Lucent’s SONET/SDH cards can be used on the channelized OC-3/STM-1 MDA.

Each channelized OC-3/STM-1 supports 512 channels with DS-0 timeslots that are used in the DS-1 channel-group.

Channelized OC-12/STM-4 ASAP MDA

The 1-port channelized OC-12/STM-4 variant of the ASAP MDA has features and channelization options similar to the existing 4-port channelized OC-3/STM-1 ASAP MDA.

DS-3 TDM channels can be further channelized to DS-1/E-1 channel groups. An E-3 TDM channel cannot be channelized and can only be configured in clear channel operation.

Channelized DS-3/E-3 ASAP MDA (4-Port)

The 4-port MDA provides 4 ports configurable as DS-3 or E-3. The MDA has eight (8) 1.0/2.3 connectors and accepts up to eight (8) DS-3/E-3 coax patch cables.

Each physical DS-3 connection can support a full clear-channel DS-3, or it can be channelized into independent DS-1/E-1 data channels. Each DS-1/E-1 channel can then be further channelized down to DS-0s. E-3 ports do not support channelization, only clear channel operation.

Channelized DS-3/E-3 ASAP MDA (12-Port)

The 12-port MDA provides 12 ports configurable as DS-3 or E-3. The MDA has twenty-four (24) 1.0/2.3 connectors and accepts up to twenty-four (24) DS-3/E-3 coax patch cables.

Each physical DS-3 connection can support a full clear-channel DS-3, or it can be channelized into independent DS-1/E-1 data channels. Each DS-1/E-1 channel can then be further channelized down to DS-0s. E-3 ports do not support channelization, only clear channel operation.

Channelized OC- 3/STM-1 CES MDA

The 1-port channelized OC-3/STM-1 CES MDA provides industry leading consolidation for DS1, E1 and n*64kbps for Circuit Emulation Services (CES). Two modes of circuit emulation are supported: unstructured and structured. Unstructured mode is supported for DS1 and E1 channels as per RFC4553 and MEF-8. Structured mode is supported for n*64 kbps circuits as per RFC5086 and MEF-8. Each DS1 or E1 channel can be independently configured to be loop-timed, node-timed, adaptive-timed or differential-timed.

Digital Diagnostics Monitoring

Some Alcatel-Lucent SFPs and XFPs have Digital Diagnostics Monitoring (DDM) capability where the transceiver module maintains information about its working status in device registers including:

- Temperature
- Supply voltage
- Transmit (TX) bias current
- TX output power
- Received (RX) optical power

The transceiver is also programmed with warning and alarm thresholds for low and high conditions that can generate system events. These thresholds are programmed by the transceiver manufacturer.

There are no CLI commands required for DDM operations, however, the **show>port** ***port-id*** **detail** command displays DDM information in the Transceiver Digital Diagnostics Monitoring output section.

DDM information is populated into the router's MIBs, so the DDM data can be retrieved by Network Management using SNMP. Also, RMON threshold monitoring can be configured for the DDM MIB variables to set custom event thresholds if the factory-programmed thresholds are not at the desired levels.

Following are potential uses of the DDM data:

- Optics degradation monitoring — With the information returned by the DDM-capable optics module, degradation in optical performance can be monitored and trigger events based on custom or the factory-programmed warning and alarm thresholds.
- Link/router fault isolation — With the information returned by the DDM-capable optics module, any optical problem affecting a port can be quickly identified or eliminated as the potential problem source.

Supported real-time DDM features are summarized in Table 3.

Table 3: Real-Time DDM Information

Parameter	User Units	SFP/XFP Units	SFP	XFP
Temperature	Celsius	C	Supported	Supported
Supply Voltage	Volts	µV	Supported	Supported
TX Bias Current	mA	µA	Supported	Supported
TX Output Power	dBm (converted from mW)	mW	Supported	Supported
RX Received Optical Power4	dBm (converted from dBm) (Avg Rx Power or OMA)	mW	Supported	Supported
AUX1	parameter dependent (embedded in transceiver)	-	Not supported	Supported
AUX2	parameter dependent (embedded in transceiver)	-	Not supported	Supported

The factory-programmed DDM alarms and warnings that are supported are summarized in Table 4.

Table 4: DDM Alarms and Warnings

Parameter	SFP/XFP Units	SFP	XFP	Required?
Temperature - High Alarm - Low Alarm - High Warning - Low Warning	C	Yes	Yes	Yes
Supply Voltage - High Alarm - Low Alarm - High Warning - Low Warning	µV	Yes	Yes	Yes
TX Bias Current - High Alarm - Low Alarm - High Warning - Low Warning	µA	Yes	Yes	Yes

Table 4: DDM Alarms and Warnings

Parameter	SFP/XFP Units	SFP	XFP	Required?
TX Output Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes
RX Received Optical Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes
AUX1 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes
AUX2 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes

Alcatel-Lucent SFPs and XFPs

The availability of the DDM real-time information and warning/alarm status is based on the transceiver. It may or may not indicate that DDM is supported. Although some Alcatel-Lucent SFPs support DDM, Alcatel-Lucent has not required DDM support in releases prior to Release 6.0. Non-DDM and DDM-supported SFPs are distinguished by a specific ICS value.

For Alcatel-Lucent SFPs that do not indicate DDM support in the ICS value, DDM data is available although the accuracy of the information has not been validated or verified.

For non-Alcatel-Lucent transceivers, DDM information may be displayed, but Alcatel-Lucent is not responsible for formatting, accuracy, etc.

Statistics Collection

The DDM information and warnings/alarms are collected at one minute intervals, so the minimum resolution for any DDM events when correlating with other system events is one minute.

Ports

Port Types

Before a port can be configured, the slot must be provisioned with a card type and MDA type specified.

The Alcatel-Lucent 7710 SR-Series routers support the following port types:

- Ethernet — Supported Ethernet port types include Fast Ethernet (10/100BASE-T) and Gigabit (1000BASE-T) ports on an appropriate MDA. 7710 SR ports must be configured as either access or network. The default is network.
  - → Access ports — Configured for customer facing traffic on which services are configured. If a Service Access Port (SAP) is to be configured on the port or channel, it must be configured as an access port or channel. When a port is configured for access mode, the appropriate encapsulation type must be configured to distinguish the services on the port or channel. Once a port has been configured for access mode, one or more services can be configured on the port or channel depending on the encapsulation value.
  - → Network ports — Configured for network facing traffic. Network ports participate in the service provider transport or infrastructure network. The encapsulation type cannot be specified on a network port.
- SONET-SDH and TDM — Supported SONET-SDH and TDM port types include:
  - → DS3/E3
  - → OC3/STM-1

  A SONET/SDH port/path or a TDM port/channel can be configured with the following encapsulations depending on the MDA type:

  - → ATM

  Some MDAs support ATM encapsulation on SONET/SDH and TDM ports. The ATM cell format and, where applicable, ATM cell mapping, can be configured for either UNI or NNI cell format. The format is configurable on a SONET/SDH or TDM port/channel path basis. All VCs on a path, channel or port must use the same cell format.

  - → Frame Relay
  - → PPP
  - → cHDLC
- Several Alcatel-Lucent Media Dependent Adapters (MDAs) support channelization down to the DS0 level. ATM, Frame Relay, PPP, and cHDLC are supported encapsulations on channelized ports.
- Link Aggregation (LAG) — LAG can be used to group up to eight ports into one logical link. The aggregation of multiple physical links allows for load sharing and offers

seamless redundancy. If one of the links fails, traffic will be redistributed over the remaining links. Up to 8 links can be supported in a single LAG, up to 64 LAGs can be configured on a node.

- Multilink Bundles — A multilink bundle is a collection of channels on channelized ports that physically reside on the same MDA. Multilink bundles are used by providers who offer either bandwidth-on-demand services or fractional bandwidth services (fraction of a DS3/E3 for example). Multilink bundles are supported over PPP channels (MLPPP).
- APS — Automatic Protection Switching (APS) is a means to provide redundancy on SONET equipment to guard against linear uni or bi-directional failures. The network elements (NEs) in a SONET/SDH network constantly monitor the health of the network. When a failure is detected, the network proceeds through a coordinated predefined sequence of steps to transfer (or switchover) live traffic to the backup facility (called protection facility.) This is done very quickly to minimize lost traffic. Traffic remains on the protection facility until the primary facility (called working facility) fault is cleared, at which time the traffic may optionally be reverted to the working facility.
  → APS 1+1 — A redundant protection line can be configured for every working line.
- Bundle Protection Group (BPGrp) — A BPGrp is a collection of two bundles created on the APS Group port. Working bundle resides on the working circuit of the APS group, while protection bundle resides on the protection circuit of the APS group. APS protocol running on the circuits of the APS Group port monitors the health of the Sonet/SDH line and based on it or administrative action moves user traffic from one bundle to another in the group as part of an APS switch.

Port Features

Multilink Point-to-Point Protocol

Multilink point-to-point protocol is defined in the IETF RFC 1990, *The PPP Multilink Protocol (MP)*, and provides a way to distribute data across multiple links within an MLPPP bundle to achieve high bandwidth. MLPPP allows for a single frame to be fragmented and transmitted across multiple links. This allows for lower latency and also allows for a higher maximum receive unit (MRU).

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

1. The system offering the option is capable of combining multiple physical links into one logical link;
2. The system is capable of receiving upper layer protocol data units (PDU) fragmented using the MP header (described later) and reassembling the fragments back into the original PDU for processing;
3. 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.

Once 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 Ox003d. Figure 1 and Figure 2 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 PPP in HDLC-like framing [RFC 1662]. MP frames use the same HDLC address and control pair value as PPP, namely: Address - OxFF and Control - Ox03. The two octet protocol field is also structured the same as in PPP encapsulation.

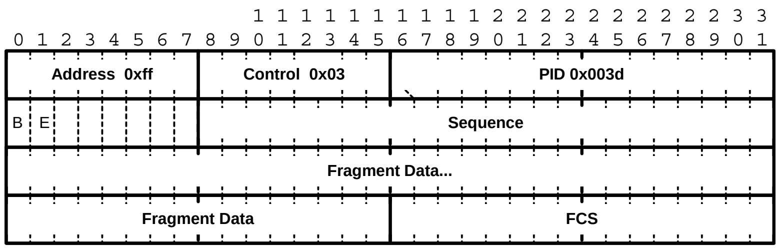

Figure 1: MLPPP 24-bit Fragment Format

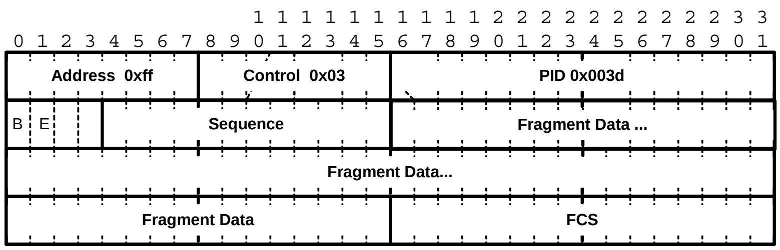

Figure 2: MLPPP 12-bit Fragment Format

The required and default format for MP is the 24-bit format. During the LCP state the 12-bit format can be negotiated. The SR-series routers should be capable of supporting and negotiating the alternate 12-bit frame format.

Protocol Field (PID)

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

A PID of Ox003d 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 below.

B & E Bits

The B&E bits are used to indicate the epoch of a packet. Ingress packets to the MLPPP process will have an MTU, which may or may not be larger than the MRRU of the MLPPP network. The B&E bits manage the fragmentation of ingress packets when it 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 true (=1).

Sequence Number

Sequence numbers can be either 12 or 24 bits long. The sequence number is zero for the first fragment on a newly constructed AVC 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 desired unbundled flow through processing of the received sequence numbers and B&E bits. For a detailed description of the algorithm refer to RFC 1990.

Information Field

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

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

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 not be added to any but the last fragment (i.e. E-bit set true).

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 transmitted in more than one fragment.

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 than PPP and therefore the following options are set for MP and 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.

Link Fragmentation and Interleaving Support

Link Fragmentation and Interleaving (LFI) provides the ability to interleave high priority traffic within a stream of fragmented lower priority traffic. This feature helps avoid excessive delays to high priority, delay-sensitive traffic over a low-speed link. This can occur if this traffic type shares a link with lower priority traffic that utilizes much larger frames. Without this ability, higher priority traffic must wait for the entire packet to be transmitted before being transmitted, which could result in a delay that is too large for the application to function properly

For example, if VoIP traffic is being sent over a DS1 or fractional DS1 which is also used for Best Effort Internet traffic, LFI could be used so the small (usually 64-128B) VoIP packets can be transmitted between the transmission of fragments from the lower priority traffic.

Figure 3 shows the sequence of events as low priority and high priority frames arrive and are handled by LFI.

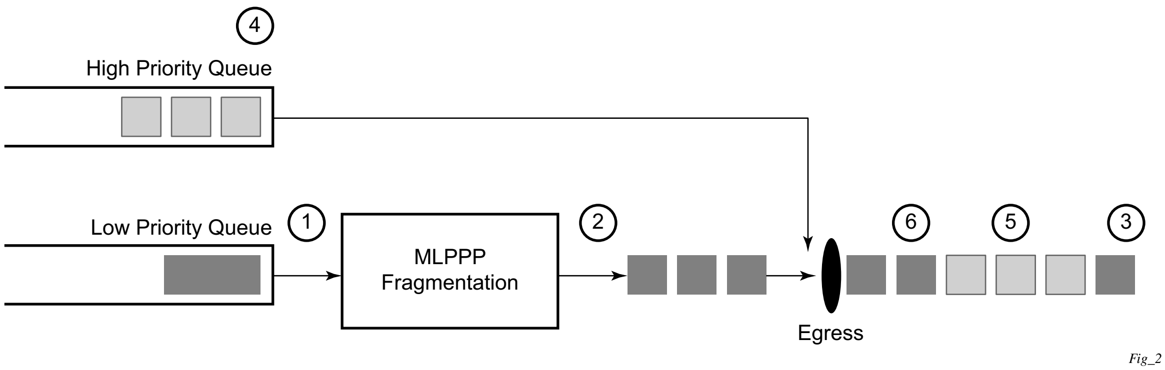

Figure 3: Frame Sequence of Events

1. A low priority frame arrives in the low priority queue. At this particular instant, there are no packets in the high priority queue so low priority frame is de-queued and passed to the fragmentation mechanism for MLPPP (or MLFR in the future).
2. The original packet is divided into 'n' fragments based on the size of the packet and the fragment threshold configuration.
3. The fragments are then transmitted out the egress port.
4. After the transmission of the fragments has begun, high priority frames arrive in the high priority queue.
5. The transmission of the remaining fragments stops and the high priority packets are transmitted out the egress interface. Note that high priority packets are not fragmented.
6. When the high priority traffic is transmitted, the remaining lower priority fragments are then transmitted.

On the ingress side, LFI requires that the ingress port can receive non-fragmented packets within the fragment stream and pass these packets directly on to the forwarding engine and then continue with the reassembly process for the fragmented frames.

Multi-Class MLPPP

Multi-class MLPPP (MC-MLPPP) allows for the prioritization of multiple types of traffic flowing between the cell site routers and the mobile operator's aggregation routers. MC-MLPPP is an extension of the MLPPP standard which allows multiple classes of service to be transmitted over a MLPPP bundle. Originally (Figure 4), link fragmentation and interleaving (LFI) was added to MLPPP that allowed two classes, but in some applications, two classes of service can be insufficient.

The MLPPP header includes two class bits to allow for up to four classes of service (Figure 5). This enhancement to the MLPPP header format is detailed in RFC 2686, *The Multi-Class Extension to Multi-Link PPP*. This allows multiple classes of services over a single MLPPP connection and allows the highest priority traffic to be transmitted over the MLPPP bundle with minimal delay regardless of the order in which packets are received.

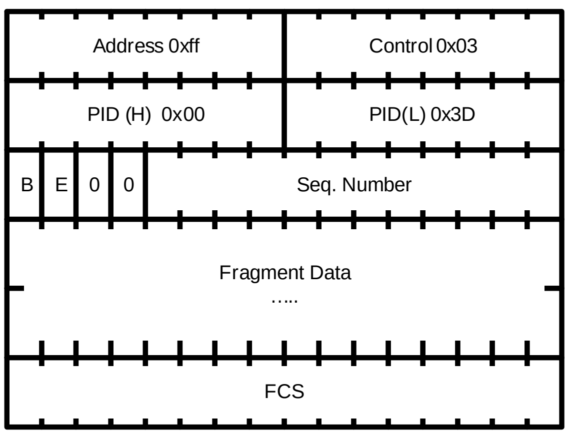

Figure 4: Original MLPPP Header Format

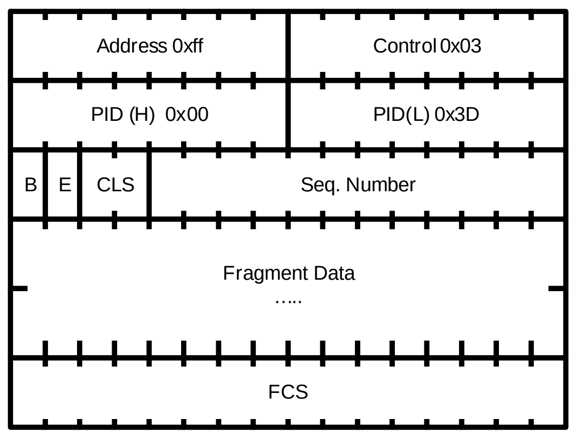

Figure 5: MC-MLPPP Short Sequence Header Format

The new MC-MLPPP header format uses the two (previously unused) bits before the sequence number as the class identifier. This allows four distinct classes of service to be identified into separate re-assembly contexts.

QoS in MC-MLPPP

If the user enables the multiclass option under an MLPPP bundle, the MDA egress data path provides a queue for each of the 4 classes of MLPPP. 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 and hence which of the four egress MDA queues to store the packet. The mapping of forwarding class to MLPPP class is a function of the user configurable number of MLPPP classes. The default mapping for a 4-class, 3-class, and 2-class MLPPP bundle is shown in Table 5.

Table 5: Default Packet Forwarding Class to MLPPP Class Mapping

FC ID	FC Name	Scheduling Priority (Default)	MLPPP Class 4-class bundle	MLPPP Class 3-class bundle	MLPPP Class 2-class bundle
7	NC	Expedited	0	0	0
6	H1	Expedited	0	0	0
5	EF	Expedited	1	1	1
4	H2	Expedited	1	1	1
3	L1	Non-Expedited	2	2	1
2	AF	Non-Expedited	2	2	1
1	L2	Non-Expedited	3	2	1
0	BE	Non-Expedited	3	2	1

Table 6 shows a different mapping enabled when the user applies one of three pre-defined egress QoS profiles in the 4-class bundle configuration only.

Table 6: Packet Forwarding Class to MLPPP Class Mapping

FC ID	FC Name	Scheduling Priority (Default)	MLPPP Class (MLPPP Egress QoS profile 1, 2, and 3)
7	NC	Expedited	0
6	H1	Expedited	0
5	EF	Expedited	1
4	H2	Expedited	2
3	L1	Non-Expedited	2
2	AF	Non-Expedited	2
1	L2	Non-Expedited	2
0	BE	Non-Expedited	3

The MLPPP class queue parameters and its scheduling parameters are also configured by applying one of the three pre-defined egress QoS profiles to an MLPPP bundle.

Table 7 and Figure 6 provide the details of the class queue threshold parameters. Packets marked with a high drop precedence, such as out-of-profile, by the service or network ingress QoS policy will be discarded when any class queue reaches the OOP threshold. Packet with a low drop precedence marking, such as in-profile, will be discarded when any class queue reaches the max threshold.

Table 7: MLPPP Class Queue Threshold Parameters

	Class 0		Class 1		Class 2		Class 3	
Queue Threshold (in ms @ Available bundle rate)	Max	Oop	Max	Oop	Max	Oop	Max	Oop
2-Class Bundle Default Egress QoS Profile	250	125	750	375	N/A	N/A	N/A	N/A
3-Class Bundle Default Egress QoS Profile	50	25	200	100	750	375	N/A	N/A
4-Class Bundle Default Egress QoS Profile	10	5	50	25	150	75	750	375
4-Class Bundle Egress QoS Profile 1	25	12	5	3	200	100	1000	500
4-Class Bundle Egress QoS Profile 2	25	12	5	3	200	100	1000	500
4-Class Bundle Egress QoS Profile 3	25	12	5	3	200	100	1000	500

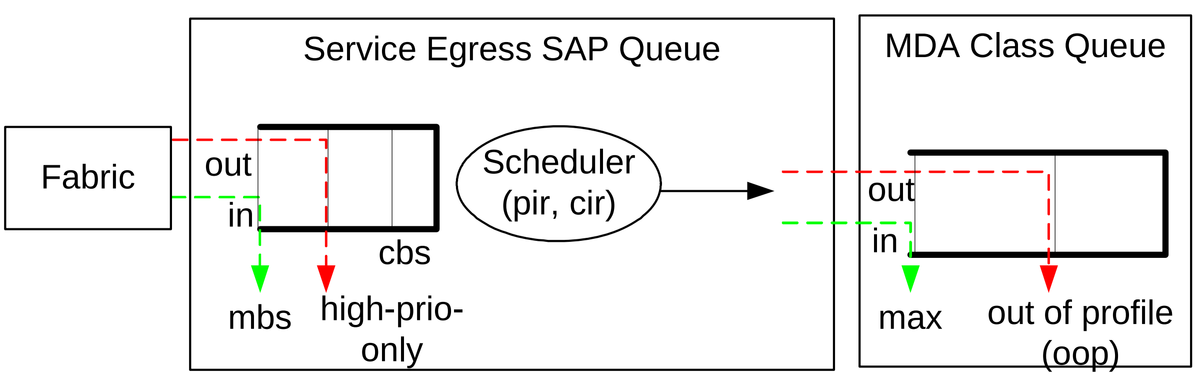

Figure 6: MLPPP Class Queue Thresholds for In-Profile and Out-of-Profile Packets

Table 8 and Table 7 provide the details of the class queue scheduling parameters.

Table 8: MLPPP Class Queue Scheduling Parameters

4-class MLPPP Egress QoS Profile	WRR Parameters			
	MIR	W1	W2	W3
Profile 1	85%	<1%	66%	33%
Profile 2	90%	<1%	89%	10%
Profile 3	85%	<1%	87%	12%

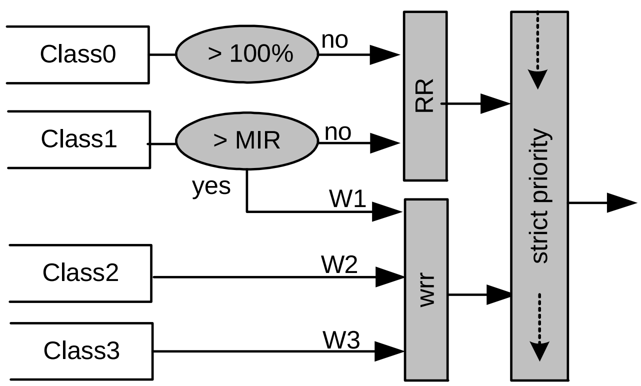

Figure 7: MLPPP Class Queue Scheduling Scheme

Note that all queue threshold and queue scheduling parameters are adjusted to the available bundle rate. If a member link goes down or a new member link is added to the bundle, the scheduling parameters MIR, W1, W2, W3, as well as the per class queue thresholds OOP and max are automatically adjusted to maintain the same values.

Class 0 queue is serviced at MLPPP at available bundle rate. Class 1 queue is guaranteed a minimum service rate but is allowed to share additional bandwidth with class 2 and 3 queues based on the configuration of WRR weight W1.

Class queues 2 and 3 can be given bandwidth guarantee by limiting MIR of class 1 queue to less than 100% and by setting the WRR weights W1, W2, and W3 to achieve the desired bandwidth distribution among all three class queues.

Note that there is one queue per bundle member link to carry link control packets, such as LCP: PPP, and which are serviced with strict priority over the 4 class queues (not shown).

In the default 2-class, 3-class, and 4-class egress QoS profile, the class queues are service with strict priority in ascending order of class number.

Ingress MLPPP Class Reassembly

For a MLPPP bundle with the multi-class option enabled, there is a default profile for setting the re-assembly timer value for each class. When the pre-defined MLPPP ingress QoS profile 1 is applied to a 4-class bundle, the values of the timers are modified as shown in Table 9.

Table 9: MLPPP Ingress QoS Profile: Reassembly Timers (msec)

	Class 0	Class 1	Class 2	Class 3
MLPPP ingress QoS default profile (2, 3, and 4-Class bundle)	25	25	25	25
MLPPP ingress QoS profile 1 (4-class bundle)	10	10	100	1000

Cisco HDLC

Cisco HDLC (cHDLC) is an encapsulation protocol for information transfer. It is a bit-oriented synchronous data-link layer protocol that specifies a data encapsulation method on synchronous serial links using frame characters and checksums.

cHDLC monitors line status on a serial interface by exchanging keepalive request messages with peer network devices. It also allows routers to discover IP addresses of neighbors by exchanging Serial Link Address Resolution Protocol (SLARP) (see SLARP on page 41) address-request and address-response messages with peer network devices.

The basic frame structure of a cHDLC frame is shown in Table 10. This frame structure is similar to PPP in an HDLC-link frame (RFC 1662, *PPP in HDLC-like Framing*). The differences to PPP in and HDLC-like frames are in the values used in the address, control, and protocol fields.

Table 10: cHDLC I-Frame

Flag	Address	Control	Protocol	Information Field	FCS
0x7E	0x0F/0x8F	0x00	—	—	16/32 bits

- Address field — The values of the address field include: 0x0F (unicast), 0x8F (broadcast).
- Control field — The control field is always set to value 0x00.
- Protocol field — The following values are supported for the protocol field:

Table 11: cHDLC Protocol Fields

Protocol	Field Value
IP	0x0800
Cisco SLARP	0x8035
ISO CLNP/ISO ES-IS DSAP/SSAP1	0xFEFE

- Information field — The length of the information field is in the range of 0 to 9Kbytes.
- FCS field — The FCS field can assume a 16-bit or 32-bit value. The default is 16-bits for ports with a speed equal to or lower than OC-3, and 32-bits for all other ports. The FCS for cHDLC is calculated in the same manner and same polynomial as PPP.

SLARP

An Alcatel-Lucent cHDLC interface will transmit a SLARP address resolution reply packet in response to a received SLARP address resolution request packet from peers. An Alcatel-Lucent cHDLC interface will not transmit SLARP address resolution request packets.

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, it 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.

There is interaction between the SLARP address resolution protocol and the SLARP keepalive protocol. When one end of a serial line receives a SLARP address resolution request packet, it assumes that the other end has restarted its serial interface and resets its keepalive sequence numbers. In addition to responding to the address resolution request, it will act as if the other end had sent it a keepalive packet with a sequence number of zero, and a returned sequence number the same as the returned sequence number of the last real keepalive packet it received from the other end.

SONET/SDH Scrambling and C2-byte

SONET/SDH scrambling and overhead for cHDLC follow the same rules used for POS (RFC 2615, *PPP over SONET/SDH*).

The two key SONET/SDH parameters are scrambling and signal-label (C2-byte). Scrambling is off by default. The default value of the C2-byte is 0xCF. These two parameters can be modified using the CLI. The other SONET overhead values (for example, j0) follow the same rules as the current POS implementation.

Timers

Cisco HDLC (cHDLC) has two timers associated with the protocol, the keepalive interval and the timeout interval. The keepalive interval is used to send periodic keepalive packets. The receiver process expects to receive a keepalive packet at the rate specified by the keepalive interval. The link is declared down if the receiver process does not receive a keepalive within the timeout interval. The link is declared up when the number of continual keepalive packets received equals the up-count.

It is recommended that the nodes at the two endpoints of the cHDLC link are provisioned with the same values.

Automatic Protection Switching (APS)

APS is designed to protect SONET/SDH equipment from linear uni or bi-directional failures. The Network Elements (NEs) in a SONET/SDH network constantly monitor the health of the network. When a failure is detected, the network proceeds through a coordinated predefined sequence of steps to transfer (or switchover) live traffic to the backup facility (protection facility). This happens very quickly to minimize lost traffic. Traffic remains on the protection facility until the primary facility (working facility) fault is cleared, at which time the traffic may optionally be reverted to the working facility.

This section discusses the different APS architectures and their implementations.

- APS 1+1 on page 43
  - → K1 byte on page 44
  - → K2 Byte on page 45
  - → APS Protection Switching Byte Failure on page 46
  - → APS Channel Mismatch Failure on page 46
  - → APS Mode Mismatch Failure on page 46
  - → APS Far-End Protection Line Failure on page 47
  - → 1+1 Switch Operation Example on page 47
  - → APS 1+1 Protection and Working Port Management Operations on page 49

APS 1+1

The 7710 SR supports the 1+1 architecture. When the 1+1 architecture is implemented, the active OC-N signal is permanently transmitted to both the working and protection ports so, in the egress direction, the same payloads are transmitted identically to the working and protection ports. However, in the ingress direction, the working and protection signals are selected independently. The 7710 SR only transmits data on the active circuit. For a single failure, this may cause a data hit up to 100 milliseconds.

The APS channel (bytes K1 and K2 in the SONET header) is used to exchange requests and acknowledgments for protection switch actions. The bit assignment for the K1 and K2 bytes is defined in the following sections:

- K1 byte
- K2 Byte

K1 byte

The switch priority of a request is assigned as indicated by bits 1 through 4 of the K1 byte.

Table 12: K1 Byte, Bits 1-4: Type of Request

Bit 1234	Condition
1111	Lockout of protection
1110	Force switch
1101	SF - High priority
1100	SF - Low priority
1011	SD - High priority
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

The channel requesting switch action is assigned by bits 5 through 8. When channel number 0 is selected, the condition bits show the received protection channel status. When channel number 1 is selected, the condition bits show the received working channel status. The Alcatel-Lucent 7710 SR-Series supports only channel values of 0 and 1.

Table 13 displays bits 5-8 of a K1 byte and K2 Bits 1-4 and the channel number code assignments.

Table 13: K1 Byte, Bits 5-8 (and K2 Bits 1-4), Channel Number Code Assignments

Channel Number Code	Channel and Notes
0	Null channel. SD and SF requests apply to conditions detected on the protection line. For 1+1 systems, Forced and Request Switch requests apply to the protection line. Only code 0 is used with Lockout of Protection request.
1-14	Working channel. Only code 1 applies in a 1+1 architecture. Codes 1 through n apply in a 1:n architecture. SD and SF conditions apply to the corresponding working lines.
15	Extra traffic channel. May exist only when provisioned in a 1:n architecture. Only No Request is used with code 15.

K2 Byte

The K2 byte is used to indicate the bridging actions performed at the line-terminating equipment (LTE), the provisioned architecture and mode of operation.

The bit assignment for the K2 byte is listed in Table 14.

Table 14: K2 Byte Functions

Bits 1-8	Function	
1-4	Channel number. The 7710 SR supports only values of 0 and 1.	
5	0	Provisioned for 1+1 mode.
	1	Provisioned for 1:n mode.
6-8	111	Line AIS
	110	Line RDI
	101	Provisioned for bi-directional switching
	100	Provisioned for uni-directional switching
	011	(reserved for future use)
	010	(reserved for future use)
	001	(reserved for future use)
	000	(reserved for future use)

APS Protection Switching Byte Failure

An APS Protection Switching Byte (APS-PSB) 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 3 consecutive frames (depending on the interface type (framer) used, the 7710 SR may not be able to strictly enforce the 3 frame check per GR-253 and G.783/G.841) and it is either an unused code or irrelevant for the specific switching operation. An inconsistent APS byte defect occurs when no three consecutive received K1 bytes of the last 12 frames are the same.

If the failure detected persists for 2.5 seconds, a Protection Switching Byte alarm is raised. When the failure is absent for 10 seconds, the alarm is cleared. This alarm can only be raised by the active port operating in bi-directional mode.

APS Channel Mismatch Failure

An APS channel mismatch failure (APS-CM) identifies that there is a channel mismatch between the transmitted K1 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 three identical K1 bytes are sent. The monitoring for this condition is continuous, not just when the transmitted value of K1 changes.

If the failure detected persists for 2.5 seconds, a channel mismatch failure alarm is raised. When the failure is absent for 10 seconds, the alarm is cleared. This alarm can only be raised by the active port operating in a bi-directional mode.

APS Mode Mismatch Failure

An APS mode mismatch failure (APS-MM) can occur for two reasons. The first is if the received K2 byte indicates that 1:N protection switching is being used by the far-end of the OC-N line, while the near end uses 1+1 protection switching. The second is if the received K2 byte indicates that uni-directional mode is being used by the far-end while the near end uses bi-directional mode. This defect is detected within 100 ms of receiving a K2 byte that indicates either of these conditions.

If the failure detected persists for 2.5 seconds, a mode mismatch failure alarm is raised. Upon declaring this failure, if the defect indicates that the far-end is configured for a uni-directional mode, the local end stops sending K bytes since the 7710 SR currently only supports bi-directional switching mode. However, it continues to monitor the received K2 byte, and should it ever indicate that the far-end has switched to a bi-directional mode the mode mismatch failure clearing process starts.

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

APS Far-End Protection Line Failure

An APS far-end protection line (APS-FEPL) failure corresponds to the receipt of a K1 byte in 3 consecutive frames that indicates a signal fail (SF) at the far end of the protection line. This forces the received signal to be selected from the working line.

If the failure detected persists for 2.5 seconds, a far-end protection line failure alarm is raised. When the failure is absent for 10 seconds, the alarm is cleared. This alarm can only be raised by the active port operating in a bi-directional mode.

1+1 Switch Operation Example

Table 15 outlines the steps that a bi-directional protection switching process will go through during a typical automatic switch.

Table 15: Actions for the Bi-directional Protection Switching Process

Status	APS Commands Sent in K1 and K2 Bytes on Protection Line		Action	
	B -> A	A -> 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->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

Differences in SONET/SDH Standards

SONET and SDH standards are slightly different with respect to the behavior of K1 and K2 Bytes. Table 16 depicts the differences between the two standards.

Table 16: Differences between SONET and SDH standards

	SONET	SDH	Comments
SONET/SDH standards use different codes in the transmitted K1 byte (bits 1-4) to notify the far-end of a signal fail/signal degrade detection.	1100 for signal fail 1010 for signal degrade 1101 unused 1011 unused	1101 for signal fail 1011 for signal degrade 1100 unused 1010 unused	None
SONET systems signal the switching mode in bits 5-8 of the K2 byte whereas SDH systems do not signal at all.	101 for bi-dir 100 for uni-dir	Not used. 000 is signaled in bits 5 to 8 of K2 byte for both bi-directional as well as uni-directional switching.	SONET systems raise a mode mismatch alarm as soon as a mismatch in the Tx and Rx K2 byte (bits 5 to 8) is detected. SDH systems do not raise the mode mismatch alarm.

APS 1+1 Protection and Working Port Management Operations

Switching Modes

The APS protocol utilizes K1 and K2 bytes of the SONET/SDH header to exchange commands and replies between the near-end and far-end. An APS 1+1 system supports the bi-directional mode.

The 7710 SR-Series only transmits user traffic on an active circuit. This may add to a network outage during an APS switch. The 7710 SR-Series supports APS bi-directional mode. In bi-directional mode a failure of the signal in either direction causes both near-end and far-end equipment to switch to the protection lines.

In bi-directional mode, the highest priority local request is compared to the remote request (received from the far-end node using an APS command), and whichever has the greater priority is selected. The relative priority of all events that affect APS 1+1 protection is listed in the Table 15 on page 47 in descending order. The requests can be automatically initiated (such as signal failure or signal degrade), external (such as lockout, forced switch, request switch), and state requests (such as revert-time timers, etc.).

Revertive Mode

The APS 1+1 system also provides the revertive and non-revertive modes where non-revertive switching is the default option. The user can configure the switch of activity between the working and protection lines to be either revertive or non-revertive. In revertive switching, 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 switching, a switch to the protection line is maintained even after the working line has recovered from a failure (or if the manual switch is cleared).

A revert-time is defined for revertive switching so frequent automatic switches as a result of intermittent failures are prevented. The revert-time is a user-provisioned entity with a period of 0 to 60 minutes in 1-minute increments. A change in this value takes effect upon the next initiation of the wait to restore (WTR) timer. It 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.

In case of failure on both working and the protection line, the line that has less severe errors on the line will be active at any point in time. If there is signal degrade on both ports, the active port that failed last will stay active. When there is signal failure on both ports, the working port will always be active. The reason is that the signal failure on the protection line is of a higher priority than on the working line.

Mirroring Support

Mirroring parameters configured on a specific port or service, are maintained during an APS failover.

APS User-Initiated Requests

Lockout Protection

The lockout of protection disables the use of the protection line. Since the **tools>perform>aps>lockout** 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 locked out.

Request Switch of Active to Protection

The request or manual switch of active to protection command switches the active line to use the protection line (by issuing a manual switch request in the **tools>perform>aps>force** context) 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.

Request Switch of Active to Working

The request or manual switch of active to working command switches the active line back from the protection line to the working line (by issuing a manual switch request in the **tools>perform>aps>force** context) 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.

Forced Switching of Active to Protection

The forced switch of active to protection command switches the active line to the protection line (by issuing a forced switch request in the **tools>perform>aps>force** context) 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 of protection or by detecting a signal failure on the protection line. If the active line is already on the protection line, no action takes place.

Forced Switch of Active to Working

The forced switch of active to working command switches the active line back from the protection line to the working (by issuing a forced switch request in the **tools>perform>aps>force** context) unless a request of equal or higher priority is already in effect.

Exercise Command

The **exercise** command is only supported in the bi-directional mode of the 1+1 architecture. The exercise command is specified in the **tools>perform>aps>force>exercise context** and exercises the protection line by sending an exercise request over the protection line to the tail-end and expecting a reverse request response back. The switch is not actually completed during the exercise routine.

Supported APS Port Configurations

All SONET/SDH MDA/CMAs use SONET/SDH physical layer transport but first generation channelized MDA/CMAs support the APS functionality. The following table displays examples of the port types that can be paired to provide APS protection. Both ports must be the same type and must be configured at the same speed.

Table 17: Supported APS Configurations

MDA Type	M8-OC3	M2-OC48	C2-OC12/3-SFP	M4-ATMOC12/3	CHOC3-AS-SFP	CHOC12-AS-SFP	CHOC3-CES-SFP	M4-CHOC3-AS-SFP	M1-CHOC12-AS-SFP	C1-CHOC3-CES-SFP
M8-OC3	•		a							
M2-OC48		•								
C2-OC12/3-SFP	a		a							
M4-ATMOC12/3				•						
M4-CHOC3-AS-SFP								•	•	•
CHOC3-AS-SFP					•					
CHOC12-AS-SFP						•				
CHOC3-CES-SFP							•	•	•	•
M1-CHOC12-AS-SFP										•
C1-CHOC3-CES-SFP										•

[a] The working and protect channel lines must be set to the same OC3 speed.

APS on a Single Node

APS 1+1 can be implemented on a port by port basis. If all ports on an MDA/CMA need to be protected then the ports on the MDA/CMA or must be individually configured.

The working and protect lines are capable of being connected to:

- Two ports on the same MDA/CMA.
- Two ports on different MDA/CMAs but on the same card.

If the working and protection channel are on the same MDA/CMA, protection is limited to the physical port and the media connecting the two devices. If different MDAs are used, protection extends to MDA module failure.

Working and protection circuits can be connected to an ADM and serve as an access or network port providing one or more services or network interfaces to the 7750 SR. This access or network port can be a single channel or multiple channels; each channel must support PPP - BCP, IPCP, OSICP, and MPLSCP; FR; and, in case of the ATM or ASAP MDAs, ATM. APS 1+1 capability on the ASAP MDA provides protection to all channels on the protected SONET/SDH port and to all IMA and MLPPP bundles which member links all reside on the protected SONET/ SDH port.

IMA APS protection is supported only when the 7750 SR is connected through ADM to another equipment running a single IMA instance at the far end. By design, IMA APS implementation is expected to keep IMA protocol up as long as the far end can tolerate frame loss similar to the 7750 SR ASAP implementation.

Similarly, the PPP protocol state machine for PPP channels and MLPPP bundles remains UP when a switchover occurs between the working and protect circuits.

The ADM or compatible head-end transmits a valid data signal to both the working and protection circuits. The signal on the protect line will be ignored until the working channel fails or degrades to the degree that requires a switchover to the protect channel. When the switchover occurs all services including all their QoS and filter policies are activated on the protection channel.

Removing or Failure of a Protect MDA/CMA

The detection of an CMA/MDA removal or an CMA/MDA failure can take additional time. This can affect the APS switchover time upon the removal or failure of a protection MDA. If the removal is scheduled during maintenance, it is recommended that the port and/or protect circuit be shutdown.

Protection of Upper Layer Protocols and Services

For a single-chassis APS, upper layer protocols and services are not affected by a switchover from the working to the protect channel or vice versa.

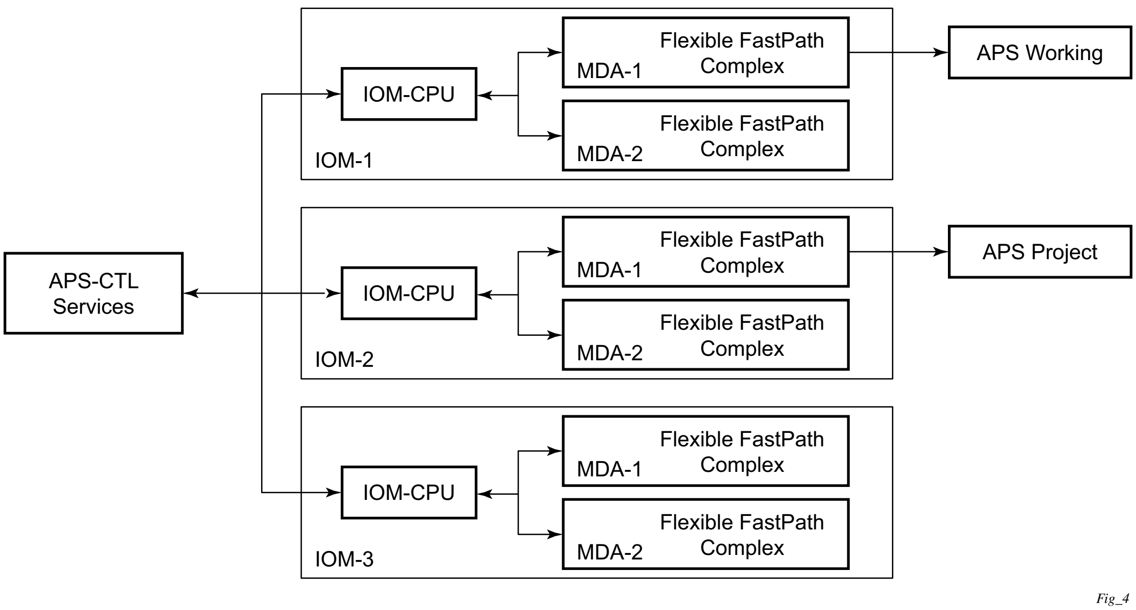

Figure 8: APS Working and Protection Channel

Figure 8 displays that the APS working channel is connected to IOM-1 / MDA-1 and the protection channel is connected to IOM-2 / MDA-1. In this example, assume that the working channel is currently used to transmit and receive data.

Switch-Over Process for Transmitted Data

For packets arriving on all interfaces that need to be transmitted over APS protected interfaces, the next hop associated with all these interfaces are programmed in all Flexible Fast-Path complexes in each MDA with a logical next-hop index. This next hop-index identifies the actual next-hop information used to direct traffic to the APS working channel on CFM/MDA/CMA-1.

All Flexible Fast-Path complexes in each CMA/MDA are also programmed with next hop information used to direct traffic to the APS protect channel on CFM/MDA/CMA-1. When the transmitted data needs to be switched from the working to the protect channel, only the relevant next hop indexes need to be changed to the pre-programmed next-hop information for the protect channel on IOM-2 / MDA-1.

Although the control CPM on the SF/CPM blade initiates the changeover between the working to protect channel, the changeover is transparent to the upper layer protocols and service layers that the switchover occurs.

Physical link monitoring of the link is performed by the CPU on the relevant IOM for both working and protect channel.

Switch-Over Process for Received Data

The Flexible Fast-Path complexes for both working and protect channels are programmed to process ingress. The inactive (protect) channel however is programmed to ignore all packet data. To perform the switch-over from working channel to the protect channel the Flexible Fast-Path complex for the working channel is set to ignore all data while the Flexible Fast-Path complex of the protect channel will be changed to accept data.

APS Switch After CFM Switchover

Immediately after a CFM switchover, there is a period during which the former standby CFM that is transitioning to the active state needs to audit the APS CFM.

Multi-Chassis APS

The APS functionality can protect against nodal (7710 SR) failure by configuring the working circuit of an APS group on one 7710 SR node while configuring the protect circuit of the same APS group on a different 7710 SR node.

Multi-chassis APS is supported for channels with PPP and ATM encapsulation. Multi-chassis APS is supported for multilink-bundles of type PPP but not for multlink-bundles of type IMA. Multi-chassis APS is not supported for channels with cHDLC and frame-relay encapsulation. on ATM MDA and ASAP MDA. It is also supported for ATM and PPP channelized interfaces, and for MLPPP bundles on ASAP MDA.

APS and Multi-Chassis APS for MLPPP

Figure 9 displays Alcatel-Lucent's and example of support for MLPPP termination on APS-protected channelized OC-n/STM-n links.

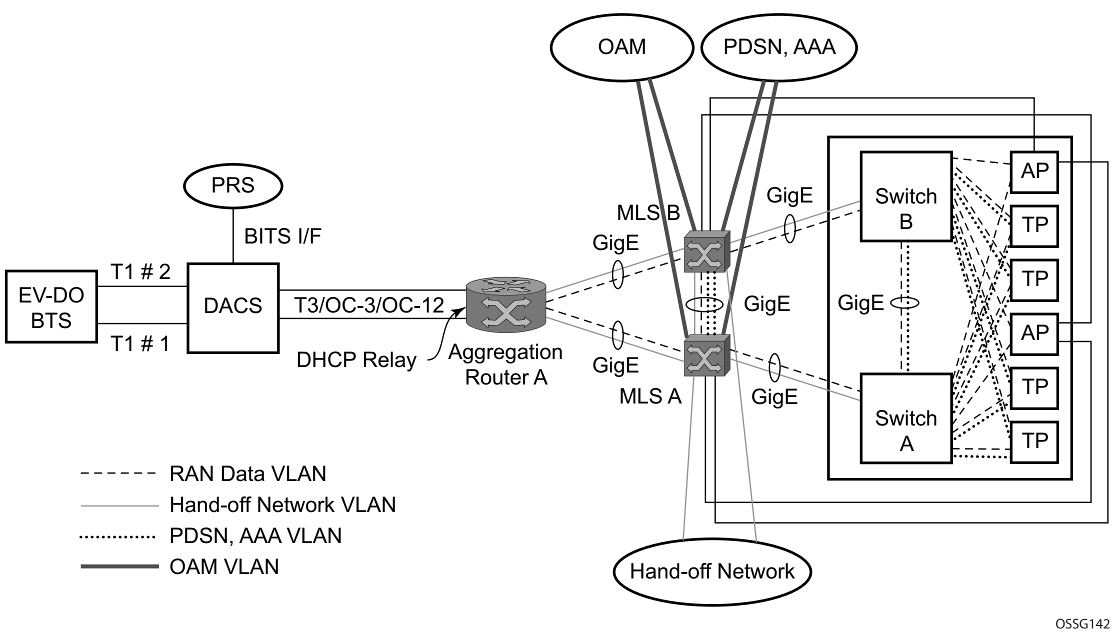

Figure 9: Single Router – Dual (Layer 2) Switch Topology Example

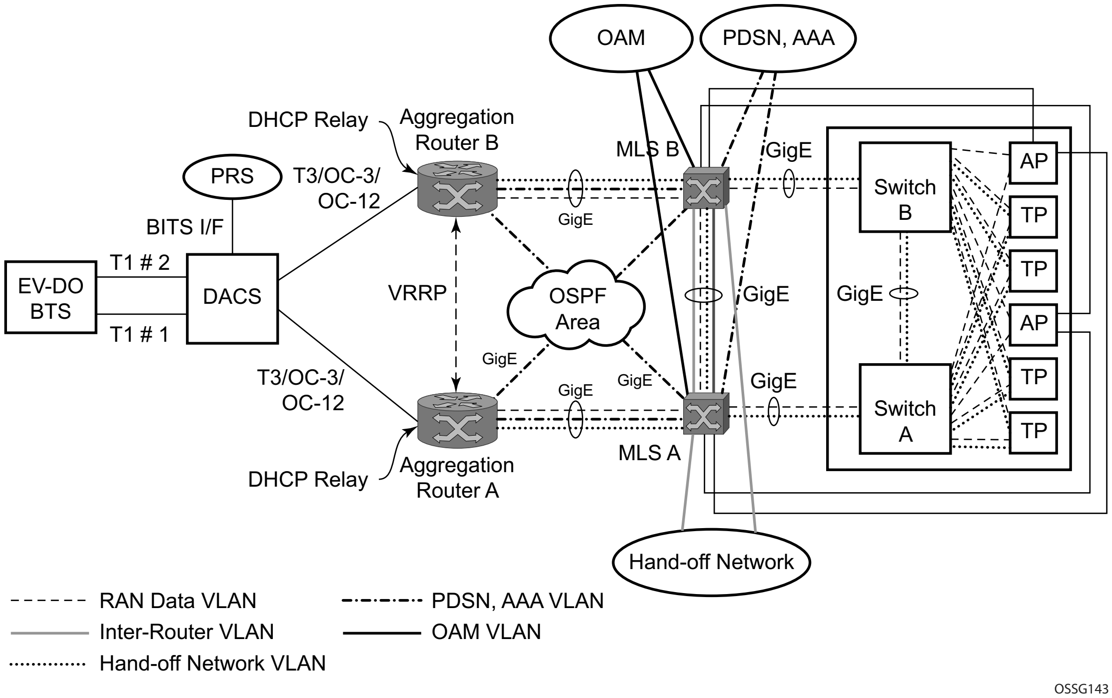

Figure 10: Dual Router – Dual (Layer 2 or Layer 3) Switch Topology Network Example

Figure 10 depicts multiple OC-3/STM-1 and/or OC-12/STM-4 links terminating from the digital access cross-connect system (DACS) and deliver T-1/E-1 channels that terminate on the service router.

7750 and 7710 service routers support APS on channelized interfaces. This allows Alcatel-Lucent’s service routers to be deployed as the radio access network (RAN) aggregation router which connects the base transceiver station (BTS) and the radio network controller (RNC).

MC-APS for ATM SAP with ATM VLL and Ethernet VLL Redundancy

MC-APS was initially supported for limited applications such as VPLS services. By extending the support to ATM VLLs and Ethernet VLL with ATM SAPs allow MC-APS to operate with pseudowire redundancy in a similar manner that MC-LAG operates with pseudowire redundancy. The combination of these features provides a solution for access node redundancy and network redundancy as shown in Figure 11.

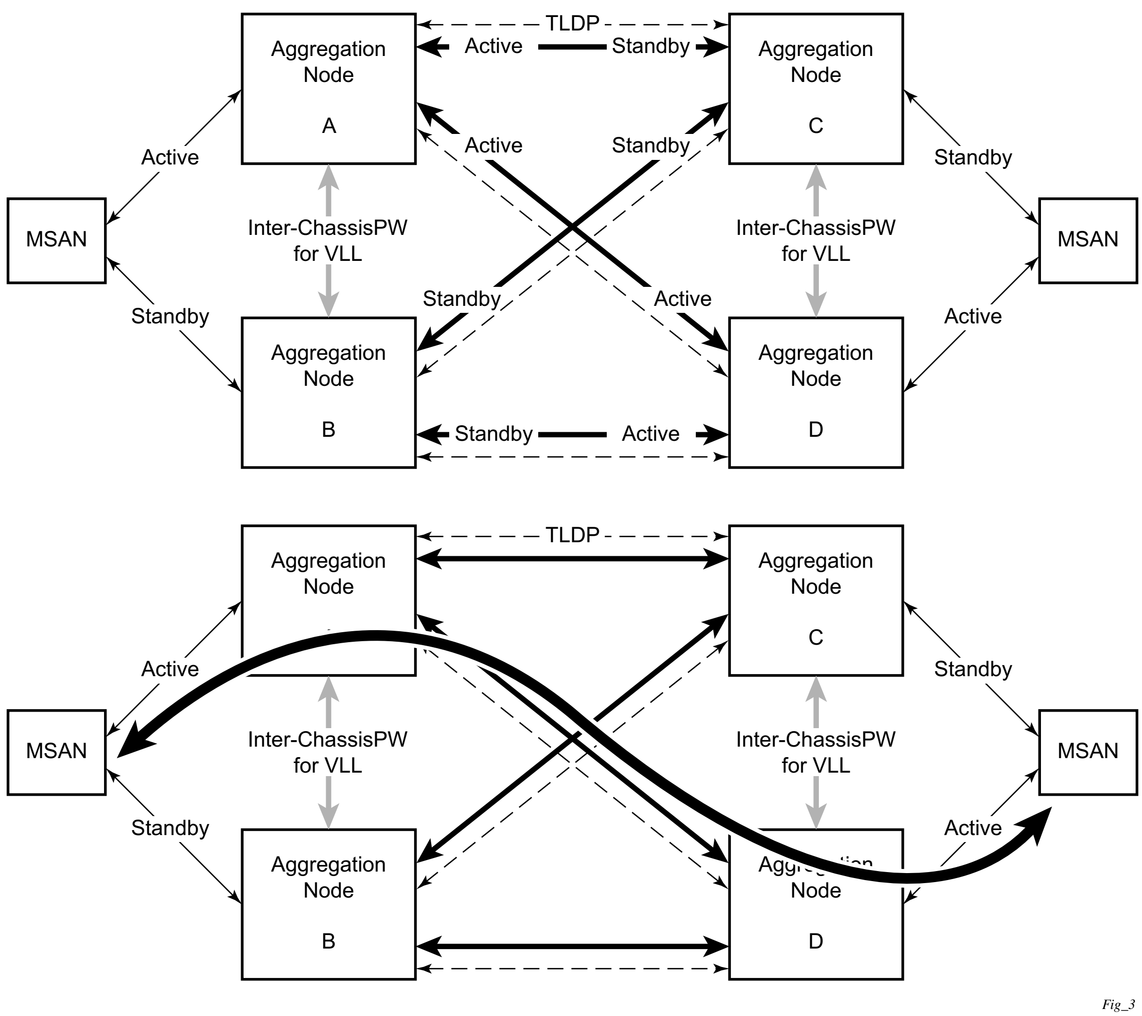

Figure 11: Access and Node and Network Resilience

In this application, 2G and 3G cell sites are aggregated into a Tier 2 or Tier 3 hub site before being backhauled to a Tier 1 site where the radio network controller (RNC) which terminates user calls is located. This application combines MC-APS on the RNC access side and pseudowire redundancy and pseudowire switching on the core network side. pseudowire switching is used in order to separate the routing domains between the access network and the core network.

An example of the customer application in the mobile market is displayed in Figure 12.

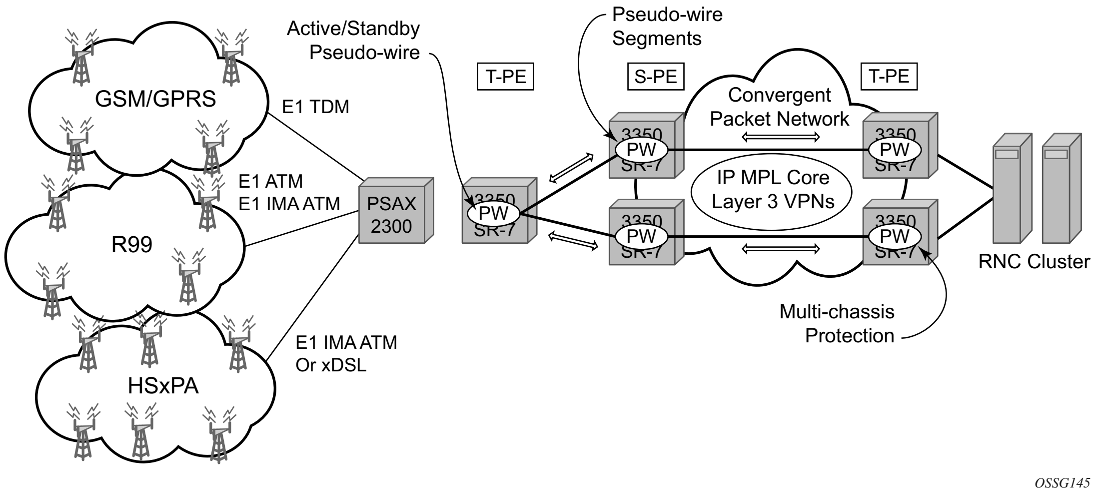

Figure 12: MC-APS with ATM VLL Redundancy

Multi-Chassis APS for ATM

The 7710 SR multi-chassis APS for ATM supports the following:

- Clear-channel interfaces
- 1+1 bi-directional APS
- VPLS services over APS-enabled circuits/ports.
- Service router platforms: 7710 SR-c12 and 7710 SR-c4.

The multi-chassis APS implementation requires that the working and protect circuits are configured on two different nodes. These two nodes connect to each other with an IP link that is used to establish a signalling path between the two 7710 SRs.

Note that the working circuit and the protect circuit must have compatible configurations (such as the same speed, framing, and port-type). The relevant APS groups in both the working and protection routers must have same group ID, but they can have different names (for example, group port descriptions). The configuration consistency between the working circuit/router and the protection circuit/router is not enforced by the 7710 SR. Service or network-specific configuration data is not signalled and synchronized between the two service routers.

Signalling is provided using the direct connection between the two service routers. A heartbeat protocol can be used to add robustness to the interaction between the two routers.

Signalling functionality includes support for:

- APS group matches between service routers.
- Verification that one side is configured as a working circuit and the other side is configured as the protect circuit. In case of a mismatch, a trap (incompatible-neighbor) is generated.
- Change in working circuit status is sent from the working router to keep the protect router in sync.
- Protect router, based on K1/K2 byte data, member circuit status, and external request, selects the active circuit, and informs the working router to activate or de-activate the working circuit.

Note that external requests like lockout, force, and manual switches are allowed only on the APS group having the protection circuit.

LAG

Based on the IEEE 802.3ad standard, Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two network devices, depending on the number of links installed (from 1 to 8). LAG also provides redundancy in the event that one or more links participating in the LAG fail. All physical links in a given LAG links combine to form one logical interface.

Packet sequencing must be maintained for any given session. The hashing algorithm deployed by Alcatel-Lucent 7710 SR 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.

LAGs must be statically configured or formed dynamically with Link Aggregation Control Protocol (LACP). The optional marker protocol described in IEEE 802.3ad is not implemented. LAGs can be configured on network and access ports.

LAG Features

Hardware capabilities:

- The LAG load sharing is executed in firmware, which provides line rate forwarding for all port types.

Software capabilities:

- In addition to the mandated IEEE LAG implementation, Alcatel-Lucent’s solution has several improvements including dynamic costing and LAG port threshold features. The dynamic cost and LAG port threshold features can be enabled even if the second node is not an Alcatel-Lucent 7710 SR router.
  - → Dynamic cost

    Dynamic cost can be enabled with the **config>lag** *dynamic-cost* command or by the action specified in the **config>lag port-threshold** command.

    If dynamic cost is enabled and the number of active links is greater than the port threshold value (0-7), then the path cost is dynamically calculated whenever there is a change in the number of active links regardless of the specified port threshold action. If the port-threshold is met and the action is set to dynamic cost, then the path cost is dynamically recalculated regardless of the global dynamic cost configuration.

    Enabling dynamic costing causes the physical link metrics used by OSPF to be applied based on the operational or aggregate link bandwidth in the LAG that is available at the time, providing the number of links that are up exceeds the configured LAG port threshold value. If the number of available links falls below the configured threshold, the configured threshold action determines if and at what cost this LAG will be advertised.

For example, assume a single link in OSPF has an associated cost of 100 and the LAG consists of four physical links. The cost associated with the logical link is 25. If one link fails then the cost would automatically be adjusted to 33.

If dynamic cost is not configured then costing is applied based on the total number of links configured. The cost would be calculated at 25. This will remain static provided the number of links that are up exceeds the configured LAG threshold.

→ LAG port threshold

The LAG port threshold feature allows configuration of the behavior, once the number of available links in a LAG falls below or is equal to the specified threshold. Two options are available:

1. If the number of links available (up) in a LAG is less than the configured threshold, then the LAG is regarded as operationally down.
   For example, assume a LAG consists of eight physical links. The threshold is set to four and dynamic costing is not configured. If the operational links is equal to or drops below four, the link is regarded as operationally down until the number of operational links is four or more.
2. When the number of links available in a LAG is less than the configured threshold, the LAG starts using the dynamic-cost allowing other nodes to adjust their routing tables according to the revised costs. In this case, when the threshold is not crossed, a fixed metric (all links operational) is advertised.

Configuring LAGs

LAG configuration guidelines include:

- When preprovisioning chassis cards, MCMs, CMA/MDAs, and Ethernet ports, distribute the LAG ports for a given LAG over as many slots and CMA/MDAs as possible. This minimizes the impact that a slot or CMA/MDA failure has on the performance of the LAG.
- A maximum of 64 LAGs, eight ports in each, can be configured on a 7710 SR-Series.
- Ports can be added or removed from the LAG while the LAG and its ports (other than the port being removed) remain operational. When ports to and/or from the LAG are added or removed, the hashing algorithm is adjusted for the new port count.
- `show` commands display physical port statistics on a port-by-port basis or the entire LAG can be displayed.
- LAG is supported on Ethernet ports.
- Ports of a particular LAG can be of different types but they must be the same speed and duplex. To guarantee the same port speed is used for all ports in a LAG, autonegotiation must be disabled or in limited mode to ensure only a specific speed is advertised.

Figure 13 displays traffic routed between ALA-1 and ALA-2 as a LAG consisting of four ports.

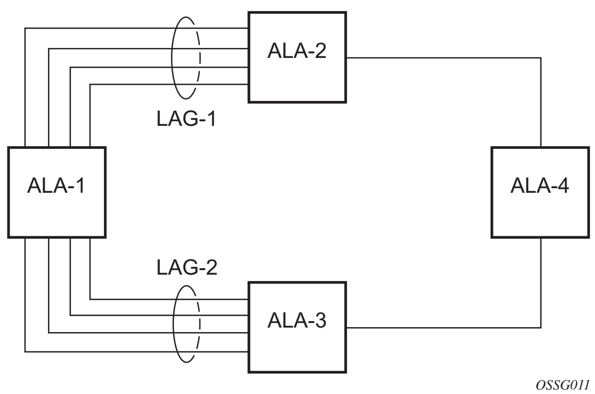

Figure 13: LAG Configuration

LAG and ECMP Hashing

When a requirement exists to increase the available bandwidth for a logical link that exceeds the physical bandwidth or add redundancy for a physical link, typically one of two methods is applied; equal cost multi-path (ECMP) or Link Aggregation (LAG). A 7710 SR-Series can deploy both at the same time, meaning, using ECMP of two or more Link Aggregation Groups (LAG) and/or single links. The 7710 SR-Series supports up to 16 equal cost routes in ECMP and up to eight ports per LAG.

To avoid out-of-sequence packets the algorithm for selecting the next hop in an ECMP or LAG must be deterministic. The algorithm performs at line rate and is executed in the 7710 SR-Series Network Processor Array (NPA) when the packet ingresses the CFM, after determining that the next hop is an ECMP and/or LAG.

Depending on the type of traffic that needs to be distributed into an ECMP and/or LAG, different variables are used as input to the hashing algorithm that determines the next hop selection. There are several traffic types to consider:

- VPLS known unicast traffic. This is hashed based on the IP source and destination addresses, or the MAC source and destination addresses for non-IP traffic. Optionally TCP and UDP traffic can include the source and destination port information in the hash algorithm.
- The hash used for LAG for VPLS services does not include the VPLS service ID. The MAC SA/DA are hashed and then, if the Ethertype is IPv4 or IPv6, the hash is replaced with one based on the IP source address/destination address. If Layer 4 hashing is enabled on the ingress port, the Layer 4 source port and destination port are hashed. Packets for the same SAP can be sprayed across different LAG members, if the result of this hash modulo the number of LAG links is different.
- Unicast IP traffic routed by an SR series router uses the IP SA/DA or optionally TCP/UDP port information.
- MPLS switched traffic is based on the whole label stack (up to 5 labels), along with the incoming port and system IP address. Note that the EXP/TTL information in each label is not included in the hash algorithm.
- VPLS multicast, broadcast and unknown unicast traffic transmitted on SAPs is not sprayed on a per-frame basis, but instead the SAP ID is used to pick ECMP and LAG paths statically.
  - → VPLS multicast, broadcast and unknown unicast traffic transmitted on SDPs is hashed on a per packet basis in the same way as VPLS unicast traffic. However, per packet hashing is applicable only to the distribution of traffic over LAG ports, as the ECMP path is still chosen statically based on the service ID.

    Data is hashed twice to get the ECMP path. If LAG and ECMP are performed on the same frame, the data will be hashed again to get the LAG port (three hashes for LAG). However, if only LAG is performed, then hashing will only be performed twice to get the LAG port.

  → VPLS multicast traffic transmitted on SAPs with IGMP snooping enabled is load-balanced based on the internal multicast ID which is unique for every (s,g) record. This way, multicast traffic pertaining to different streams is distributed across different LAG member ports.

- VLL traffic from a service access point is not sprayed on a per-packet basis, but as for VPLS flooded traffic, the service ID is used to pick one of the ECMP/LAG paths. The exception to this is when shared-queuing is configured on an Etherpipe SAP or Frame Relay pipe SAP. In this case, traffic spraying is the same for VPLS known unicast traffic.
- IP multicast is sprayed over LAG based on the unique multicast ID.
- IP multicast Layer 4 UDP traffic will not be hashed.

For all cases that involve per-packet hashing, the NPA produces a 20-bit result based on hashing the relevant packet data. This result is input to a modulo like calculation (divide by the number of routes in the ECMP and use the remainder) to determine the ECMP index.

If the ECMP index results in the selection of a LAG as the next hop, then the hash result is hashed again and the result of the second hash is input to the modulo like operation (divide by the number of ports in the LAG and use the remainder) to determine the LAG port selection.

LAG on Access

Link Aggregation Groups (LAG) is supported on access ports. This is treated the same as LAG on network ports which provides a standard method to aggregate Ethernet links. The difference lies in how QoS is handled. If all members of the LAG are on the same CFM then there is no difference in how HQoS is handled. For example, for routed packets or for VPLS known unicast, hashing is performed to get an ECMP value and then rehashed to do the spraying for the access LAG ports. SAP to SAP VLL, and VPLS flooded packets will only use one port of the LAG.

There are two user-selectable modes to address the need to manage an HQoS policy on a SAP (this can include a link aggregate which spans cards).

Port Link Damping

Hold time controls enable port link damping timers that reduce the number of link transitions reported to upper layer protocols.

The 7710 SR OS port link damping feature guards against excessive port transitions. Any initial port transition is immediately advertised to upper layer protocols, but any subsequent port transitions are not advertised to upper layer protocols until a configured timer has expired.

An “up” timer controls the dampening timer for link up transitions, and a “down” timer controls the dampening timer for link down transitions.

LACP

Generally, link aggregation is used for two purposes: provide an increase in bandwidth and/or provide redundancy. Both aspects are addressed by aggregating several Ethernet links in a single LAG.

LACP enhancements allow active lag-member selection based on particular constrains. The mechanism is based on the IEEE 802.3ad standard so interoperability is ensured.

Multi-Chassis LAG

This section describes the Multi-Chassis LAG (MC-LAG) concept. MC-LAG is an extension of a LAG concept that provides node-level redundancy in addition to link-level redundancy provided by “regular LAG”.

Typically, MC-LAG is deployed in a network-wide scenario providing redundant connection between different end points. The whole scenario is then built by combination of different mechanisms (for example, MC-LAG and redundant pseudowire to provide e2e redundant p2p connection or dual homing of DSLAMs in Layer 2 TPSDA).

Overview

Multi-chassis LAG is a method of providing redundant Layer 2 access connectivity that extends beyond link level protection by allowing two systems to share a common LAG end point.

The multi-service access node (MSAN) node is connected with multiple links towards a redundant pair of Layer 2 aggregation nodes such that both link and node level redundancy, are provided. By using a multi-chassis LAG protocol, the paired Layer 2 aggregation nodes (referred to as redundant-pair) appears to be a single node utilizing LACP towards the access node. The multi-chassis LAG protocol between redundant-pair ensures a synchronized forwarding plane to/from the access node and is used to synchronize the link state information between the redundant-pair nodes such that proper LACP messaging is provided to the access node from both redundant-pair nodes.

In order to ensure SLAs and deterministic forwarding characteristics between the access and the redundant-pair node, the multi-chassis LAG function provides an active/standby operation towards/from the access node. LACP is used to manage the available LAG links into active and standby states such that only links from 1 aggregation node are active at a time to/from the access node.

Characteristics related to MC are:

- Selection of the common system ID, system-priority and administrative-key are used in LACP messages so partner systems consider all links as the part of the same LAG.
- Extension of selection algorithm in order to allow selection of active sub-group.
  - → The sub-group definition in LAG context is still local to the single box, meaning that even if sub-groups configured on two different systems have the same sub-group-id they are still considered as two separate subgroups within given LAG.
  - → Multiple sub-groups per PE in a MC-LAG is supported.
  - → In case there is a tie in the selection algorithm, for example, two sub-groups with identical aggregate weight (or number of active links) the group which is local to the system with lower system LACP priority and LAG system ID is taken.

- Providing inter-chassis communication channel allows inter-chassis communication to support LACP on both system. This communication channel enables the following:
  - → Supports connections at the IP level which do not require a direct link between two nodes. The IP address configured at the neighbor system is one of the addresses of the system (interface or loop-back IP address).
  - → The communication protocol provides heartbeat mechanism to enhance robustness of the MC-LAG operation and detecting node failures.
  - → Support for operator actions on any node that force an operational change.
  - → The LAG group-ids do not have to match between neighbor systems. At the same time, there can be multiple LAG groups between the same pair of neighbors.
  - → Verification that the physical characteristics, such as speed and auto-negotiation is configured and initiates operator notifications (traps) if errors exist. Consistency of MC-LAG configuration (system-id, administrative-key and system-priority) is provided. Similarly, load-balancing mode of operation must be consistently configured on both nodes.
  - → Traffic over the signalling link should be encrypted using a user configurable message digest key.
- MC-LAG function provides active/stand-by status to other software applications in order to built a reliable solutions.

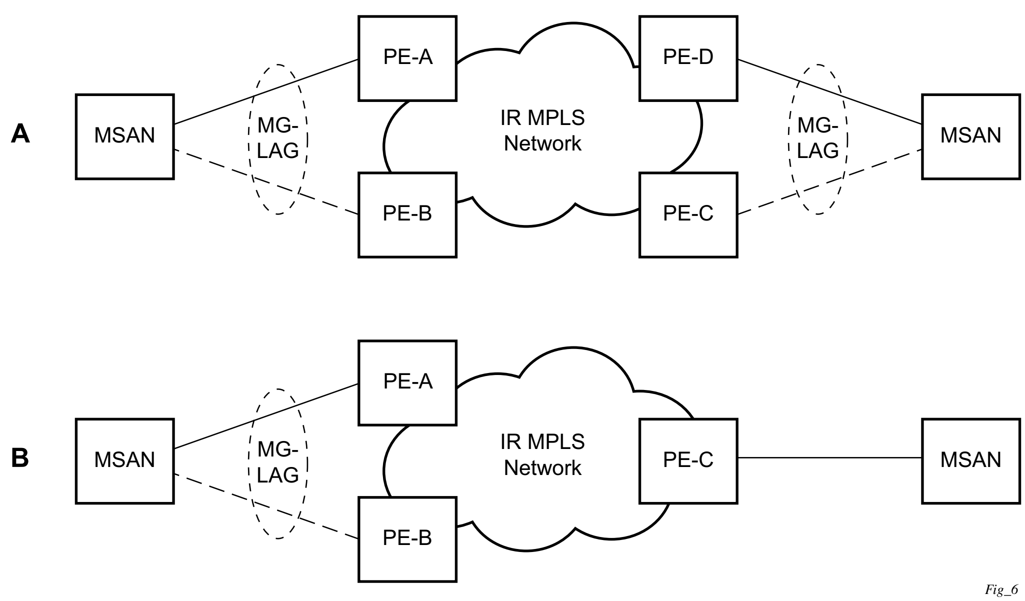

Figure 14: MC-LAG Dual Homing to Remote PE Pairs

Figure 14 depicts different combinations of MC-LAG attachments supported. The supported configurations can be sub-divided into following sub-groups:

- Dual-homing to remote PE pairs
  - → both end-points attached with MC-LAG
  - → one end-point attached
- Dual-homing to local PE pair
  - → both end-points attached with MC-LAG
  - → one end-point attached with MC-LAG
  - → both end-points attached with MC-LAG to two overlapping pairs

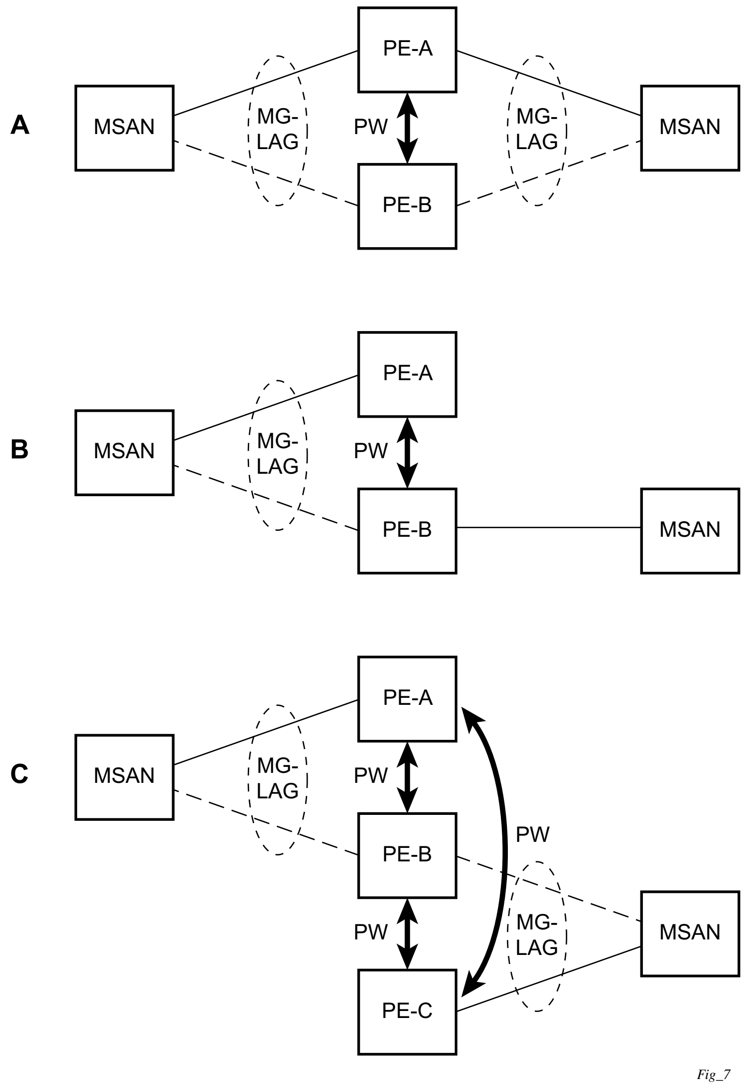

Figure 15: MC-LAG Dual Homing to Local PE-Pairs

The forwarding behavior of the nodes abide by the following principles. Note that logical destination (actual forwarding decision) is primarily determined by the service (VPLS or VLL) and then principle below applies only if destination or source is based on MC-LAG:

- Packets received from the network will be forwarded to all local active links of the given destination-sap based on conversation hashing. In case there are no local active links, the packets will be cross-connected to inter-chassis pseudowire.
- Packets received from the MC-LAG sap will be forwarded to active destination pseudo-wire or active local links of destination-sap. In case there are no such objects available at the local node, the packets will be cross-connected to inter-chassis pseudowire.

MC-LAG and Subscriber Routed Redundancy Protocol (SRRP)

MC-LAG and SRRP enables dual-homed links from any IEEE 802.3ad standards-based access device (for example, a IP DSLAM, Ethernet switch or a Video on Demand server) to multiple Layer 2 or Layer 3 aggregation nodes. In contrast with slow recovery mechanisms such as Spanning Tree, multi-chassis LAG provides synchronized and stateful redundancy for VPN services or triple play subscribers in the event of the access link or aggregation node failing, with zero impact to end users and their services.

Refer to the 7710 SR OS Triple Play Guide for information about SRRP.

Point-to-Point (p2p) Redundant Connection Across Layer 2 VPN Network

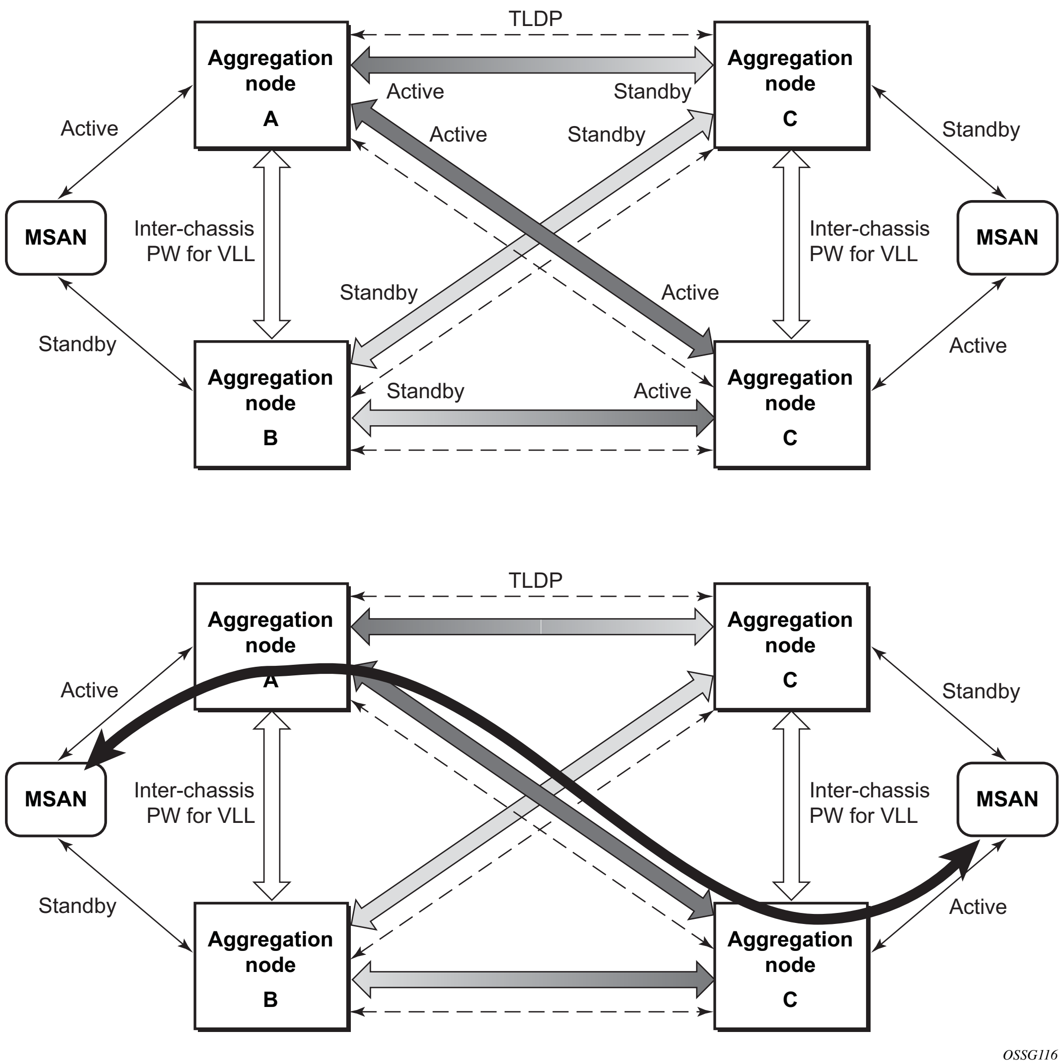

Figure 16: P2P Redundant Connection Through a Layer 2 VPN Network

Figure 16 shows the connection between two multi-service access nodes (MSANs) across network based on Layer 2 VPN pseudo-wires. The connection between MSAN and a pair of PE routers is realized by MC-LAG. From MSAN perspective, redundant pair of PE routers acts as a single partner in LACP negotiation. At any point in time, only one of the routers has an active link(s) in a given LAG. The status of LAG links is reflected in status signaling of pseudo-wires set between all participating PEs. The combination of active and stand-by states across LAG links as well and pseudo-wires give only 1 unique path between pair of MSANs.

Note that the configuration in Figure 16 depicts one particular configuration of VLL connections based on MC-LAG, particularly the VLL connection where two ends (SAPs) are on two different redundant-pairs. In addition to this, other configurations are possible, such as:

- Both ends of the same VLL connections are local to the same redundant-pair.
- One end VLL endpoint is on a redundant-pair the other on single (local or remote) node.

DSLAM Dual Homing in Layer 2 TPSDA Model

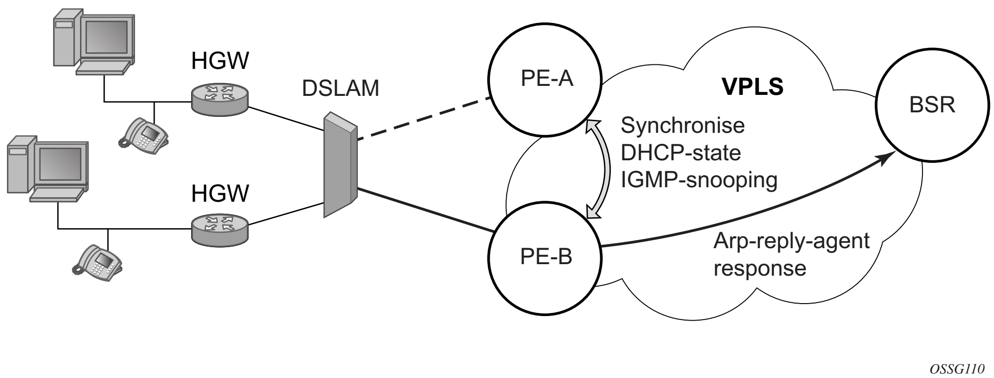

Figure 17: DSLAM Dual-Homing Using MC-LAG

Figure 17 illustrates a network configuration where DSLAM is dual homed to pair of redundant PEs by using MC-LAG. Inside the aggregation network redundant-pair of PEs is connecting to VPLS service which provides reliable connection to single or pair of Broadband Service Routers (BSRs).

MC-LAG and pseudo-wire connectivity, PE-A and PE-B implement enhanced subscriber management features based on DHCP-snooping and creating dynamic states for every subscriber-host. As in any point of time there is only one PE active, it is necessary to provide the mechanism for synchronizing subscriber-host state-information between active PE (where the state is learned) and stand-by PE. In addition, VPLS core must be aware of active PE in order to forward all subscriber traffic to a PE with an active LAG link. The mechanism for this synchronization is outside of the scope of this document.

802.1x Network Access Control

The Alcatel-Lucent 7710 SR-Series supports network access control of client devices (PCs, STBs, etc.) on an Ethernet network using the IEEE. 802.1x standard. 802.1x is known as Extensible Authentication Protocol (EAP) over a LAN network or EAPOL.

802.1x Modes

The Alcatel-Lucent 7710 SR-Series supports port-based network access control for Ethernet ports only. Every Ethernet port can be configured to operate in one of three different operation modes, controlled by the port-control parameter:

- `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 switch cannot provide authentication services to the host through the interface.
- `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 router and the host can initiate an authentication procedure as described below. The port will remain in un-authorized state (no traffic except EAPOL frames is allowed) until the first client is authenticated successfully. After this, traffic is allowed on the port for all connected hosts.

802.1x Basics

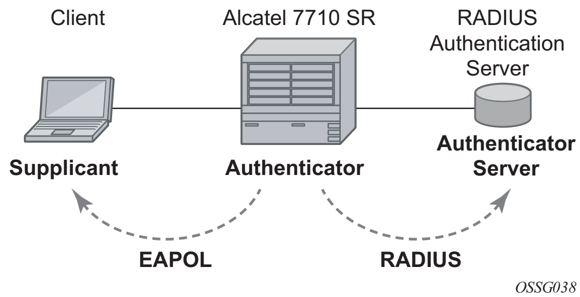

Figure 18: 802.1x Architecture

The IEEE 802.1x standard defines three participants in an authentication conversation (see Figure 18):

- The supplicant — This is 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.

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 via the Extended Authentication Protocol (EAP) over LANs (EAPOL). On the back end, the communication between the authenticator and the authentication server is done with the RADIUS protocol. The authenticator is thus a RADIUS client, and the authentication server a RADIUS server.

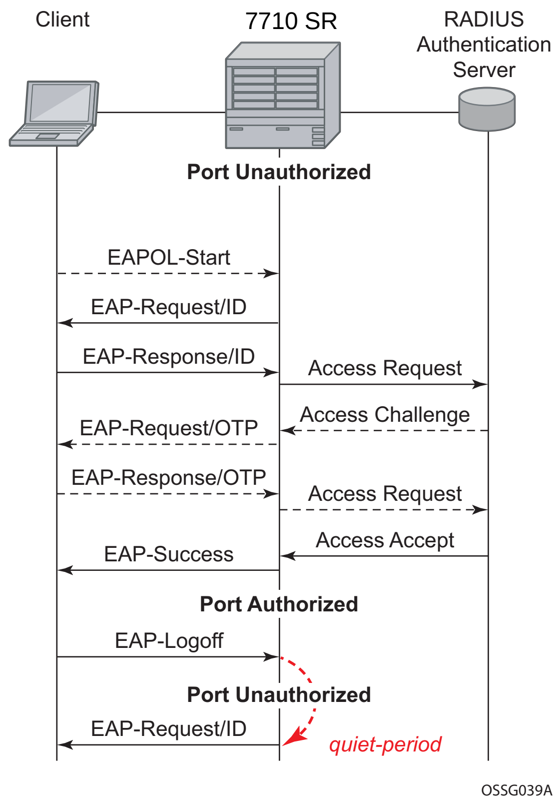

Figure 19: 802.1x Authentication Scenario

The messages involved in the authentication procedure are illustrated in Figure 19.

The 7710 SR-Series will initiate the procedure when the Ethernet port becomes operationally up, by sending a special PDU called EAP-Request/ID to the client. The client can also initiate the exchange by sending an EAPOL-start PDU, if it doesn't receive the EAP-Request/ID frame during bootup. The client responds on the EAP-Request/ID with a EAP-Response/ID frame, containing its identity (typically username + password).

After receiving the EAP-Response/ID frame, the 7710 SR-Series will encapsulate the identity information into a RADIUS AccessRequest packet, and send it off to the configured RADIUS server.

The RADIUS server checks the supplied credentials, and if approved will return an AccessAccept message to the 7710 SR-Series. The router notifies the client with an EAP-Success PDU and puts the port in authorized state.

802.1x Timers

The 802.1x authentication procedure is controlled by a number of configurable timers and scalars. There are two separate sets, one for the EAPOL message exchange and one for the RADIUS message exchange. See Figure 20 for an example of the timers.

EAPOL timers:

- `transit-period` — Indicates how many seconds the Authenticator will listen for an EAP-Response/ID frame. If the timer expires, a new EAP-Request/ID frame will be sent and the timer restarted. The default value is 60. The range is 1-3600 seconds.
- `supplicant-timeout` — This timer is started at the beginning of a new authentication procedure (transmission of first EAP-Request/ID frame). If the timer expires before an EAP-Response/ID frame is received, the 802.1x authentication session is considered as having failed. The default value is 30. The range is 1-300.
- `quiet-period` — Indicates number of seconds between authentication sessions It is started after logoff, after sending an EAP-Failure message or after expiry of the supplicant-timeout timer. The default value is 60. The range is 1-3600.

RADIUS timer and scaler:

- `max-auth-req` — Indicates the maximum number of times that the 7710 SR-Series will send an authentication request to the RADIUS server before the procedure is considered as having failed. The default value is value 2. The range is 1-10.
- `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 *max-auth-req* times. The default value is 60. The range is 1-3600 seconds.

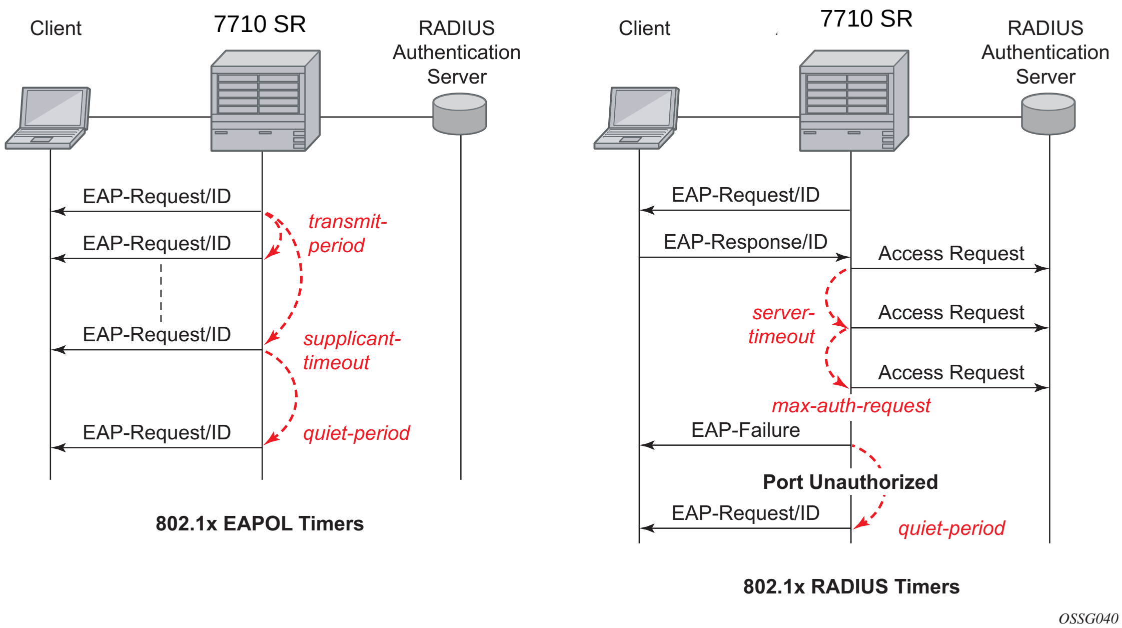

Figure 20: 802.1x EAPOL Timers (left) and RADIUS Timers (right)

The Alcatel-Lucent 7710 SR-Series can also be configured to periodically trigger the authentication procedure automatically. This is controlled by the enable re-authentication and reauth-period parameters. Reauth-period indicates the period in seconds (since the last time that the authorization state was confirmed) before a new authentication procedure is started. The range of reauth-period is 1-9000 seconds (the default is 3600 seconds, one hour). Note that the port stays in Authorized state during the re-authentication procedure.

802.1x Configuration and Limitations

Configuration of 802.1x network access control on the Alcatel-Lucent 7710 SR-Series consists of two parts:

- Generic parameters, which are configured under `config>security>dot1x`
- Port-specific parameters, which are configured under `config>port>ethernet>dot1x`

801.x authentication:

- Provides access to the port for any device, even if only a single client has been authenticated;
- Can only be used to gain access to a pre-defined Service Access Point (SAP). It is not possible to dynamically select a service (e.g., a VPLS) depending on the 802.1x authentication information;
- Only supported on untagged Ethernet ports. (`config>port>ethernet# encap-type null`);
- Only supported on access ports. (`config>port>ethernet# mode access`).

802.3ah OAM

802.3ah Clause 57 (EFM OAM) defines the Operations, Administration, and Maintenance (OAM) sub-layer, which provides mechanisms useful for monitoring link operation such as remote fault indication and remote loopback control. In general, OAM provides network operators the ability to monitor the health of the network and quickly determine the location of failing links or fault conditions. EFM OAM described in this clause provides data link layer mechanisms that complement applications that may reside in higher layers.

OAM information is conveyed in slow protocol frames called OAM protocol data units (OAMPDUs). OAMPDUs contain the appropriate control and status information used to monitor, test and troubleshoot OAM-enabled links. OAMPDUs traverse a single link, being passed between peer OAM entities, and as such, are not forwarded by MAC clients (like bridges or switches).

The following EFM OAM functions are supported:

- EFM OAM capability discovery.
- Active and passive modes.
- Remote failure indication – handling of critical link events (link fault, dying gasp, etc.)
- Loopback — A mechanism is provided to support a data link layer frame-level loopback mode. Both remote and local loopback modes are supported.
- EFM OAMPDU tunneling.
- High resolution timer for EFM OAM in 100ms interval (minimum).

OAM Events

EFM OAM defines a set of events that may impact link operation. The following events are supported:

- Critical link events (defined in 802.3ah clause 57.2.10.1)
  - → Link fault: the PHY has determined a fault has occurred in the receive direction of the local DTE.
  - → Dying gasp: an unrecoverable local failure condition has occurred.
  - → Critical event: an unspecified critical event has occurred.

These critical link events are signaled to the remote DTE by the flag field in OAM PDUs.

Remote Loopback

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

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

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

Note that during remote loopback test operation, all frames except EFM OAM PDUs are dropped at the local port for the receive direction, where remote loopback is enabled. If local loopback is enabled, then all frames except EFM OAM PDUs are dropped at the local port for both the receive and transmit directions. This behavior may result in many protocols (e.g., STP, LAG) resetting their state machines.

Note that when a port is in loopback mode, service mirroring will not work if the port is a mirror-source or a mirror-destination.

802.3ah OAM PDU Tunneling for Epipe Service

The 7710 routers support 802.3ah. Customers who subscribe to Epipe service treat the Epipe as a wire, so they demand the ability to run 802.3ah between their devices which are located at each end of the Epipe.

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

When OAM PDU tunneling is enabled, 802.3ah OAM PDUs received at one end of an Epipe are forwarded through the Epipe. 802.3ah can run between devices that are located at each end of the Epipe. When OAM PDU tunneling is disabled (by default), OAM PDUs are dropped or processed locally according to the **efm-oam** configuration (shutdown or not shutdown).

Note that by enabling 802.3ah for a specific port and enabling OAM PDU tunneling for the same port are mutually exclusive. Enforcement is performed on the CLI level.

MTU Configuration Guidelines

Observe the following general rules when planning your service and physical MTU configurations:

- The 7710 SR-Series must contend with MTU limitations at many service points. The physical (access and network) port, service, and SDP MTU values must be individually defined.
- Identify the ports that will be designated as network ports intended to carry service traffic.
- 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.

Default MTU Values

Table 18 displays the default MTU values which are dependent upon the (sub-) port type, mode, and encapsulation.

Table 18: MTU Default Values

Port Type	Mode	Encap Type	Default (bytes)
Ethernet	access	null	1514
Ethernet	access	dot1q	1518
Fast Ethernet	network	—	1514
Other Ethernet	network	—	9212*
SONET path or TDM channel	access	BCP-null	1518
SONET path or TDM channel	access	BCP-Dot1q	1522
SONET path or TDM channel	access	IPCP	1502
SONET path or TDM channel	network	—	9208
SONET path or TDM channel	access	frame-relay	1578
SONET path or TDM channel	access	atm	1524

*The default MTU for Ethernet ports other than Fast Ethernet is actually the lesser of 9212 and any MTU limitations imposed by hardware which is typically 16K.

Modifying MTU Defaults

MTU parameters should be modified on the service level as well as the port level.

- The service-level MTU parameters configure the service payload (Maximum Transmission Unit – MTU) in bytes for the service ID overriding the service-type default MTU.
- The port-level MTU parameters configure the maximum payload MTU size for an Ethernet port or SONET/SDH SONET path (sub-port) or TDM port/channel, or a channel that is part of a multilink bundle or LAG.

The default MTU values should be modified to ensure that packets are not dropped due to frame size limitations. The service MTU must be less than or equal to both the SAP port MTU and the SDP path MTU values. When an SDP is configured on a network port using default port MTU values, the operational path MTU can be less than the service MTU. In this case, enter the `show service sdp` command to check the operational state. If the operational state is down, then modify the MTU value accordingly.

Configuration Example

In order for the maximum length service frame to successfully travel from a local ingress SAP to a remote egress SAP, the MTU values configured on the local ingress SAP, the SDP (GRE or MPLS), and the egress SAP must be coordinated to accept the maximum frame size the service can forward. For example, the targeted MTU values to configure for a distributed Epipe service (ALA-A and ALA-B) are displayed in Figure 21.

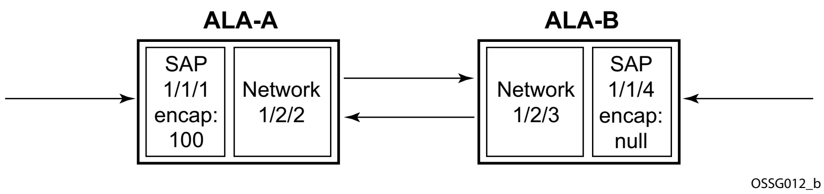

Figure 21: MTU Configuration Example

Table 19: MTU Configuration Example Values

	ALA-A		ALA-B	
	Access (SAP)	**Network**	**Network**	**Access (SAP)**
Port (slot/MDA/port)	1/1/1	1/3/1	1/5/1	1/1/1
Mode type	dot1q	network	network	null
MTU	1518	1556	1556	1514

Since ALA-A uses dot1q encapsulation, the SAP MTU must be set to 1518 to be able to accept a 1514 byte service frame (see Table 18 for MTU default values). Each SDP MTU must be set to at least 1514 as well. If ALA-A's network port (1/3/1) is configured as an Ethernet port with a GRE SDP encapsulation type, then the MTU value of network ports 1/3/1 and 1/5/1 must *each* be at least 1556 bytes (1514 MTU + 28 GRE/Martini + 14 Ethernet). Finally, the MTU of ALA-B's SAP (access port 1/1/1) must be at least 1514, as it uses null encap.

Deploying Preprovisioned Components

When a line card/CMA/MDA is installed in a preprovisioned slot, the device detects discrepancies between the preprovisioned card and CMA/MDA type configurations and the types actually installed. Error messages display if there are inconsistencies and the card will not initialize.

When the proper preprovisioned card and CMA/MDA are installed into the appropriate chassis slot, alarm, status, and performance details will display.

Configuration Process Overview

Figure 22 displays the process to provision chassis slots, line cards, MDAs, and ports.

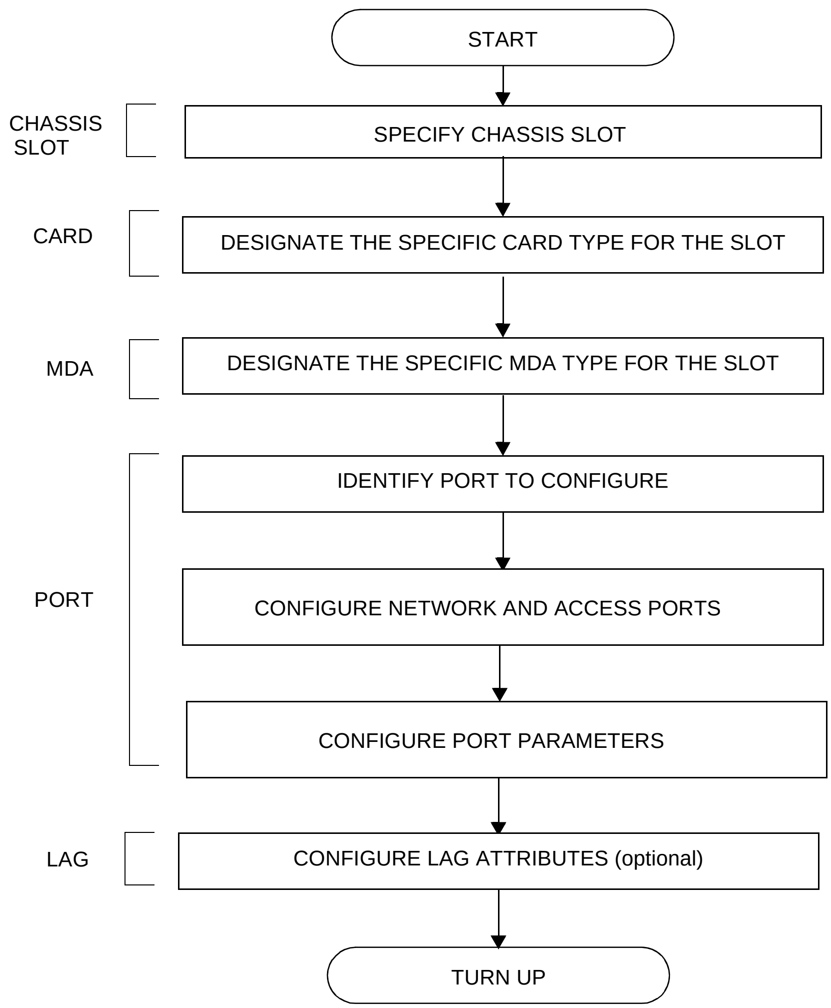

Figure 22: Slot, Card, MDA, and Port Configuration and Implementation Flow

Configuration Notes

The following information describes provisioning caveats:

- Chassis slots must be preprovisioned to accept specific line card types.
- Line cards must be preprovisioned to accept specific MDA types.

  If a card or MDA type is installed in a slot provisioned for a different type, the card will not initialize.
- A card and MDA installed in an unprovisioned slot remain administratively and operationally down until the slot, card type, MDA slot, and MDA type is specified.
- Ports cannot be provisioned until the slot, card and MDA type are specified.
- cHDLC does not support HDLC windowing features, nor other HDLC frame types such as S-frames.
- cHDLC operates in the HDLC Asynchronous Balanced Mode (ABM) of operation.
- All SAP-level statistics are retained with an APS switch. A SAP will reflect the data received regardless of the number of APS switches that has occurred. ATM statistics, however, are cleared after an APS switch. Thus, any ATM statistics viewed on an APS port are only the statistics since the current active member port became active.

  Physical layer packet statistics on the APS group reflect what is currently on the active member port.
- Port and path-level statistics follow the same behavior.

  Any SONET physical-layer statistics (for example, B1,B2,B3,...) on the APS port are only what is current on the active APS member port.
- APS configuration rules:
  - → A physical port (either working or protection) must be shutdown before it can be removed from an APS group port.
  - → For a single-chassis APS group, a working port must be added first. Then a protection port can be added or removed at any time.
  - → A protection port must be shutdown 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 on the APS port level and configuration on the physical member ports are blocked.
  - → For APS-protected bundles, all members of a working bundle must reside on the working port of an APS group. Similarly all members of a protecting bundle must reside on the protecting circuit of that APS group.

Configuring Physical Ports with CLI

This section provides information to configure cards, MDAs, and ports.

Topics in this section include:

Preprovisioning Guidelines

7710 SR-Series routers have at least two ports located on CCM module to connect terminals to the router: a console port and an auxiliary port.

Configure parameters from a system console connected to a 7710 SR console port, using Telnet to access a 7710 SR remotely or SSH to open a secure shell connection.

Predefining Entities

In order to initialize a card, the chassis slot, line card type, and MDA type must match the preprovisioned parameters. In this context, *preprovisioning* means to configure the entity type (such as the line card type, MDA type, port, and interface) that is planned for a chassis slot, line card, or MDA. 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 line card and MDA types are specified.
- Install line cards in slots with no preconfiguration parameters specified. Once the card is installed, the card and MDA types must be specified.
- Install a line card in a slot provisioned for a different card type (the card will not initialize). The existing card and MDA configuration must be deleted and replaced with the current information.

Preprovisioning a Port

Before a port can be configured, the slot must be preprovisioned with an allowed card type and the MDA must be preprovisioned with an allowed MDA type.
Other recommendations include:

- Ethernet
  - → Configure an access port for customer facing traffic on which services are configured.

    An encapsulation type may be specified in order to distinguish services on the port or channel. Encapsulation types are not required for network ports.

    To configure an Ethernet access port, refer to Configuring Ethernet Port Parameters on page 101.
- SONET/SDH
  - → SONET/SDH can be used only when configuring an OC-3, OC-12, and SONET paths on an appropriate MDA.

    To configure a SONET path, refer to Configuring SONET/SDH Port Parameters on page 103.

    Configure a network port or channel to participate in the service provider transport or infrastructure network.

    Accounting policies can only be associated with network ports/channels and Service Access Ports (SAPs). Accounting policies are configured in the `config>log>accounting-policy` context.

    To configure an Ethernet network port, refer to Configuring Ethernet Port Parameters on page 101.
- Channelized
  - → Channelized ports can only be configured on channel-capable MDAs such as the channelized Any Service Any Port MDAs or the channelized DS-1 CMA.

Once ports are preprovisioned, Link Aggregation Groups (LAGs), multilink-bundles (IMA), or Bundle Protection Groups (for example IMA BPGrps), can be configured to increase the bandwidth available between two nodes. Up to eight links can be grouped. All physical links or channels in a given LAG/bundle combine to form one logical connection. A LAG/bundle also provides redundancy in case one or more links that participate in the LAG/bundle fail. For command syntax, see Configuring Multilink PPP Bundles on page 122 or Configuring LAG Parameters on page 128. To configure channelized port for TDM, refer to section Configuring Channelized Ports on page 107. To configure channelized port for Sonet/SDH high speed chaneels (ASAP MDAs only), refer to Configuring SONET/SDH Port Parameters on page 103.

Basic Configuration

The most basic configuration must have the following:

- Identify chassis slot.
- Specify line card type (must be an allowed card type).
- Specify MCM slot (not required for CMA)
- Specify MCM type (must be an allowed MCM type)
- Identify MDA slot.
- Specify MDA type (must be an allowed MDA type).
- Identify specific port to configure.

The following example displays some card configurations:

```
ALA-A>config# info
. . .
#--------------------------------------------------
echo "Card Configuration"
#--------------------------------------------------
    card 1
        card-type iom-12g
        mcm 1
            mcm-type mcm-v1
        exit
        mcm 3
            mcm-type mcm-v1
        exit
        mda 1
            mda-type m60-10/100eth-tx
        exit
        mda 3
            mda-type m4-atmoc12/3-sfp
        exit
        mda 5
            mda-type c8-10/100eth-tx
        exit
        mda 6
            mda-type c1-1gb-sfp
        exit
        mda 7
            mda-type c8-chds1
        exit
        mda 8
            mda-type c4-ds3
        exit
    exit
#--------------------------------------------------
ALA-A> config#
```

Common Configuration Tasks

The following sections are basic system tasks that must be performed.

- Configuring Cards, MDA Carrier Modules (MCMs) and Media Dependent Adapters (MDAs) on page 94
- Configuring Cards and Compact Media Adapters (CMAs) on page 95
  - → Configuring MDA/CMA Access and Network Pool Parameters on page 96
- Configuring Ports on page 97
  - → Configuring Port Pool Parameters on page 97
  - → Configuring APS Parameters on page 98
  - → Configuring Ethernet Port Parameters on page 101
  - → Configuring SONET/SDH Port Parameters on page 103
  - → Configuring Channelized Ports on page 107
  - → Configuring Frame Relay Parameters on page 117
  - → Configuring Multilink PPP Bundles on page 122
- Configuring LAG Parameters on page 128

Configuring Cards, MDA Carrier Modules (MCMs) and Media Dependent Adapters (MDAs)

Card configurations must include a chassis slot designation. A slot must be preconfigured with the type of cards, MCMs, and MDAs which are allowed to be provisioned.

Note: Output for Media Dependent Adapters (MDAs) show an “m” in the **mda-type** description, for example, **m60-eth10/100-tx**.

Use the **config** > **info** command to display card configuration information:

```
A:7710-3>config# info
. . .
#------------------------------------------
echo "Card Configuration"
#------------------------------------------
    card 1
        card-type iom-12g
        mcm 1
                mcm-type mcm-v1
            exit
            mcm 3
                mcm-type mcm-v1
            exit
        mda 1
            mda-type m60-eth10/100-tx
        exit
        mda 3
            mda-type m60-eth10/100-tx
        exit
    exit
```

Configuring Cards and Compact Media Adapters (CMAs)

Card configurations must include a chassis slot designation. A slot must be preconfigured with the type of cards and CMAs which are allowed to be provisioned.

Note: Compact Media Adapters (CMAs) are configured using the MDA command. Output for Compact Media Adapter MDAs show a “c” in the **mda-type** description, for example, **c8-10/100eth-tx**.

Use the **config > info** command to display card configuration information:

```
A:7710-3>config# info
. . .
#------------------------------------------
echo "Card Configuration"
#------------------------------------------
    card 1
        card-type iom-12g
          mda 5
            mda-type c8-10/100eth-tx
          exit
          mda 6
            mda-type c8-10/100eth-tx
          exit
    exit
#------------------------------------------
```

Configuring MDA/CMA Access and Network Pool Parameters

MDA-level pools are used by ingress network queues. Network policies can be applied (optional) to create and edit QoS pool resources on egress network ports, channels, and ingress MDAs. Network-queue and slope policies are configured in the `config>qos` context.

The following example displays an MDA pool configuration:

```
A:ALA-B>config>card>mda# info
----------------------------------------------
            mda-type m10-1gb-sfp
            network
                egress
                    pool
                        slope-policy "B"
                    exit
                exit
            exit
            access
                ingress
                    pool
                        resv-cbs 50
                        slope-policy "A"
                    exit
                exit
            exit
----------------------------------------------
A:ALA-B>config>card>mda#
```

Configuring Ports

This section provides the CLI syntax and examples to configure the following:

- Configuring Port Pool Parameters on page 97
- Configuring APS Parameters on page 98
- Configuring Ethernet Port Parameters on page 101
- Configuring SONET/SDH Port Parameters on page 103
- Configuring Channelized Ports on page 107

Configuring Port Pool Parameters

The following example displays port pool configurations:

```
A:ALA-B>config>port# info
----------------------------------------------
        access
            egress
                pool
                    slope-policy "slopePolicy1"
                exit
            exit
        exit
        network
            egress
                pool
                    slope-policy "slopePolicy2"
                exit
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-B>config>port#
```

Configuring APS Parameters

NOTE: It is recommended to group working lines and protect lines on separate MDAs/CMAs.

APS configuration rules:

- A working port must be added first. Then a protection port can be added or removed at any time.
- A protection port must be shutdown 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 on the APS port level and configuration on the physical member ports are blocked.
- For a multi-chassis APS group, only one member circuit (either working or protect) can be added. Note that the neighbor IP address of an APS group must be configured before adding a member circuit in it. The configuration of a non-zero neighbor IP address indicates the APS group as multi-chassis. Thus, the member circuit and services must be removed before adding or removing the neighbor IP address (for example, before converting an APS group from multi-chassis to single-chassis or single-chassis to multi-chassis).
- Bundle Protection Group (BPGrp) - A BPGrp is a collection of two bundles created on the APS Group port. Working bundle resides on the working circuit of the APS group, while protection bundle resides on the protection circuit of the APS group. APS protocol running on the circuits of the APS Group port monitors the health of the Sonet/SDH line and based on it or administrative action moves user traffic from one bundle to another in the group as part of an APS switch.

The following displays a working chassis APS configuration:

```
A:ALA-274>config>port (1/1/2)# info
----------------------------------------------
        description "APS Group"
        aps
            neighbor 13.1.1.2
            working-circuit 1/1/1
        exit
        no shutdown
----------------------------------------------
A:ALA-274>config>port#
```

The following displays a protect APS configuration:

```
A:ALA-274>config>port (1/2/2)# info
----------------------------------------------
        description "APS Group"
        aps
            neighbor 13.1.1.1
            protect-circuit 1/2/2
        exit
        no shutdown
----------------------------------------------
A:ALA-274>config>port#
```

Configuring an IES Service with an ATM SAP

The following displays an IES service SAP configuration:

```
:ALA-701>config>service>ies# info
----------------------------------------------
            interface "atm_1" create
                address 2.3.4.1/24
                sap 1/1/1:17/24 create
                exit
            exit
            interface "atm_2" create
                address 2.4.5.1/24
                sap 1/1/1:18/300 create
                exit
            exit
            no shutdown
----------------------------------------------
B:ALA-701>config>service>ies#
```

Configuring an Epipe Service with an ATM SAP

The following displays an Epipe service SAP configuration:

```
B:ALA-701>config>service# info
----------------------------------------------
...
            epipe 5 customer 1 create
                shutdown
                sap 1/1/2:15/25 create
                exit
                sap 1/1/3:25/35 create
                exit
            exit
----------------------------------------------
B:ALA-701>config>service#
```

Configuring Ethernet Port Parameters

Ethernet Network Port

A network port is network facing and participates in the service provider transport or infrastructure network processes.

The following example displays a network port configuration:

```
A:ALA-B>config>port# info
----------------------------------------------
        description "Ethernet network port"
        ethernet
        exit
        no shutdown
----------------------------------------------
A:ALA-B>config>port#
```

Ethernet Access Port

Services are configured on access ports used for customer-facing traffic. If a Service Access Port (SAP) is to be configured on a port, it must be configured as access mode. When a port is configured for access mode, the appropriate encapsulation type can be specified to distinguish the services on the port. Once a port has been configured for access mode, multiple services may be configured on the port.

The following example displays an Ethernet access port configuration:

```
A:ALA-A>config>port# info
----------------------------------------------
        description "Ethernet access port"
        access
            egress
                pool
                    slope-policy "slopePolicy1"
                exit
            exit
        exit
        network
            egress
                pool
                    slope-policy "slopePolicy2"
                exit
            exit
        exit
        ethernet
            mode access
            encap-type dot1q
        exit
```

```
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

Configuring 802.1x Authentication Port Parameters

The following example displays an 802.1x port configuration:

```
A:ALA-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
----------------------------------------------
A:ALA-A>config>port>ethernet>dot1x#
```

Configuring SONET/SDH Port Parameters

SONET/SDH features can only be configured on ports on the following MDAs and CMAs:

- OC-3 (CMA/MDA)
- OC-3 ASAP
- OC-12/3 (CMA/MDA)
- OC-48 (MDA)
- OC-12 ASAP
- ATM OC-12/3 (MDA)
- Channelized ASAP OC12

SONET/SDH Network Port

The following example displays a SONET/SDH network mode configuration:

```
A:ALA-A>config>port# info
----------------------------------------------
        description "SONET/SDH network port"
        sonet-sdh
            path
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

SONET/SDH Access Port

The following example displays a SONET/SDH access port configuration:

```
A:ALA-A>config>port2/2/2# info
----------------------------------------------
        description "SONET/SDH access port"
        sonet-sdh
            path
                mode access
                encap-type frame-relay
                mac 00:03:47:c8:b4:86
                frame-relay
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

Multi-Class MLPPP

The following guidelines apply to multi-class MLPPP:

- MC-MLPPP must be configured before links are added to a bundle.
- MC-MLPPP and LFI (**config>port>multilink-bundle>interleave-fragments**) are mutually exclusive.
- MC-MLPPP is not supported when port is configured as **network** mode.
- MC-MLPPP can be enabled on every MLPPP bundle and bundle protection group.
- MC-MLPPP is supported only on ASAP MDAs (for example, m4-choc3-as-sfp, m1-choc12-as-sfp, m4-chds3-as, m12-chds3-as).
- Short and long sequence packet formats are supported (both ends must be of the same type) with static mapping of forwarding classes to MC-MLPPP class (based on the number of classes negotiated with the far end).
- Single fragment size for all classes is supported.
- Prefix elision is not supported. The prefix elision (compressing common header bytes) option advises the peer that, in each of the given classes, the implementation expects to receive only packets with a certain prefix; this prefix is not to be sent as part of the information in the fragment(s) of this class.

Configuring Channelized Ports

- Configuring Cisco HDLC on a Channelized Port on page 111

When configuring channelized ports, the port ID is specified in different ways depending on the MDA type and level of channelization. Ethernet ports cannot be channelized.

The 7710 SR supports a channelized DS1 card (c8-chds1). The channelization is as follows:

N*DS0 in DS1 port.{1..24}

N*DS0 in E1 port.{1..32}

A port ID for channels has one of the following syntax as applicable to channelization and mapping options where the port configuration syntax is slot/mda/port (Table 20):

Table 20: Channelized Port Syntax Examples

	PortID for Physical Port Speed	
Channel speed	OC12/STM4	OC3/STM1
SONET/SDH		
STS12/STM4	port.sts12	N/A
STS3/STM1	port.sts3-{1..4}	port.sts3
STS1/STM0	port.sts1-{1..4}.{1..3}	port.sts1-{1..3}
TUG3	port.tug3-{1..4}.{1..3}	port.tug3-{1..3}
TU3	port.tu3-{1..4}.{1..3}	port.tu3-{1..3}
VT15/VC1.1	port.vt15-{1..4}.{1..3}.{1..4}.{1..7}	port.vt15-{1..3}.{1..4}.{1..7}
VT2/VC12	port.vt2-{1..4}.{1..3}.{1..3}.{1..7}	port.vt2-{1..3}.{1..3}.{1..7}
TDM		
DS3/E3	port.{1..4}.{1..3}	port.{1..3}
DS1 in DS3	port.{1..4}.{1..3}.{1..28}	port.{1..3}.{1..28}
DS1 in VT2	port.{1..4}.{1..3}.{1..3}.{1..7}	port.{1..3}.{1..3}.{1..7}
DS1 in VT15	port.{1..4}.{1..3}.{1..4}.{1..7}	port.{1..3}.{1..4}.{1..7}
E1 in DS3	port.{1..4}.{1..3}.{1..21}	port.{1..3}.{1..21}
E1 in VT2	port.{1..4}.{1..3}.{1..3}.{1..7}	port.{1..3}.{1..3}.{1..7}
N*DS0 in DS1 in DS3	port.{1..4}.{1..3}.{1..28}.{1..24}	port.{1..3}.{1..28}.{1..24}
N*DS0 in DS1 in VT2	port.{1..4}.{1..3}.{1..3}.{1..7}.{1..24}	port.{1..3}.{1..3}.{1..7}.{1..24}
N*DS0 in DS1 in VT15	port.{1..4}.{1..3}.{1..4}.{1..7}.{1..24}	port.{1..3}.{1..4}.{1..7}.{1..24}
N*DS0 in E1in DS3	port.{1..4}.{1..3}.{1..21}.{2..32}	port.{1..3}.{1..21}.{2..32}
N*DS0 in E1in VT2	port.{1..4}.{1..3}.{1..3}.{1..7}.{2..32}	port.{1..3}.{1..3}.{1..7}.{2..32}

Verify the MDA Type

To make sure you have a channel-capable MDA or CMA, verify the MDA-type you are configuring by entering a **show mda** *slot-id* command.

In the following example, MDA 7 shows a channelized DS1 CMA.

```
A:7710-3>config# show mda
===============================================================================
MDA Summary
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m60-10/100eth-tx      m60-10/100eth-tx      up        up
      3     m4-atmoc12/3-sfp      m4-atmoc12/3-sfp      up        up
      5     c8-10/100eth-tx       c8-10/100eth-tx       up        up
      6     c1-1gb-sfp            c1-1gb-sfp            up        up
      7     c8-chds1              c8-chds1              up        up
      8     c4-ds3                c4-ds3                up        up
===============================================================================
A:7710-3>

A:7710-3>config# show mda 1/7 detail
===============================================================================
MDA 1/7 detail
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
      7     c8-chds1              c8-chds1              up        up
MDA Specific Data
    Maximum port count            : 8
    Number of ports equipped      : 8
    Network ingress queue policy  : default
    Capabilities                  : TDM, PPP, FR
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS1
    Max number of channels        : 64
    Channels in use               : 0

Hardware Data
    Part number                   : Sim Part#
    CLEI code                     : Sim CLEI
    Serial number                 : mda-7
    Manufacture date              : 01012003
    Manufacturing string          : Sim MfgString mda-7
    Manufacturing deviations      : Sim MfgDeviation mda-7
    Administrative state          : up
    Operational state             : up
    Temperature                   : 35C
    Temperature threshold         : 75C
    Time of last boot             : 2006/10/02 09:28:22
    Current alarm state           : alarm cleared
    Base MAC address              : 04:7b:01:07:00:01
===============================================================================
A:7710-3>
```

In the TDM E1 context, configure DS0 channel groups and their parameters. For a DS1 channel-group, up to 24 timeslots can be assigned (numbered 1..24). For an E1 channel-group, up to 31 timeslots can be assigned (numbered 2..32). For ATM, all timeslots are auto-configured when a channel group gets created (there is no sub-E1 for ATM). ATM, Frame Relay and BCP-NULL encapsulation examples follow :

```
ALA-A>config>port>tdm# e1 1.1
ALA-A>config>port>tdm>e1# channel-group 1
ALA-A>config>port>tdm>e1>channel-group# timeslots 2
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group#
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm>e1# channel-group 2
ALA-A>config>port>tdm>e1>channel-group# timeslots 3
ALA-A>config>port>tdm>e1>channel-group# encap-type frame-relay
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group# exit
ALA-A>config>port>tdm>e1# channel-group 3
ALA-A>config>port>tdm>e1>channel-group# timeslots 11,12
ALA-A>config>port>tdm>e1>channel-group# encap-type cisco-hdlc
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group# exit
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm>e1# exit
ALA-A>config>port>tdm# e1 1.2
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm>e1# channel-group 1
ALA-A>config>port>tdm>e1>channel-group# encap-type atm
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group# exit
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm# info
----------------------------------------------
        tdm
           ds3 1
                no shutdown
            exit
           e1 1.1
                channel-group 1
                     timeslots 2
                     no shutdown
               exit
                channel-group 2
                    encap-type frame-relay
                    frame-relay
                    exit
                    timeslots 10
                    no shutdown
                exit
                channel-group 3
                    encap-type cisco-hdlc
                    cisco-hdlc
                    exit
                    timeslots 11,12
                    no shutdown
                exit
                no shutdown
            exit
           e1 1.2
```

```
                channel-group 1
                    encap-type atm
                    atm
                    exit
                    no shutdown
                exit
                no shutdown
        exit
        no shutdown
----------------------------------------------
ALA-A>config>port>tdm#
```

Services can now be applied to the configured channelized ports.

Configuring Cisco HDLC on a Channelized Port

Use the following CLI syntax to configure cHDLC:

CLI Syntax:
```
config# port {port-id |bundle-id |aps-id}
  tdm
     ds3 [sonet-sdh-index]
        channelized {ds1|e1}
        no shutdown
     ds1
        channel-group channel-group
           cisco-hdlc
              down-count down-count
              keepalive time-interval
              up-count up-count
           encap-type {bcp-null|bcp-dot1q|ipcp|ppp-auto|frame-
           relay|wan-mirror|cisco-hdlc}
           timeslots timeslots
           no shutdown
```

The following example displays SONET/SDH access mode configuration command usage:

Example:
```
A:ALA-29>config>port>tdm# ds3
A:ALA-29>config>port>tdm>ds3# channelized ds1
A:ALA-29>config>port>tdm>ds3# no shutdown
A:ALA-29>config>port>tdm>ds3# exit
A:ALA-29>config>port>tdm# ds1 1
A:ALA-29>config>port>tdm>ds1# no shutdown
A:ALA-29>config>port>tdm>ds1# channel-group 1
A:ALA-29>config>port>tdm>ds1>channel-group# timeslots 1-20
A:ALA-29>config>port>tdm>ds1>channel-group# encap-type cisco-hdlc
A:ALA-29>config>port>tdm>ds1>channel-group# exit
A:ALA-29>config>port>tdm>ds1# channel-group 1
A:ALA-29>config>port>tdm>ds1>channel-group# no shutdown
A:ALA-29>config>port>tdm>ds1>channel-group# exit
A:ALA-29>config>port>tdm>ds1# exit
A:ALA-29>config>port>tdm#
```

The following example displays a configuration:

```
A:ALA-29>config>port# inf
----------------------------------------------
        tdm
            ds3
                channelized ds1
                no shutdown
            exit
            ds1 1
                channel-group 1
                    encap-type cisco-hdlc
```

```
                    timeslots 1-20
                    cisco-hdlc
                    exit
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-29>config>port#
```

Configuring ATM Interface Parameters

ATM interface parameters can only be configured for SONET/SDH ports/paths and TDM ports/channels supporting ATM encapsulation, and for IMA multilink bundles.

ATM interface parameters allow users to configure characteristics of an ATM interface. The 7710 SR product family supports configuration of the following ATM interface characteristics:

- Cell-format — Allows user to select the ATM cell format to be used on a given interface: UNI/NNI
- ILMI — Allows user to enable/disable ILMI protocol
- traffic-desc — Allows user to configure ILMI PVCC TM characteristics over a given ATM interface (ingress and egress direction characteristics can be configured separately)
- Mapping — Allows user to select ATM cell mapping into an HDLC frame: Direct/PLCP

PLCP/Direct Mapping

Setting mapping to PLCP changes the effective speed of a DS3 interface to 40.704 M. When a port operates in a PLCP mode, the OCD events and LCD are not applicable (including related status fields and counters).

Similarly the below-defined PLCP statuses, alarms, counters do not apply for direct mapped ports.

When a path operates in the PLCP mode, 7710 SR supports the standard ATM MIB monitoring of the PLCP operations, for example:

- PLCP severely errored framing seconds
- PLCP alarm state
- PLCP unavailable seconds counter

Table 21 illustrates how SONET alarm status, path operational status, ATM interface and PLCP status and PLCP Alarm state interact:

Table 21: Alarm State Interactions

Content of the Received Signal						Status Field Values			
Local Signal	Local Frame	Local Payld	Local PLCP Framing	Far End Framing	Far End PLCP Framing	Path Sonet Alarm Status	Path Oper Status	Atm Interface Oper Status	PLCP Alarm State
Y	Y	Y	Y	Y	Y	None	Up	Up	No Alarm
Y	Y	Y	Y	Y	Prob	None	Up	Lower Layer Down	Far End Alarm Rx
Y	Y	Y	Y	Prob	Prob	RDI	Down	Lower Layer Down	Far End Alarm Rx
Y	Y	Y	Prob	Y	N/A	None	Up	Lower Layer Down	Incoming LOF
Y	Y	Y	Prob	Prob	N/A	RDI	Down	Lower Layer Down	Incoming LOF
Y	Prob	N/A	N/A	N/A	N/A	LOF	Down	Lower Layer Down	Incoming LOF
AIS	N/A	N/A	N/A	N/A	N/A	AIS	Down	Lower Layer Down	Incoming LOF
Prob	N/A	N/A	N/A	N/A	N/A	LOS	Down	Lower Layer Down	Incoming LOF

DS3 path configured for PLCP mapping:

- Supports transmit and receive of the Ax, Px and C1 bits.
- Ignores the received Z1, Z2, Z3 octets of the PLCP frame and transmits all zeros in the Z1, Z2, Z3 octets of the PLCP frame.
- Ignores the received F1 octet of the PLCP frame, and transmits all zeros in the F1 octet of the PLCP frame.
- Samples and uses for performance monitoring received FEBE bits of G1 octet and transmits the number of BIP-8 errors detected by the receive framer using the FEBE bits of the G1 octet.Detects a PLCP Far End Alarm when 10 consecutive PLCP frames are received with the RAI bit set, and transmits a set RAI bit when the local port has declared PLCP-LOF. When the local port declares PLCP-LOF is cleared, the outgoing RAI bit is cleared.

- Ignores the received X bits of the G1 octet, and transmits all zeros in the X bits of the G1 octet of the PLCP frame.
- Ignores the received M1 and M2 octets and transmits all zeros in the M1 and M2 octets of the PLCP frame.

ATM Interface Commands

Use the following CLI syntax to configure ATM interface parameters for SONET/SDH paths:

CLI Syntax:

```
config# port {port-id |aps-id}
 sonet-sdh
    path [sonet-sdh-index]
          atm
             cell-format cell-format
             ilmi [vpi/vci]
                egress
                   traffic-desc traffic-desc-profile-id
                ingress
                   traffic-desc traffic-desc-profile-id
                keep-alive [poll-frequency seconds] [poll-
                   count value] [test-frequency seconds]
                protocol protocol-type
                [no] shutdown
             min-vp-vpi value
```

Use the following CLI syntax to configure ATM interface parameters for TDM channels:

CLI Syntax:

```
config# port {port-id}
 tdm
    ds1 [ds1-id]
       channel-group 1
          atm
             cell-format cell-format
             min-vp-vpi value
    ds3 [sonet-sdh-index]
       atm
          cell-format cell-format
          min-vp-vpi value
          mapping {direct | plcp}
    e1 [e1-id]
       channel-group 1
          atm
             cell-format cell-format
             min-vp-vpi value
    e3 [sonet-sdh-index]
       atm
          cell-format cell-format
          min-vp-vpi value
```

Configuring Frame Relay Parameters

Frame Relay pipes are used to provide customer-to-customer Frame Relay PVCs or to interconnect individual Frame Relay clouds.

Frame Relay parameters can only be configured in SONET/SDH and channelized TDM MDA contexts.

The following displays a TDM frame relay configuration:

```
A:ALA-7>config>port# info detail
----------------------------------------------
        description "DS3/E3"
...
        tdm
            buildout long
            ds3 ds3
                type t3
                channelized
                clock-source loop-timed
                framing c-bit
                no feac-loop-respond
                no mdl
                no mdl-transmit
                no loopback
                report-alarm ais los
                no report-alarm oof rai looped
                no shutdown
            exit
            ds1 ds1-1
                shutdown
                framing esf
                no loopback
                report-alarm ais los
                no report-alarm oof rai looped
                channel-group 1
                    description "DS3/E3"
                    mode access
                    encap-type frame-relay
                    no mtu
                    no mac
                    timeslots 1
                    speed 64
                    crc 16
                    frame-relay
                        lmi-type itu
                        mode dte
                        n393dce 4
                        n393dte 4
                        n391dte 6
                        n392dce 3
                        n392dte 3
                        t391dte 10
                        t392dce 15
                    exit
                    no shutdown
                exit
```

```
                exit
            exit
            no shutdown
----------------------------------------------
A:ALA-7>config>port#
```

SONET/SDH Interfaces

This section applies also to FR interfaces on Sonet/SDH high-speed channels on ASAP MDAs. In order to configure Frame Relay on the associated port/channel, the `frame-relay` encapsulation type must be specified.

The following output displays the Frame Relay encapsulation type and the Frame Relay defaults.

```
A:ALA-7>config>port# info detail
----------------------------------------------
        description "OC-3/OC-12 SONET/SDH"
        access
            ingress
                pool default
                    resv-cbs default
                    slope-policy "default"
                exit
            exit
            egress
                pool default
                    resv-cbs sum
                    slope-policy "default"
                exit
            exit
        exit
        network
            egress
                pool default
                    resv-cbs default
                    slope-policy "default"
                exit
            exit
        exit
        sonet-sdh
            framing sonet
            clock-source node-timed
            no loopback
            speed oc12
            report-alarm loc lrdi lb2er-sf slof slos
            no report-alarm lais ss1f lb2er-sd lrei
            threshold ber-sd rate 6
            threshold ber-sf rate 3
            section-trace byte 0x1
            path
                description "OC-3/OC-12 SONET/SDH"
                mode access
                encap-type frame-relay
                no mtu
                no mac
                crc 32
                no scramble
                trace-string "Alcatel 7710 ALA-"
                report-alarm plop pplm puneq
                no report-alarm pais prdi prei
                signal-label 0xcf
                frame-relay
                    lmi-type itu
```

```
                    mode dte
                    n393dce 4
                    n393dte 4
                    n391dte 6
                    n392dce 3
                    n392dte 3
                    t391dte 10
                    t392dce 15
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-7>config>port#
```

IMA Test Procedure

Use the following CLI to perform IMA Test Pattern Procedure on a member link of an IMA group:

CLI Syntax:
```
configure# port bundle-type-slot/mda.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 IMA group and its member links. 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, i.e. 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, for example, data traffic will not be affected by the ongoing test.
3. There can only be a single test executed per an IMA group at any given 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 shutdown before a new test-link value or test pattern is accepted.
6. The current IMA group test pattern configuration and result of a given IMA test can be seen by executing a show command for the IMA group. A test-link result can have three values:

   a. Disabled: The test-link is currently not running.

   b. Operating: The test pattern procedure is **no shutdown** and there are currently no failed-links for this running test-pattern-procedure.

   c. Link-Failed: One or more links have failed the test-pattern-procedure. Execute a **show port <slot/mda/port.sonet-sdh-index> 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, will result in the test-link value being reset to default.
8. IMA test procedure configurations are not saved when the admin save command is executed.

Configuring Multilink PPP Bundles

Multilink bundles can be created with as few as one, or as many as 8 members. 56 multilink bundles can be configured per MDA, and 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 is based on a link control protocol (LCP) option negotiation that permits a system to indicate to its peer that it is capable of combining multiple physical links into a bundle.

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:

- Multilink bundle configuration should include at least two ports.
- A maximum of eight ports can be included in a multilink bundle.
- Multilink bundles can only be aggregated on a single MDA.

```
A;ALA-A>config# port bundle-1/3.1
A;ALA-A>config>port# multilink-bundle
A;ALA-A>config>port>ml-bundle# member 1/3/1.ds0grp-1.1
A;ALA-A>config>port>ml-bundle# member 1/3/1.ds0grp-2.2
A;ALA-A>config>port>ml-bundle# member 1/3/1.ds0grp-1.1
```

Configuring Multilink ATM Inverse Multiplexing (IMA) Bundles

IMA bundles are supported on Channelized ASAP MDAs. The bundles aggregate E1 or DS1 ATM channels into a single logical ATM interface.

IMA Bundles

Use the following CLI syntax to configure IMA group bundle parameters:

CLI Syntax:
```
configure# port bundle-ima-slot/port.bundle-num
  description description-string
  multilink-bundle
     fragment-threshold value
     ima
        atm
           cell-format {uni|nni}
           min-vp-vpi vp-vpi-value
        exit
        link-delay {activate |deactivate} milli-seconds
        max-bandwidth number-links
  member port-id
  minimum-links minimum-links
  red-differential-delay red-diff-delay down
```

Configuration notes:
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 those common IMA group interface characteristics:

- Encapsulation type (ATM)
- ATM interface characteristics (under the ATM menu context)
- Interface mode type (only access is supported)
- MTU value (derived from the primary link)

Member links inherit those common characteristics from the IMA group that they are part of and as long as they are part of an IMA group. Characteristics derived from the primary link (MTU, interface mode type) can be changed on the primary link only and not on other links in the bundle or a bundle itself. The primary link is the member which has the lowest ifindex. When a member is added/deleted the primary member may be changed based on ifIndicies of all member links.

Once a path becomes part of an IMA group logical link, the path ceases to exist as a physical ATM path interface. This means that:

1. ATM interface characteristics enforced over the link are those of a bundle. Note that when a link is removed from an IMA bundle, the link's ATM characteristics are reset to ATM interface defaults.
2. No services can be configured on the member link itself.

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/reset to defaults when a link is added to/ removed from an IMA bundle. Upon addition to an IMA group, each added member gets automatically assigned an IMA link Id. IMA link Ids are in range from 0 to 7 and stay constant as long as the router does not reboot.

When configuring IMA bundles, consider the following guidelines:

- IMA bundles should contain at least two members.
- A maximum of eight members can be included in an IMA group bundle.
- IMA bundles can only be aggregated on a single MDA.
- IMA group maximum bandwidth and minimum link settings allow, by default, for oversubscription of shaped services. When that occurs, however, scheduling of traffic over an IMA group ATM interface degrades to round-robin between shaped services. To preserve full ATM TM even during a member link failure, it is recommended that maximum bandwidth is set to minimum links.
- When configuring the red differential delay for IMA groups on ASAP MDAs, the value configured is converted into acceptable frame sequence number delay on a link since delay is granular to IMA frame sequence number difference. For EI channels (receiving frame time 27ms), configured values map to the enforced values as follows: 0 ms maps to 0 frame sequence number difference (27ms delay), 1-27 ms maps to 1 frame sequence number difference (54 ms delay), 28 - 50 ms maps to 2 frame sequence number difference (81 ms delay). Similarly, for DS1 channels (receiving frame time 35 ms), configured values map to enforced values as follows: 0 ms maps to 0 frame sequence number difference (35 ms delay), 1-27 ms maps to 1 frame sequence number difference (70 ms delay), 28 - 50 ms maps to 2 frame sequence number difference (105 ms delay).
- When a channel is deleted from an IMA group it is recommended that a deletion takes place at the far end first when the far end supports graceful deletion to ensure no cell loss takes place on the 7710 RX end of the channel. When a channel is deleted on the 7710 SR end first, a small data loss will take place on the 7710 RX side (depending on the time required for the far end to deactivate its TX on the link being deleted).
- When 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 bundle with 3 group members residing on a channelized OC-3 ASAP MDA in slot 1/3/1:

```
ALA-A>config# port bundle-ima-1/3.1
ALA-A>config>port# multilink-bundle
ALA-A>config>port>ml-bundle# member 1/3/1.1.1.1
ALA-A>config>port>ml-bundle# member 1/3/1.1.2.1
ALA-A>config>port>ml-bundle# member 1/3/1.1.3.1
```

Configuring Bundle Protection Group Ports

Bundle Protection groups enable APS protection of one bundle residing on a working circuit of an APS group port by another bundle residing on the protection circuit of that APS group port. The following examples show the process to configure BPGRP on ASAP MDAs to provide an APS protection for an IMA bundle.

First, two ASAP MDAs must be configured.

Example:
```
config# card 1
config>card# mda 1
config>card>mda# mda-type m4-choc3-as-sfp
config>card>mda# no shutdown
config>card>mda# exit
config>card# exit
config# card 1
config>card# mda 3
config>card>mda# mda-type m4-choc3-as-sfp
config>card>mda# no shutdown
config>card>mda# exit
```

Configure an APS group with working and protection circuits on the ASAP MDAs.

Example:
```
config>port>aps# working-circuit 1/1/1
config>port>aps# protect-circuit 1/3/1
config>port>aps# exit
config>port# no shutdown
```

Create eight ATM DS1 channels on the APS group.

Example:
```
config>port>aps#
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# exit
config>port# tdm
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 1.1
config>port>tdm>ds1# channel-group 1
config>port>tdm>ds1>channel-group# encap-type atm
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
config>port>tdm# ds1 1.8
config>port>tdm>ds1# channel-group 1
```

```
config>port>tdm>ds1>channel-group# encap-type atm
config>port>tdm>ds1>channel-group# no shutdown
config>port>tdm>ds1>channel-group# exit
```

Next, configure an IMA-type BPG with working and protection bundles on working and protection circuits of aps-1 and members the created DS1s (this creates 2 IMA bundles, one on working and one on protection circuit):

Example:
```
config# port bpgrp-ima-1
config>port# multilink-bundle
config>port>multilink-bundle# working-bundle bundle-ima-1/1.1
config>port>multilink-bundle# protect-bundle bundle-ima-2/1.1
config>port>multilink-bundle# member aps-1.1.1.1
config>port>multilink-bundle# member aps-1.1.2.1
config>port>multilink-bundle# member aps-1.1.3.1
config>port>multilink-bundle# member aps-1.1.4.1
config>port>multilink-bundle# member aps-1.1.5.1
config>port>multilink-bundle# member aps-1.1.6.1
config>port>multilink-bundle# member aps-1.1.7.1
config>port>multilink-bundle# member aps-1.1.8.1
config>port>multilink-bundle# exit
config>port>multilink-bundle# no shutdown
config>port>multilink-bundle# exit
config>port# no shutdown
```

Finally, a service can be configured on this bundle using the BPG ID (for example, an ATM VC 0/32 SAP would be: `sap bpg-ima-1:0/32`).

Configuring LAG Parameters

LAG configurations should include at least two ports. Other considerations include:

- A maximum of eight ports can be included in a LAG. All ports in the LAG must share the same characteristics (speed, duplex, hold-timer, etc.). The port characteristics are inherited from the primary port.
- Autonegotiation must be disabled or set limited mode for ports that are part of a LAG to guarantee a specific port speed.
- Ports in a LAG must be configured as full duplex.

The following example displays LAG configuration output:

```
A:ALA-A>config>lag# info detail
----------------------------------------------
        description "LAG2"
        mac 04:68:ff:00:00:01
        port  1/1/1
        port  1/3/1
        port  1/5/1
        port  1/7/1
        port  1/9/1
        dynamic-cost
        port-threshold 4 action down
----------------------------------------------
A:ALA-A>config>lag#
```

Service Management Tasks

This section discusses basic procedures of the following service management tasks:

- Modifying or Deleting an MCM, MDA or CMA on page 129
- Modifying a Card Type on page 130
- Deleting a Card on page 131
- Deleting Port Parameters on page 131

Modifying or Deleting an MCM, MDA or CMA

To change an MDA or CMA type already provisioned for a specific slot/card, first you must shut down the slot/MDA/port configuration and then delete the CMA, MDA and/or the MCM from the configuration.

Note: To modify or delete CMAs, use the MDA command structure.

Use the following CLI syntax to modify an MDA:

CLI Syntax:
```
config> port port-id
 shutdown
```

CLI Syntax:
```
config> card slot-number
     shutdown
  [no] mda mda-number
     [no] mda-type mda-type
     shutdown
```

Note: It is not required to shutdown and remove an MCM to remove or modify an MDA. Use the following sequence if changing the MCM type or slot configuration.

CLI Syntax:
```
config> card slot-number
     shutdown
  [no] mcm mcm-number
     no mcm-type mcm-type
     shutdown
```

Modifying a Card Type

In order to modify the card type already provisioned for a specific slot, you must shutdown existing port configurations and shutdown and remove all MDA or CMA configurations. After removing MDA configurations, shutdown and remove the MCM from service before modifying the card.

Note: CMAs do not require an MCM, therefore, if removing a CMA-type MDA from service, it is not required to shutdown and remove an MCM before modifying the card.

Use the following CLI syntax to modify a card type already provisioned for a specific slot:

CLI Syntax:
```
config> port port-id
         [no] shutdown
```

CLI Syntax:
```
config> card slot-number
         mda mda-number
            [no] mda-type mda-type
            [no] shutdown
```

CLI Syntax:
```
config> card slot-number
            shutdown
         [no] mcm mcm-number
            no mcm-type mcm-type
            shutdown
```

Deleting a Card

In order to delete the card type provisioned for a specific slot, you must shutdown existing port configurations and shutdown and remove all MDA or CMA configurations. After removing MDA configurations, you may shutdown and remove the MCM from service before modifying the card.

Note: CMAs do not require an MCM, therefore, if removing a CMA-type MDA from service, it is not required to shutdown and remove an MCM before modifying the card:

Use the following CLI syntax to delete a card provisioned for a specific slot:

CLI Syntax:
```
config> port port-id
 shutdown
```

CLI Syntax:
```
config> card slot-number
 card-type card-type
 mcm mcm-number
    no mcm-type mcm-type
    no shutdown
 mda mda-number
    no mda-type mda-type
    no shutdown
```

Deleting Port Parameters

Use the following CLI syntax to delete a port provisioned for a specific card/MDA:

Use the following CLI syntax to delete a port provisioned for a specific card/MDA or CMA:

CLI Syntax:
```
config>port port-id
 shutdown
```

Card, MDA, and Port Command Reference

Command Hierarchies

Card and MDA Configuration Commands


```
config
    — [no] card slot-number
        — card-type card-type
        — no card-type
        — [no] mcm mcm-slot
            — mcm-type mcm-type
            — no mcm-type
            — [no] shutdown
        — [no] mda mda-slot
            — access
                — egress
                — ingress
            — clock-mode adaptive
```

— **clock-mode differential** [**timestamp-freq** {**19440** | **77760** | **103680**}]
— **egress**
— **ingress**
    — **mcast-path-management**
        — **ancillary-override**
            — **path-limit** *megabits-per-second*
            — **no path-limit**
        — **bandwidth-policy** <**policy-name**>
        — **no bandwidth-policy**
        — **primary-override**
            — **path-limit** *megabits-per-second*
            — **no path-limit**
        — **secondary-override**
            — **path-limit** *megabits-per-second*
            — **no path-limit**
        — [**no**] **shutdown**
    — **scheduler-policy** *hsmda-scheduler-policy-name*
    — **no scheduler-policy**
— **mda-type** *mda-type*
— **no mda-type**
— **network**
    — **egress**
    — **ingress**
        — **queue-policy** *name*
        — **no queue-policy**
— [**no**] **shutdown**
— [**no**] **shutdown**

Port Configuration Commands

config
— **port** {*port-id* | *bundle-id* | }
— **no port** {*port-id* | *bundle-id* | *bpgrp-id* | *aps-id*}
    — **access**
        — **egress**
            — **channel**
        — **ingress**
    — [**no**] **ddm-events**
    — **description** *long-description-string*
    — **no description**
    — **network**
        — **egress**
    — [**no**] **shutdown**

Port APS Commands

config
— [**no**] **port** {*aps-id}*
    — **aps**
        — **advertise-interval** *advertise-interval*
        — **no advertise-interval**
        — **hold-time** *hold-time*
        — **no hold-time**

— **neighbor** ***ip-address***
— **no neighbor**
— **protect-circuit** *port-id*
— **no protect-circuit**
— **revert-time** *minutes*
— **no revert-time**
— **switching-mode** {**bi-directional** | **uni-directional**}
— **working-circuit** *port-id*
— **no working-circuit**

Ethernet Commands

config
- — [**no**] **port** {*port-id*}
  - — **ethernet**
    - — **autonegotiate** [**limited**]
    - — [**no**] **autonegotiate**
    - — **dot1q-etype**
    - — **no dot1q-etype**
    - — **dot1x**
      - — **max-auth-req** *max-auth-request*
      - — **port-control** {**auto** | **force-auth** | **force-unauth**}
      - — **quiet-period** *seconds*
      - — **radius-plcy** *name*
      - — **re-auth-period** *seconds*
      - — [**no**] **re-authentication**
      - — **server-timeout** *seconds*
      - — **no server-timeout**
      - — **supplicant-timeout** *seconds*
      - — **no supplicant-timeout**
      - — **transmit-period** *seconds*
      - — **no transmit-period**
    - — **down-when-looped**
      - — **keep-alive** *timer*
      - — **no keep-alive**
      - — **retry-timeout** *timer*
      - — **no retry-timeout**
      - — [**no**] **shutdown**
    - — **duplex** {**full** | **half**}
    - — **efm-oam**
      - — [**no**] **accept-remote-loopback**
      - — **mode** {**active** | **passive**}
      - — [**no**] **shutdown**
      - — [**no**] **transmit-interval** *interval* [**multiplier** *multiplier*]
      - — [**no**] **tunneling**
    - — **egress-rate** *sub-rate*
    - — **no egress-rate**
    - — [**no**] **egress-scheduler-override**
      - — **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
      - — **no level** *priority-level*
      - — **max-rate** *rate*
      - — **no max-rate**
    - — **egress-scheduler-policy** *port-scheduler-policy-name*
    - — **no egress-scheduler-policy**
    - — **encap-type** {**dot1q** | **null** | **qinq**}
    - — **no encap-type**
    - — **hold-time** {[**up** *hold-time up*] [**down** *hold-time down*]}
    - — **no hold-time**
    - — **ingress-rate** *ingress-rate*
    - — **no ingress-rate**
    - — [**no**] **lacp-tunnel**
    - — **load-balancing-algorithm** *option*
    - — **no load-balancing-algorithm**
    - — **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**
— **pbb-etype** [**0x0600**..**0xffff**]
— **no pbb-etype**
— **qinq-etype**
— **no qinq-etype**
— [**no**] **report-alarm** [**signal-fail**] [**remote**] [**local**] [**no-frame-lock**] [**high-ber**]
— **speed** {**10** | **100** | **1000**}
— **xgig** {**lan** | **wan**}

Multilink Bundle Commands

config
- [**no**] **port** {*bundle-id*}
  - **multilink-bundle**
    - **fragment-threshold** *fragment-threshold*
    - **fragment-threshold unlimited**
    - **no fragment-threshold**
    - **ima**
      - **atm**
        - **cell-format** *cell-format*
        - **min-vp-vpi** *value*
      - **link-delay** {**activate** | **deactivate**} ***milli-seconds***
      - **no link-delay** {**activate** | **deactivate**}
      - **max-bandwidth** *number-links*
      - **no max-bandwidth**
      - **test-pattern-procedure**
        - [**no**] **shutdown**
        - **test-link** *port-id*
        - **no test-link**
        - **test-pattern** *pattern*
        - **no test-pattern**
      - **version** *IMA-version*
      - **no version**
    - [**no**] **interleave-fragments**
    - [**no**] **member** *port-id*
    - **minimum-links** *minimum-links*
    - **no minimum-links**
    - **mlppp**
      - **egress**
        - **qos-profile** *profile-id*
        - **no qos-profile**
      - **endpoint-discriminator class** {**ip-address** | **global-mac-address**} [**discriminator-id** *discriminator-id*]
      - **no endpoint-discriminator**
      - **ingress**
        - **qos-profile** *profile-id*
        - **no qos-profile**
      - **multiclass** *count*
      - **no multiclass**
    - **mrru** *mrru*
    - **no mrru**
    - [**no**] **protect-bundle**
    - **red-differential-delay** *red-diff-delay* [**down**]
    - **no red-differential-delay**
    - [**no**] **short-sequence**
    - [**no**] **working-bundle**
    - **yellow-differential-delay** *yellow-diff-delay*
    - **no yellow-differential-delay**

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** *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*
        - **ilmi** [*vpi/vci*]
        - **no ilmi**
          - **egress**
            - **traffic-desc** *traffic-desc-profile-id*
            - **no traffic-desc**
          - **ingress**
            - **traffic-desc** *traffic-desc-profile-id*
            - **no traffic-desc**
          - **keep-alive** [**poll-frequency** *seconds*] [**poll-count** *value*] [**test-frequency** *seconds*]
          - **no keep-alive**
          - **protocol** *protocol-type*
          - **no protocol**
          - [**no**] **shutdown**
        - **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*
      - **no description**
      - [**no**] **egress-scheduler-override**
        - **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
        - **no level** *priority-level*
        - **max-rate** *rate*
        - **no max-rate**
      - **egress-scheduler-policy** *port-scheduler-policy-name*
      - **no egress-scheduler-policy**
      - **encap-type** {**atm** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc**}
      - **frame-relay**
        - **lmi-type** {**ansi** | **itu** | **none** | **rev1**}
        - **mode** {**dce** | **dte** | **bidir**}
        - **n391dte** *intervals*
        - **no n391dte**
        - **n392dce** *threshold*
        - **no n392dce**
        - **n392dte** *threshold*

- — **no n392dte**
- — **n393dte** *count*
- — **no n393dte**
- — **n393dte** *count*
- — **no n393dte**
- — **t391dte** *keepalive*
- — **no t391dte**
- — **t392dce** *keepalive*
- — **no t392dce**

— **load-balancing-algorithm** *option*
— **no load-balancing-algorithm**
— **mac** *ieee-address*
— **no mac**
— **mode** {**access** | **network**}
— **mtu** *mtu*
— **no mtu**
— **network**
- — **accounting-policy** *policy-id*
- — **no accounting-policy**
- — [**no**] **collect-stats**
- — **queue-policy** *name*
- — **no queue-policy**

— **payload** {**sts3** | **tug3** | **ds3** | **e3** | **vt2** | **vt15** | **ds1** | **e1**}
— **ppp**
- — **network** *time-interval* [**dropcount** *drop-count*]
- — **no network**

— [**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*}
— [**no**] **single-fiber**
— **speed** {**oc3** | **oc12**}
— **no speed**
— **threshold** {**ber-sd** | **ber-sf**} **rate** *threshhold-rate*
— **no threshold** {**ber-sd** | **ber-sf**}

TDM Commands

config
- — [**no**] **port** {*port-id*}
  - — **tdm**
    - — **buildout** {**long** | **short**}
    - — **lbo** [**0dB** | **-7.5dB** | **-15.0dB** | **-22.5dB**]
    - — **length** {**133** | **266** | **399** | **533** | **655**}
    - — [**no**] **ds1** *ds1-id*
      - — **bert** {**2e3** | **2e9** | **2e11** | **2e15** | **2e20** | **2e20q** | **2e23** | **ones** | **zeros** | **alter-nating**} **duration** *duration*
      - — **no bert**
      - — **bit-error-insertion** *rate*
      - — **no bit-error-insertion**
      - — [**no**] **channel-group** *channel-group*
        - — **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**
        - — [**no**] **egress-scheduler-override**
          - — **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
          - — **no level** *priority-level*
          - — **max-rate** *rate*
          - — **no max-rate**
        - — **egress-scheduler-policy** *port-scheduler-policy-name*
        - — **no egress-scheduler-policy**
        - — **encap-type** {**bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
        - — **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**}
— **idle-payload-fill** **pattern** *pattern*
— **no idle-payload-fill**
— **idle-signal-fill** {**all-ones**}
— **idle-signal-fill** **pattern** *pattern*
— **no idle-signal-fill**
— **load-balancing-algorithm** *option*
— **no load-balancing-algorithm**
— **mac** *ieee-address*
— **no mac**
— **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-period* [**dropcount** *drop count*]
    — **no keepalive**
— [**no**] **scramble**
— [**no**] **shutdown**
— **signal-mode** {**cas**}
— **speed** {**56** | **64**}
— **timeslots** *timeslots*
— **no timeslots**

— **clock-source** {**loop-timed** | **node-timed** | **adaptive** | **differential**}
— **framing (DS1)** {**esf** | **sf** | **ds1-unframed**}
— **insert-single-bit-error**
— [**no**] **invert-data**
— **loopback** {**line** | **internal** | **fdl-ansi** | **fdl-bellcore** | **payload-ansi** | **inband-ansi** | **inband-bellcore**}
— **no loopback**
— [**no**] **remote-loop-respond**
— [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]
— [**no**] **shutdown**
— **signal-mode** {**cas**}
— **no signal-mode**
— **threshold** {**ber-sd** | **ber-sf**} **rate** {**1** | **5** | **10** | **50** | **100**}
— **no threshold** {**ber-sd** | **ber-sf**}

— [**no**] **ds3** [*sonet-sdh-index*]
  — **atm**
    — **cell-format** *cell-format*
    — **mapping** *mapping*
    — **min-vp-vpi** *value*
  — **bert** {**2e3** | **2e9** | **2e11** | **2e15** | **2e20** | **2e20q** | **2e23** | **ones** | **zeros** | **alternating**} **duration** *duration*
  — **no bert**
  — **bit-error-insertion** *rate*
  — **no bit-error-insertion**
  — **channelized** {**ds1** | **e1**}
  — **no channelized**
  — **cisco-hdlc**

— **down-count** *down-count*
— **no down-count**
— **keepalive** *time-interval*
— **no keepalive**
— **up-count** *up-count*
— **no up-count**
— **clock-source** {**loop-timed** | **node-timed** | **adaptive** | **differential**}
— **crc** {**16** | **32**}
— **description** *description-string*
— **no description**
— [**no**] **egress-scheduler-override**
— **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
— **no level** *priority-level*
— **max-rate** *rate*
— **no max-rate**
— **egress-scheduler-policy** *port-scheduler-policy-name*
— **no egress-scheduler-policy**
— **encap-type** {**bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
— [**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**
— **load-balancing-algorithm** *option*
— **no load-balancing-algorithm**
— **loopback** {**line** | **internal** | **remote**}
— **no loopback**
— **mac** *ieee-address*
— **no mac**
— **mdl** {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **gen**} *mdl-string*
— **no mdl** [**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **gen**]
— **mdl-transmit** {**path** | **idle-signal** | **test-signal**}
— **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-period* [**dropcount** *drop-count*]
— **no keepalive**
— [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]
— [**no**] **scramble**
— [**no**] **shutdown**
— **subrate** {**digital-link**} *rate-step*
— **no subrate**

— [**no**] **e1** [*e1-id*]
    — **bert** {**2e3** | **2e9** | **2e11** | **2e15** | **2e20** | **2e20q** | **2e23** | **ones** | **zeros** | **alternating**} **duration** *duration*
    — **no bert**
    — **bit-error-insertion** *rate*
    — **no bit-error-insertion**
    — [**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**
        — [**no**] **egress-scheduler-override**
            — **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
            — **no level** *priority-level*
            — **max-rate** *rate*
            — **no max-rate**
        — **egress-scheduler-policy** *port-scheduler-policy-name*
        — **encap-type** {**bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
        — **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**}
        — **idle-payload-fill** {**all-ones**}
        — **idle-payload-fill** **pattern** *pattern*
        — **no idle-payload-fill**
        — **idle-signal-fill** {**all-ones**}
        — **idle-signal-fill** **pattern** *pattern*
        — **no idle-signal-fill**
        — **load-balancing-algorithm** *option*
        — **no load-balancing-algorithm**
        — **mac** *ieee-address*
        — **no mac**
        — **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-period* [**dropcount** *drop count*]
  — **no keepalive**
— [**no**] **scramble**
— [**no**] **shutdown**
— **speed** {**56** | **64**}
— **timeslots** *timeslots*
— **no timeslots**

— **clock-source** {**loop-timed** | **node-timed** | **adaptive** | **differential**}
— **framing (E1)** {**no-crc-g704** | **g704** | **e1-unframed**}
— **insert-single-bit-error**
— [**no**] **invert-data**
— **loopback** {**line** | **internal**}
— **no loopback**
— [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]
— [**no**] **shutdown**
— **signal-mode** {**cas**}
— **no signal-mode**
— **threshold** {**ber-sd** | **ber-sf**} **rate** {**1** | **5** | **10** | **50** | **100**}
— **no threshold** {**ber-sd** | **ber-sf**}

— [**no**] **e3** [*sonet-sdh-index*]
- — **atm**
  - — **cell-format** *cell-format*
  - — **min-vp-vpi** *value*
- — **bert** {**2e3** | **2e9** | **2e11** | **2e15** | **2e20** | **2e20q** | **2e23** | **ones** | **zeros** | **alternating**} **duration** *duration*
- — **no bert**
- — **bit-error-insertion** *rate*
- — **no bit-error-insertion**
- — **cisco-hdlc**
  - — **down-count** *down-count*
  - — **no down-count**
  - — **keepalive** *time-interval*
  - — **no keepalive**
  - — **up-count** *up-count*
  - — **no up-count**
- — **clock-source** {**loop-timed** | **node-timed**}
- — **crc** {**16** | **32**}
- — **description** *description-string*
- — **no description**
- — [**no**] **egress-scheduler-override**
  - — **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
  - — **no level** *priority-level*
  - — **max-rate** *rate*
  - — **no max-rate**
- — **egress-scheduler-policy** *port-scheduler-policy-name*
- — **encap-type** {**bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
- — [**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** | **g832**}
- — **idle-cycle-flag** {**flags** | **ones**}
- — **no idle-cycle-flag**
- — **load-balancing-algorithm** *option*
- — **no load-balancing-algorithm**
- — **loopback** {**line** | **internal** | **remote**}
- — **no loopback**
- — **mac** *ieee-address*
- — **no mac**
- — **mdl** {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **gen**} *mdl-string*
- — **no mdl** [**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **gen**]

— **mdl-transmit** {**path** | **idle-signal** | **test-signal**}
— **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-period* [**dropcount** *drop-count*]
    — **no keepalive**
— [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]
— [**no**] **scramble**
— [**no**] **shutdown**

LAG Commands

config
— [**no**] **lag** [*lag-id*]
    — **access**
        — **adapt-qos** *type*
    — **description** *long-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*]
    — **no lacp**
    — **lacp-xmit-interval** {**slow** | **fast**}
    — **no lacp-xmit-interval**
    — [**no**] **lacp-xmit-stdby**
    — **mac** *ieee-address*
    — **no mac**
    — **mode** {**access** | **network**}
    — **no mode**
    — **port** *port-id* [*port-id* …up to 8 total] [**priority** *priority*] [**sub-group** *sub-group-id*]
    — **no port** *port-id* [*port-id* …up to 8 total]
    — **port-threshold** *value* [**action** {**dynamic-cost** | **down**}]
    — **no port-threshold**
    — **port-type** {**standard** | **hsmda-ports**}
    — **no port-type**
    — **selection-criteria** [**highest-count** | **highest-weight**] [**slave-to-partner**]
    — **no selection-criteria**
    — [**no**] **shutdown**

Multi-Chassis Redundancy Commands

config
— **redundancy**
— **multi-chassis**
— [**no**] **peer** *ip-address*
— **authentication-key** [*authentication-key* | *hash-key*] [**hash** | **hash2**]
— **no authentication-key**
— **description** *description-string*
— **no description**
— [**no**] **mc-lag**
— **hold-on-neighbor-failure** *multiplier*
— **no hold-on-neighbor-failure**
— **keep-alive-interval** *interval*
— **no keep-alive-interval**
— **lag** *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *lag-id*] **system-priority** *system-priority*
— **no lag** *lag-id*
— [**no**] **shutdown**
— **mc-ring**
— **ring** *sync-tag* [**create**]
— **no ring** *sync-tag*
— **in-band-control-path**
— **dst-ip** *ip-address*
— **no dst-ip**
— **interface** *ip-int-name*
— **no interface**
— **service-id** *service-id*
— **no service-id**
— [**no**] **path-b**
— [**no**] **range** *vlan-range*
— [**no**] **path-excl**
— [**no**] **range** *vlan-range*
— **ring-node** *ring-node-name* [**create**]
— **no ring-node** *ring-node-name*
— **connectivity-verify**
— **dst-ip** *ip-address*
— **no dst-ip**
— **interval** *interval*
— **no interval**
— **service-id** *service-id*
— **no service-id**
— [**no**] **shutdown**
— **src-ip** *ip-address*
— **no src-ip**
— **src-mac** *ieee-address*
— **no src-mac**
— **vlan** [*vlan-encap*]
— **no vlan**
— [**no**] **shutdown**
— [**no**] **shutdown**
— **source-address** *ip-address*
— **no source-address**
— [**no**] **sync**
— [**no**] **igmp**
— [**no**] **igmp-snooping**
— [**no**] **mc-ring**

— [**no**] **mld-snooping**
— **port** [*port-id* | *lag-id*] [**sync-tag** *sync-tag*]
— **no port** [*port-id* | *lag-id*]
    — **range** *encap-range* [**sync-tag** *sync-tag*]
    — **no range** *encap-range*
— [**no**] **shutdown**
— [**no**] **srrp**
— [**no**] **sub-mgmt**

Show Commands

show
- — **chassis** [**environment**] [**power-supply**]
- — **aps** [**port** *port-id*] [**group** *group-name*] [**detail**]
- — **card** [*slot-number*] [**detail**]
- — **card state**
- — **mcm** *slot* [*/mcm*] [**detail**]
- — **mda** *slot* [*/mda*] [**detail**]
- — **pools** *mda-id*[*/port*] [*access-app* [*pool-name* | **service** *service-id*]]
- — **pools** *mda-id*[*/port*] [*network-app* [*pool-name*]]
- — **lag** [*lag-id*] [**detail**] [**statistics**]
- — **lag** *lag-id* **associations**
- — **multilink-bundle** [***bundle-id*** | *bpgrp-id* | ***slot/mda*** | **type** {**mlppp**}] [**detail**]
- — **multilink-bundle** *bundle-id* **ppp** [**multiclass**]
- — **multilink-bundle** [***bundle-id*** | *bpgrp-id* | ***slot/mda*** | [**ppp**]
  - — **relations** [*bundle-id* | *bpgrp-id*] **relations**
  - — **ima**
    - — **atm** [**detail**]
      - — **connections**
      - — **port-connection** [**detail**]
      - — **pvc** [**detail**]
      - — **pvp** [*vpi*] [**detail**]
      - — **pvt** [*vpi.vci*] [**detail**]
  - — **ppp** [*bundle-id* | *bpgrp-id*] [**multiclass**]
  - — **relations**
- — **port** *port-id* [**count**] [**detail**]
- — **port** *port-id* **description**
- — **port** *port-id* **associations**
- — **port** *port-id* **ppp** [**detail**]
- — **port** *port-id* **frame-relay** [**detail**]
- — **port** *port-id* **dot1x** [**detail**]
- — **port** *port-id* **ethernet** [**efm-oam** | **detail**]
- — **port** *port-id* **cisco-hdlc** [**detail**]
- — **port** *port-id* **atm**
- — **port** *port-id* **atm connections**
- — **port** *port-id* **atm ilmi**
- — **port** *port-id* **atm interface-connections**
- — **port** *port-id* **atm pvc** [*vpi*[*/vci*]] [**detail**]
- — **port** *port-id* **atm pvp** [*vpi*] [**detail**]
- — **port** *port-id* **atm pvt** [*vpi-range*] [**detail**]
- — **port aps** [**detail**]
- — **port cem**
- — **port-tree** *port-id*
- — **redundancy**
  - — **multi-chassis all**
  - — **multi-chassis mc-lag**
  - — **multi-chassis sync**
    - — **mc-ring peer** *ip-address* **statistics**
    - — **mc-ring peer** *ip-address* [**ring** *sync-tag* [**detail**|**statistics**]]
    - — **mc-ring peer** *ip-address* **ring** *sync-tag* **ring-node** [*ring-node-name* [**detail**|**statistics**]]
    - — **mc-ring global-statistics**
- — **switch-fabric high-bandwidth-multicast**

Monitor Commands

Monitor
- — **port** ***port-id*** [*port-id*...(up to 5 max)] [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**] [**multiclass**]
- — **port (ATM) atm** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Clear Commands

clear
- — **card** *slot-number*
- — **lag** *lag-id* **statistics**
- — **mda** *mda-id*
- — **port** *port-id* **statistics**
- — **port** *port-id* **statistics**
- — **port** *port-id* **atm pvc** [*vpi[/vci*]] **statistics**
- — **port** *port-id* **atm pvp** [*vpi*] **statistics**
- — **port** *port-id* **atm pvt** [*vpi1.vpi2*] **statistics**
- — **port** *port-id* **atm ilmi statistics**
- — **port** *port-id* **atm interface-connection statistics**

Debug Commands

debug
- — **atm**
  - — **lmi** [*port-id*]
  - — **ilmi** [*port-id*]
  - — **no ilmi** *port-id*
- — **cisco-hdlc** *port-id*
- — **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*]
- — [**no**] **ppp** *port-id*

Tools Commands

tools
- — **dump**
  - — **redundancy**
    - — **multi-chassis**
      - — **mc-ring**
      - — **srrp-sync-data** [**instance** *instance-id*] [**peer** *ip-address*]
      - — **sync-database** [**peer** *ip-address*] [**port** *port-id* | *lag-id*] [**sync-tag** *sync-tag*] [**application** {**dhcps**|**igmp**|**igmp-snooping**|**mc-ring**|**srrp**|**sub-mgmt**|**mld-snooping**}] [**detail**] [**type** {**alarm-deleted**|**local-deleted**}]
- — **perform**
  - — **ima**
    - — **reset** *bundle-id*

Configuration Commands

Generic Commands

description

Syntax **description** *description-string*
no description

Context config>port
config>port>sonet-sdh>path
config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1>channel-group
config>port>tdm>e3
config>lag

Description This command creates a text description for a configuration context to help identify the content in the configuration file.

The **no** form of this command removes any description string from the context.

Default No description is associated with the configuration context.

Parameters *long-description-string* — The description character string. Strings can be up to 160 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

shutdown

Syntax [**no**] **shutdown**

Context config>card
config>card>mda
config>port
config>port>sonet-sdh>path
config>port>tdm>ds1
config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e1>channel-group
config>port>tdm>e3
config>port>sonet-sdh>path>atm>ilmi
config>lag
config>port>ethernet>efm-oam
config>redundancy>multi-chassis>peer
config>redundancy>mc>peer>mc-lag
config>redundancy>mc>peer>mcr>ring
config>redundancy>mc>peer>mcr>node>cv
config>redundancy>multi-chassis>peer>sync

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.

The **no** form of this command administratively enables an entity.

Special Cases **card —** The default state for a card is **no shutdown**.

mcm — The default state for an mcm is **no shutdown**.

mda — The default state for a mda is **no shutdown**.

lag — The default state for a Link Aggregation Group (LAG) is **shutdown**.

port — The default state for a port is **shutdown**.

path — The default state for a SONET/SDH path is **shutdown**.

Card Commands

card

Syntax **card** *slot-number*
no card *slot-number*

Context config

Description This mandatory command enables access to the chassis card Input/Output Control Forwarding Module (IOM/CFM), slot, MCM and MDA CLI context.

The **no** form of this command removes the card from the configuration. All associated ports, services, and MDAs must be shutdown.

Default No cards are configured.

Parameters *slot-number* — The slot number of the card in the chassis.

Values 1 — 10 depending on chassis model.

card-type

Syntax **card-type** *card-type*
no card-type

Context config>card

Description This mandatory command adds an IOM/CFM to the device configuration for the slot. The card type can be preprovisioned, meaning that the card does not need to be installed in the chassis.

A card must be provisioned before an MDA, MCM or port can be configured.

A card can only be provisioned in a slot that is vacant, meaning no other card can be provisioned (configured) for that particular slot. To reconfigure a slot position, use the no form of this command to remove the current information.

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.

If a card is inserted that does not match the configured card type for the slot, then a medium severity alarm is raised. The alarm is cleared when the correct card type is installed or the configuration is modified.

A high severity alarm is raised if an administratively enabled card is removed from the chassis. The alarm is cleared when the correct card type is installed or the configuration is modified. A low severity trap is issued when a card is removed that is administratively disabled.

An appropriate alarm is raised if a partial or complete card failure is detected. The alarm is cleared when the error condition ceases.

The **no** form of this command removes the card from the configuration.

Default No cards are preconfigured for any slots.

Parameters *card-type* — The type of card to be configured and installed in that slot.

Values iom-12g, iom-9g

MCM Commands

mcm

Syntax **mcm** *mcm-slot*
no mcm *mcm-slot*

Context config>card

Description This mandatory command enables access to a card's MCM CLI context to configure MCMs.

Default No MCM slots are configured by default.

Parameters *mcm-slot* — The MCM slot number to be configured. Even slot numbers 2-12 are invalid. MCM provisioning is not required to provision Compact Media Adapters (CMAs).

Values SR-c4: 1, 3
SR-c12: 1, 3, 5, 7, 9, 11

mcm-type

Syntax **mda** *mcm-type*
no mcm *mcm-type*

Context config>card>mcm

Description This mandatory command provisions a specific MCM type to the device configuration for the slot. The MCM can be preprovisioned but an MDA must be provisioned before ports can be configured. Ports can be configured once the MDA is properly provisioned.

To modify an MCM slot, shut down all port associations. MCMs are required to provision MDAs. MCMs are not required to provision CMAs.

Parameters *mcm-type* — The type of MCM to provision for that slot.

Values mcm-v1

MDA Commands

mda

Syntax **mda** *mda-slot*
no mda *mda-slot*

Context config>card

Description This mandatory command enables access to a card's MDA CLI context to configure MDAs.

Default No MDA slots are configured by default.

Parameters *mda-slot* — The MDA slot number to be configured. MDAs may not be provisioned before MCMs are configured for the same slot. MCMs are not required for CMA provisioning.

Values 7710 SR c-12 MDA: 1, 3, 5, 7, 9, 11
7710 SR c-12 CMA: 1-12

7710 SR c-4 MDA: 1, 3
7710 SR c-4 CMA: 1-4

mda-type

Syntax **mda-type** *mda-type*
no mda-type

Context config>card>mda

Description This mandatory command provisions a specific MDA/CMA type to the device configuration for the slot. The MDA/CMA can be preprovisioned but an MDA/CMA must be provisioned before ports can be configured. Ports can be configured once the MDA/CMA is properly provisioned.

A maximum of six MDAs or eight CMAs (or a combination) can be provisioned on a 7710 SR-c12. A maximum of two MDAs or four CMAs (or a combination) can be provisioned on a 7710 SR-c4. Only one MDA/CMA can be provisioned per MDA slot. To modify an MDA slot, shut down all port associations.

CMAs do not rely on MCM configuration and are provisioned without MCMs.

Note: CMAs are provisioned using MDA commands. A medium severity alarm is generated if an MDA/CMA is inserted that does not match the MDA/CMA type configured for the slot. This alarm is cleared when the correct MDA/CMA is inserted or the configuration is modified. A high severity alarm is raised when an administratively enabled MDA/CMA is removed from the chassis. This alarm is cleared if the either the correct MDA/CMA type is inserted or the configuration is modified. A low severity trap is issued if an MDA/CMA is removed that is administratively disabled.

An alarm is raised if partial or complete MDA/CMA failure is detected. The alarm is cleared when the error condition ceases.

The **no** form of this command deletes the MDA/CMA from the configuration. The MDA/CMA must be administratively shut down before it can be deleted from the configuration.

Default No MDA/CMA types are configured for any slots by default.

Parameters *mda-type* — The type of MDA or CMA selected for the slot postion.

7750: m60-10/100eth-tx, m10-1gb-sfp, m16-oc12/3-sfp, m8-oc12/3-sfp, m16-oc3-sfp, m8-oc3-sfp, m4-oc48-sfp, m1-oc192, m5-1gb-sfp, m12-chds3, m1-choc12-sfp, m1-10gb, m4-choc3-sfp, m2-oc48-sfp, m20-100eth-sfp, m20-1gb-tx, m2-10gb-xfp, m4-atmoc12/3-sfp, m16-atmoc3-sfp, m20-1gb-sfp, m4-chds3, m1-10gb-xfp, vsm-cca, m5-1gb-sfp-b, m10-1gb-sfp-b, m4-choc3-as-sfp, m10-1gb+1-10gb, isa-ipsec, m1-choc12-as-sfp, m12-chds3-as, m4-chds3-as, isa-aa, m10-1gb-hs-sfp, m1-10gb-hs-xfp, m1-choc3-ces-sfp, m4-10gb-xfp, m2-10gb-xfp-b

7710: m60-10/100eth-tx, m8-oc3-sfp, m5-1gb-sfp, m2-oc48-sfp, m20-100eth-sfp, m20-1gb-tx, m4-atmoc12/3-sfp, m20-1gb-sfp, m5-1gb-sfp-b, m4-choc3-as-sfp, c8-10/100eth-tx, c1-1gb-sfp, c8-chds1, c4-ds3, c2-oc12/3-sfp, c8-atmds1, c1-choc3-ces-sfp, m1-choc12-as-sfp, m12-chds3-as, m4-chds3-as

7450: m60-10/100eth-tx, m10-1gb-sfp, m16-oc12/3-sfp, m8-oc12/3-sfp, m16-oc3-sfp, m4-oc48-sfp, m1-10gb, m2-oc48-sfp, m20-100eth-sfp, m20-1gb-tx, m2-10gb-xfp, m20-1gb-sfp, m1-10gb-xfp, vsm-cca, m5-1gb-sfp-b, m10-1gb-sfp-b, m10-1gb+1-10gb, isa-aa, m10-1gb-hs-sfp, m1-10gb-hs-xfp, m4-10gb-xfp, m2-10gb-xfp-b

ddm-events

Syntax [**no**] **ddm-events**

Context config>port

Description This command enables Digital Diagnostic Monitoring (DDM) events for the port.

The **no** form of the command disables DDM events.

clock-mode

Syntax **clock-mode adaptive**
clock-mode differential [**timestamp-freq** {**19440** | **77760** | **103680**}]

Context config>card>mda

Description This command configures the clock mode and timestamp frequency of the MDA.
The clock mode can only be modified if there are no SAPs associated with the MDA.

This command is not enabled for the ISA-AA MDA.

Default none

Parameters **adaptive —** specifies the MDA is in an adaptive clock mode.

differential — Specifies that MDA is in the differential clock mode.

timestamp-freq — Specifies the differential timestamp frequency of the differential clock on the MDA.

Values 19440, 77760, 103680

egress

Syntax **egress**

Context config>card>mda

Description This command enables the context to configure egress MDA parameters.

ingress

Syntax **ingress**

Context config>card>mda

Description This command enables the context to configure ingress MDA parameters.

mcast-path-management

Syntax **mcast-path-management**

Context config>card>mda>ingress

Description This command enables the context to configure local MDA settings for ingress multicast path management.

ancillary-override

Syntax **ancillary-override**

Context config>card>mda>ingress>mcast-mgmt

Description This command enables the context to configure ancillary path bandwidth override parameters.

path-limit

Syntax **path-limit** *megabits-per-second*
no path-limit

Context config>card>mda>ingress>mcast-mgmt>anc-override

Description This command overrides the path limits contained in the bandwidth policy associated with the MDA.

The **no** form of the command removes the path limit override from an ingress multicast path and restores the path limit defined in the bandwidth policy associated with the MDA.

Parameters *megabits-per-second* — Specifies the path limit override to give the upper limit that multicast channels may use on each path.

Values ancillary-override: 1 — 5000
primary-override: 1 — 2000
secondary-override: 1 — 2000

bandwidth-policy

Syntax **bandwidth-policy** *policy-name*
no bandwidth-policy

Context config>card>mda>ingress>mcast-mgmt

Description This command specifies an existing multicast bandwidth policy. Bandwidth policies are used to manage the ingress multicast path bandwidth. Each forwarding plane supports multicast forwarding paths into the switch fabric. Bandwidth policy parameters are configured in the **config>mcast-mgmt** context.

Parameters *policy-name* — Specifies an existing multicast bandwidth policy

primary-override

Syntax **primary-override**

Context config>card>mda>ingress>mcast-mgmt

Description This command enables the context to configure primary path limit override parameters.

secondary-override

Syntax **secondary-override**

Context config>card>mda>ingress>mcast-mgmt

Description This command enables the context to configure secondary path limit override parameters.

scheduler-policy

Syntax **scheduler-policy** *hsmda-scheduler-policy-name*
no scheduler-policy

Context config>card>mda>ingress

Description This command overrides the default HSMDA scheduling policy on the ingress MDA. The command can only be executed on an MDA provisioned as a QMDA (HSMDA). Attempting to provision a scheduler policy on a non-HSMDA will fail. The defined hsmda-scheduler-policy-name must be an existing HSMDA scheduler policy. An HSMDA scheduler policy that is currently associated with an HSMDA cannot be removed from the system.

When the scheduler policy is changed on an ingress HSMDA, the ingress scheduling parameters are immediately changed to reflect the parameters within the policy.

The scheduler policy defined on the ingress context of an HSMDA cannot be changed when local scheduler overrides exist. The scheduler overrides must be removed prior to changing the scheduler policy. Once the scheduler policy is changed, any required overrides may be redefined.

The **no** form of the command restores default HSMDA scheduler policy control over the ingress scheduler on the HSMDA. The **no scheduler-policy** command cannot be executed when scheduler overrides exist on the ingress HSMDA. The overrides must be removed prior to executing the no scheduler-policy command.

Parameters *hsmda-scheduler-policy-name* — Specifies an existing policy created in the **config>qos>hsmda-scheduler-policy** context. The “default” policy name cannot be specified. Instead, the **no scheduler-policy** command should be executed resulting in the default scheduler policy being used by the ingress MDA.

Interface QoS Commands

access

Syntax **access**

Context config>card>mda
config>port

Description This command enables the access context to configure egress and ingress pool policy parameters.

This command is not enabled for the ISA-AA MDA.

On the MDA level, access egress and ingress pools are only allocated on channelized MDAs/CMAs.

network

Syntax **network**

Context config>card>mda
config>port

Description This command enables the network context to configure egress and ingress pool policy parameters.

This command is not enabled for the ISA-AA MDA.

On the MDA level, network egress pools are only allocated on channelized MDAs/CMAs.

egress

Syntax **egress**

Context config>card>mda>access
config>card>mda>network
config>port>access
config>port>network

Description This command enables the context to configure egress buffer pool parameters which define the percentage of the pool buffers that are used for CBS calculations and specify the slope policy that is configured in the **config>qos>slope-policy** context.

This command is not enabled for the ISA-AA MDA.

On the MDA level, network and access egress pools are only allocated on channelized MDAs/CMAs.

ingress

Syntax **ingress**

Context config>card>mda>access
config>card>mda>network
config>port>access

Description This command enables the context to configure ingress buffer pool parameters which define the percentage of the pool buffers that are used for CBS calculations and specify the slope policy that is configured in the **config>qos>slope-policy** context.

This command is not enabled for the ISA-AA MDA.

On the MDA level, access ingress pools are only allocated on channelized MDAs/CMAs.

channel

Syntax **channel**

Context config>port>access>egress

Description This command configures access egress parameters for all channels on this port.

queue-policy

Syntax **queue-policy** *name*
no queue-policy

Context config>card>mda>network>ingress
config>port>sonet-sdh>path>network

Description This command specifies the network-queue policy which 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.

Default default

Parameters *name* — Specifies an exisiting network-queue policy name.

General Port Commands

port

Syntax **port** {*port-id* | *bundle-id* | *aps-id* | *bpgrp-id*}
no port {*bundle-id* | *aps-id* | *bpgrp-id*}

Context config

Description This command enables access to the context to configure ports, multilink bundles, and bundle protection groups (BPGs). Before a port can be configured, the chassis slot must be provisioned with a valid card type and the MDA parameter must be provisioned with a valid MDA type. (See **card** and **mda** commands.)

Default No ports are configured. All ports must be explicitly configured and enabled.

Parameters *port-id* — Specifies the physical port ID in the *slot/mda/port* format.

bundle-id — Specifies the multilink bundle to be associated with this IP interface. 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: keyword
slot: card/mda slot numbers
bundle-num: 1 — 256

For example:
router1>config# port bundle-1/1.1 (multilink PPP bundle)

aps-id — This option configures APS on un-bundled SONET/SDH ports. All SONET-SDH port parameters, with certain exceptions, for the working and protection circuit ports must be configured in the **config>port>aps-***group-id* context. The working and protection circuit ports inherit all those parameters configured. The exception parameters for the working and protect circuits can be configured in the **config>port>sonet-sdh** context. Exception list commands include:

clock-source
[no] loopback
[no] report-alarm
section-trace
[no] threshold

When an **aps-***group-id* is created all applicable parameters under the port CLI tree (including parameters under any submenus) assume **aps-***group-id* defaults, or when those are not explicitly specified, default to SONET/SDH port defaults for any SONET port.

.All but a few exception SONET/SDH parameters for the working channel port must be configured in the **config>port>aps>sonet-sdh** context. The protection channel inherits all the configured parameters. The exception parameters for the protection channel can be configured in the **config>port>aps>sonet-sdh** context.

Signal failure (SF) and signal degrade (SD) alarms are not enabled by default on POS interfaces. It is recommended to change the default alarm notification configuration for POS ports that belong to APS groups in order to be notified of SF/SD occurrences to be able to interpret the cause for an APS group to switch the active line.

For path alarms, modify the logical line aps-id in the **configure port aps-id sonet-sdh path report-alarm** context. For example:

configure port **aps-1** sonet-sdh path report-alarm p-ais

For line alarms, separately, modify the 2 physical ports that are members of the logical aps-id port (the working and protect lines). APS reacts only to line alarms, not path alarms.
For example:

configure port **1/2/3** sonet-sdh report-alarm lb2er-sd

configure port **1/3/4** sonet-sdh report-alarm lb2er-sd

For example:

```
A:ALA-48>config>port>aps# info
----------------------------------------------
            working-circuit 1/2/3
            protect-circuit 1/3/4
----------------------------------------------
A:ALA-48>config>port>aps#
```

If the SD and SF threshold rates must be modified, the changes must be performed at the line level on both the working and protect APS port member.

The **no** form of this command deletes an aps-*group-id* or bundle-aps-group-id. In order for an aps-*group-id* to be deleted,

The same rules apply for physical ports, bundles deletions apply to APS ports/bundles deletions (for example an aps-group-id must be shutdown, have no service configuration on it, and no path configuration on it). In addition working and protection circuits must be removed before an aps-group-id may be removed.

Syntax: **port aps**-*group-id*

aps:	keyword
group-id:	1 — 16

Example: **port aps**-16

egress-scheduler-override

Syntax [**no**] **egress-scheduler-override**

Context config>port>sonet-sdh>path
config>port>ethernet
config>port>tdm>ds3
config>port>tdm>ds1>channel-group

config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command applies egress scheduler overrides. When a port scheduler is associated with an egress port, it is possible to override the following parameters:

- The **max-rate** allowed for the scheduler.
- The maximum **rate** for each priority level 8 through 1.
- The CIR associated with each priority level 8 through 1.

See the 7710 SR OS Quality of Service Guide for command syntax and usage for the **port-scheduler-policy** command.

The **no** form of this command removes all override parameters from the egress port or channel scheduler context. Once removed, the port scheduler reverts all rate parameters back to the parameters defined on the port-scheduler-policy associated with the port.

level

Syntax **level** *priority-level* **rate** *pir-rate* [**cir** *cir-rate*]
no level *priority-level*

Context config>port>ethernet>egress-scheduler-override
config>port>sonet-sdh>path>egress-scheduler-override
config>port>tdm>ds3>egress-scheduler-override
config>port>tdm>ds1>channel-group>egress-scheduler-override
config>port>tdm>e3

Description This command overrides the maximum and CIR rate parameters for a specific priority level on the port or channel's port scheduler instance. When the **level** command is executed for a priority level, the corresponding priority level command in the port-scheduler-policy associated with the port is ignored.
The override level command supports the keyword **max** for the **rate** and **cir** parameter.
When executing the level override command, at least the **rate** or **cir** keywords and associated parameters must be specified for the command to succeed.

The **no** form of this command removes the local port priority level rate overrides. Once removed, the port priority level will use the port scheduler policies level command for that priority level.

Parameters *priority-level* — Identifies which of the eight port priority levels are being overridden.

Values 1 — 8

rate *pir-rate* **—** Overrides the port scheduler policy's maximum level rate and requires either the **max** keyword or a rate defined in kilobits-per-second to follow.

Values 1 — 40000000, max

cir *cir-rate* **—** Overrides the port scheduler policy's within-cir level rate and requires either the max keyword or a rate defined in kilobits-per-second to follow.

Values 0— 40000000, max

max — removes any existing rate limit imposed by the port scheduler policy for the priority level allowing it to use as much total bandwidth as possible.

max-rate

Syntax **max-rate** *rate*
no max-rate

Context config>port>ethernet>egress-scheduler-override
config>port>sonet-sdh>path>egress-scheduler-override
config>port>tdm>ds3>egress-scheduler-override
config>port>tdm>ds1>channel-group>egress-scheduler-override
config>port>tdm>e3>egress-scheduler-override
config>port>tdm>e1>channel-group>egress-scheduler-override

Description This command overrides the **max-rate** parameter found in the port-scheduler-policy associated with the port. When a max-rate is defined at the port or channel level, the port scheduler policies max-rate parameter is ignored.

The egress-scheduler-override **max-rate** command supports a parameter that allows the override command to restore the default of not having a rate limit on the port scheduler. This is helpful when the port scheduler policy has an explicit maximum rate defined and it is desirable to remove this limit at the port instance.

The **no** form of this command removes the maximum rate override from the egress port or channels port scheduler context. Once removed, the max-rate parameter from the port scheduler policy associated with the port or channel will be used by the local scheduler context.

Parameters *rate* — Specifies the explicit maximum frame based bandwidth limit. This value overrides the QoS scheduler policy rate.

Values 1 — 40000000, max

egress-scheduler-policy

Syntax **egress-scheduler-policy** *port-scheduler-policy-name*
no egress-scheduler-policy

Context config>port>ethernet
config>port>tdm>ds3
config>port>tdm>ds1>channel-group
config>port>tdm>e3
config>port>tdm>ds3>channel-group

Description This command enables the provisioning of an existing port-scheduler-policy to a port or channel. The egress-scheduler-override node allows for the definition of the scheduler overrides for a specific port or channel.

When a port scheduler is active on a port or channel, all queues and intermediate service schedulers on the port are subject to receiving bandwidth from the scheduler. Any queues or schedulers with port-parent associations are mapped to the appropriate port priority levels based on the port-parent command parameters. Any queues or schedulers that do not have a port-parent or valid intermediate scheduler parent defined are treated as orphaned and are handled based on the port scheduler policies default or explicit orphan behavior.

The port scheduler maximum rate and priority level rate parameters may be overridden to allow unique values separate from the port-scheduler-policy-name attached to the port or channel. Use the **egress-scheduler-override** command to specify the port or channel specific scheduling parameters.

The **no** form of this command removes a port scheduler policy from an egress port or channel. Once the scheduler policy is removed, all orphaned queues and schedulers revert to a free running state governed only by the local queue or scheduler parameters. This includes any queues or schedulers with a port-parent association.

Parameters *port-scheduler-policy-name* — Specifies an existing port-scheduler-policy configured in the **config**>**qos** context.

mode

Syntax **mode** {**access** | **network**}
no mode

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
config>port>tdm>e3

Description This command configures an Ethernet port, TDM channel or SONET/SDH path (sub-port) 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 or SONET path. Once an Ethernet port, a TDM channel or a SONET path has been configured for access mode, multiple services can be configured on the Ethernet port, TDM channel or SONET path. Note that Frame Relay, and cHDLC port parameters can only be configured in the access mode.

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, the **encap-type** cannot be configured for the port/channel.

The **no** form of this command restores the default.

Special Cases **SONET/SDH Path —** When network mode is selected, the appropriate control protocols are activated when the need arises. For example, configuring an IP interface on the SONET path activates IPCP while the removal of the IP interface causes the IPCP to be removed. The same applies for

MPLS, MPLSCP, and OSICP.When configuring a SONET/SDH port, the **mode** command must be entered in the channel context or an error message is generated.

Default **network** — Configures the Ethernet port, TDM channel or SONET path for transport network use.

access — Default channel/port mode for channelized, and ASAP MDAs.

Parameters **access —** Configures the Ethernet port, TDM channel or SONET path as service access.

network — Configures the Ethernet port, TDM channel or SONET path for transport network use.

mac

Syntax **mac** *ieee-address*
no mac

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
config>port>tdm>e3
config>lag

Description This command assigns a specific MAC address to an Ethernet port, Link Aggregation Group (LAG) or BCP-enabled port or sub-port.

Only one MAC address can be assigned to a port. When multiple **mac** commands are entered, the last command overwrites the previous command. When the command is issued while the port is operational, IP will issue an ARP, if appropriate, and BPDU's 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.

mtu

Syntax **mtu** *mtu-bytes*
no mtu

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
config>port>tdm>e3

Description This command configures the maximum payload MTU size for an Ethernet port or PPP-enabled port or sub-port and Frame Relay-enabled port or subport. The Ethernet port level MTU parameter indirectly defines the largest physical packet the port can transmit or the far-end Ethernet port can receive. Packets received larger than the MTU will be discarded. Packets that cannot be fragmented at egress and exceed the MTU are discarded.

The value specified for the MTU includes the destination MAC address, source MAC address, the Ethertype or Length field and the complete Ethernet payload. The MTU value does not include the preamble, start of frame delimiter or the trailing CRC.

PoS channels use the MTU to define the largest PPP payload a PoS frame may contain. A significant difference between SONET/SDH PoS channel and Ethernet physical MTU values the overhead considered part of the framing method and the overhead considered to be part of the application using the frame. In Ethernet, the preamble, start of frame delimiter and the CRC are considered part of the framing overhead and not part of the frame payload. For a PoS channel, the HDLC framing overhead is not included in the physical MTU; only the PPP and PPP payload are included. 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.

Default The default MTU value depends on the (sub-)port type, mode and encapsulation and are listed in the following table:

Type	Mode	Encap Type	Default (Bytes)
10/100 or Gig	Access	null	1514
10/100 or Gig	Access	dot1q	1518
10/100 or Gig	Access	q-in-q	1522
SONET/SDH or TDM	Access	mpls	1506
SONET/SDH or TDM	Access	bcp-null	1518
SONET/SDH or TDM	Access	bcp-dot1q	1522
SONET/SDH or TDM	Access	ipcp	1502
SONET/SDH or TDM	Access	frame-relay	1578
ATM, SONET/SDH or TDM	Access	atm	1524
10/100 or 100FX Ethernet	Network	null	1514
10/100 or 100FX Ethernet	Network	dot1q	1518
SONET/SDH	Network	ppp-auto	1524

Parameters *mtu-bytes* — Sets the maximum allowable size of the MTU, expressed as an integer.

Values 512 — 9212

	Range
config>port>ethernet	512 — 9212
config>port>sonet-sdh>path	512 — 9208
config>port>tdm>ds3	512 — 9208
config>port>tdm>ds1>channel-group	512 — 9208
config>port>tdm>e3	512 — 9208
config>port>tdm>e1>channel-group	512 — 9208

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.

The **no** form of this command disables logging of the specified alarms.

Parameters **ais —** Reports alarm indication signal errors. When configured, **ais** alarms are not raised and cleared.

Default **ais** alarms are issued

los — Reports loss of signal errors. When configured, **los** traps are not raised and cleared.

Default **los** traps are issued.

oof — Reports out-of-frame errors. When configured, **oof** alarms are not raised and cleared.

Default **oof** alarms are not issued.

rai — Reports resource availability indicator events. When configured, **rai** events are not raised and cleared.

Default **rai** alarms are not issued

looped — Reports looped packets errors.

Default **looped** alarms are not issued

network

Syntax **network**

Context config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

Description This command enables the context to configure network channel group parameters.

queue-policy

Syntax **queue-policy** *name*
no queue-policy

Context config>port>tdm>ds1>channel-group>network
config>port>tdm>e1>channel-group>network

Description This command specifies an existing network policy to apply to the channel group.

ppp

Syntax **ppp**

Context config>port>sonet-sdh>path
config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command enables access to the context to configure the LCP operational parameters for a SONET/SDH PoS link, a DS3/E3 port or channel, a DS1/E1 channel or a DS0 channel.

Default no ppp

scramble

Syntax [**no**] **scramble**

Context config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command enables payload scrambling on channel groups.

Scrambling randomizes the pattern of 1s and 0s carried in a SONET frame. Rearranging or scrambling 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/descrambling using x43+1 polynomial as defined in ITU-T I.432.1. Scrambling is enabled by default for the ATM path/ channel. Note that this scrambling is done in addition to SONET/SDH frame scrambling/ descrambling, which is always enabled in the framer.

The **no** form of this command disables scrambling.

Default **no scramble**

keepalive

Syntax **keepalive** *time-interval* [**dropcount** *drop-count*]
no keepalive

Context config>port>sonet-sdh>path>ppp
config>port>tdm>ds1>channel-group>cisco-hdlc
config>port>tdm>ds1>channel-group>ppp
config>port>tdm>ds3>ppp
config>port>tdm>e1>ppp
config>port>tdm>e3>ppp

Description This command sets the keepalive interval.

The **no** form of this command returns the interval to the default value.

Default 10

Parameters *time-interval* — Specifies the time in seconds between keepalive messages, expressed as a decimal integer.

Values 1 — 60 seconds

drop-count — Specifies the number of consecutive keepalive failed request attempts or remote replies that can be missed after which the port is operationally downed.

Values 1 — 255

APS Commands

aps

Syntax **aps**

Context config>port

Description This command configures APS (Automatic Protection Switching). APS is used by SONET/SDH add/drop multiplexers (ADMs) or other SONET/SDH-capable equipment to protect against circuit or equipment failure.

When configuring APS to protect against media or port failure, both working and protection circuits must be configured on the same node with the same **aps**-*group-id*.

The working and protection configurations on Alcatel-Lucent 7710 SRs must match the circuit configurations on the peer. This means that the working circuit on the 7710 SR must be connected to the peer's working circuit and the protect circuit must be connected to the peer's protection circuit.

The **aps** command is only available for APS groups and not physical ports.

Default none

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 both protect and working circuits to their neighbor for multi-chassis APS.

The **advertise-interval** value is valid only for a multi-chassis APS as indicated by the value of the **neighbor** command value if it is not set to 0.0.0.0.

Default 10

Parameters *advertise-interval* — Specifies the time interval, in 100s of milliseconds, between 'I am operational' messages sent by both protect and working circuits to their neighbor for multi-chassis APS.

Values 10 — 650

hold-time

Syntax **hold-time** *hold-time*
no hold-time

Context config>port>aps

Description This command specifies how much time can pass, in 100s of milliseconds, without receiving an advertise packet from the neighbor before the multi-chassis signaling link is considered not operational.

The **hold-time** is usually 3 times the value of the **advertise-interval**. The value of the **advertise-interval** is valid only for a multi-chassis APS as indicated by the value of neighbor IP address if it is not set to 0.0.0.0.

Parameters *hold-time* — Specifies how long to wait for an APS advertisement packet before the peer in a Multi-Chassis APS group is considered operationally down.

Values 10 — 650

neighbor

Syntax **neighbor** *ip-address*
no neighbor

Context config>port>aps

Description This command specifies the neighbor's IP address only on a multi-chassis APS where the working and protect circuits are configured on different routers. When the value the neighbor IP address is set to 0.0.0.0, this implies that the APS group is configured as a single-chassis APS group.

The route to the neighbor must not traverse the multi-chassis APS member (working or protect) circuits. It is recommended that the neighbor IP address configured is on a shared network between the routers that own the working and protect circuits.

By default no neighbor address is configured and both the working and protect circuits should be configured on the same router (i.e., single-chassis APS). APS is assumed to be configured wholly on a single chassis.

Parameters *ip-address* — Specifies the neighbor's IP address only on a multi-chassis APS where the working and protect circuits are configured on different routers. The node should be connected with a direct interface to ensure optimum fail-over time.

Values ipv4-address: a.b.c.d
ipv6-address: x:x:x:x:x:x:x:x (eight 16-bit pieces)
x:x:x:x:x:x:d.d.d.d
x: [0 — FFFF]H
d: [0 — 255]D

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 protect circuit port must contain only the default configuration and cannot belong to another APS group. The protect circuit port must be of the same type as the working circuit for the APS group, for the port to be added to an APS group port. If that's not the case, 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 is removed.

When a port is a protect-circuit of an APS group, the configuration options available in the **config>port** *port-id*>**sonet-sdh** context is not allowed for that port unless it is part of the noted exceptions. The exception list includes these SONET/SDH commands:

clock-source
[no] loopback
[no] report-alarm
section-trace
[no] threshold

When is port configured as a protection circuit of an APS group, the configurations described above and all service configurations related to APS port are operationally inherited by the protect circuit. If the protect circuit cannot inherit the configurations (due to resource limitations), the configuration attempt fails and an error is returned to the user.

The protect circuit must be shutdown 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 protect-circuit.

Default none

Parameters *port-id* — Specify the physical port that will act as the protection circuit for this APS group in the *slot*/*mda*/*port* format.

Syntax: *port-id*: *slot/mda/port*

Also see Modifying Hold-Down Timer Values on page 179 for information about modifying the timer defaults in the event of communication delays between the APS Controllers.

revert-time

Syntax **revert-time** *minutes*
no revert-time

Context config>port>aps

Description This command configures the revert-time timer to determine how long to wait before switching back to the working circuit after that circuit has been restored into service.

A change in the *minutes* value takes effect upon the next initiation of the wait to restore (WTR) timer. It 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).

Default The default is to not revert back unless the protect circuit fails or operator intervention.

Parameters *minutes* — Specify the time, in minutes, to wait before reverting back to the original working circuit after it has been restored into service.

Values 0— 60 minutes

Default 5

switching-mode

Syntax **switching-mode** {**bi-directional | uni-directional**}

Context config>port>aps

Description This command configures the switching mode for the APS port.

Parameters **bi-directional —** Provides protection in one direction.

uni-directional — Provides protection in both directions.

working-circuit

Syntax **working-circuit** *port-id*

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 available under **config>port** *port-id* context (including submenus) is not allowed for that port unless it is a part of the noted exceptions.

When a port is being configured as a working circuit of an APS group, all common configuration as described above and all service configurations related to the APS port is 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.

Before a working circuit can be removed from an APS group, the working circuit port must be shutdown. 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. Note that all configurations for aps-*group-id* under the **config>port** context and its submenus and all configuration for services that use this aps-*group-id* is 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 protect circuit has been removed.

Default none

Parameters *port-id* — Specify the physical port that will act as the working circuit for this APS group.

Syntax: *port-id*: *slot/mda/port*

Modifying Hold-Down Timer Values

Note that for APS configurations, the **hold-time down** and **hold-time up** default values are 100 ms and 500 ms respectively. But, if there is a large difference in the transmission delay between the APS working (**working-circuit**) and protect line (**protect-circuit**), it is highly suggested to increase the default timer on the working line accordingly with the transmission delay present on the protect line. See **hold-time** on **page 208**.

The following output shows an example of the timers on PoS interfaces.

```
A:NS044050253# show port aps-1
===============================================================================
SONET/SDH Interface
===============================================================================
Description         : APS Group
Interface           : aps-1                  Speed                : oc3
Admin Status        : up                     Oper Status          : up
Physical Link       : Yes                    Loopback Mode        : none
Single Fiber Mode   : No
Clock Source        : node                   Framing              : sonet
Last State Change   : 04/11/2007 13:53:01    Port IfIndex         : 1358987264
J0 String           : 1/1/5 7710-SR-12       Section Trace Mode   : string
Rx S1 Byte          : 0x00                   Rx K1/K2 Byte        : 0x00/0x00
Rx J0 String (Hex)  : 81 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Cfg Alarm           : loc lais lrdi ss1f lb2er-sd lb2er-sf slof slos lrei
Alarm Status        :
Hold time up        : 500 milliseconds
Hold time down      : 100 milliseconds
===============================================================================
Port Statistics
===============================================================================
                                                     Input                Output
-------------------------------------------------------------------------------
Packets                                            6670498               3804661
Discards                                                 0                     0
Unknown Proto Discards                                   0
===============================================================================
A:NS044050253#
```

For an unprotected port, these timers are different:

```
A:NS044050253# show port 1/1/2
===============================================================================
SONET/SDH Interface
===============================================================================
Description        : OC-48 SONET/SDH
Interface          : 1/1/2                     Speed                : oc48
Admin Status       : up                        Oper Status          : up
Physical Link      : Yes                       Loopback Mode        : none
Single Fiber Mode  : No
APS Group          : none                      APS Role             : none
Clock Source       : loop                      Framing              : sonet
Last State Change  : 04/11/2007 14:53:53       Port IfIndex         : 37814272
J0 String          : 0x01                      Section Trace Mode   : byte
Rx S1 Byte         : 0x00                      Rx K1/K2 Byte        : 0x00/0x00
Rx J0 String (Hex) : af 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       :
Hold time up       : 500 milliseconds
Hold time down     : 0 milliseconds

Transceiver Data

Transceiver Type   : SFP
Model Number       : SFP-OC48-SR12
Transceiver Code   : OC48 SR
Laser Wavelength   : 1310                      Diag Capable         : yes
Connector Code     : LC                        Vendor OUI           : 00:01:9c
Manufacture date   : 2004/08/20 00:00:00       Media                : SONET/SDH
Serial Number      : 6331000705
Part Number        : CT2-MS1LBTD32Z2
Optical Compliance*: 00:01:00:00:00:00:00:00
Link Len 9u        : 2 kms                     Link Len Cu          : 0 m
Link Len 9u        : 20 * 100m                 Link Len 62.5u       : 0 * 10m
Link Len 50u       : 0 * 10m

===============================================================================
Port Statistics
===============================================================================
                                                     Input               Output
-------------------------------------------------------------------------------
Packets                                            3870094              6656408
Discards                                                 0                    0
Unknown Proto Discards                                   0
===============================================================================
A:NS044050253#
```

Ethernet Port Commands

ethernet

Syntax **ethernet**

Context config>port

Description This command enables access to the context to configure Ethernet port attributes.

This context can only be used when configuring Fast Ethernet Ethernet LAN ports on an appropriate MDA.

autonegotiate

Syntax **autonegotiate** [**limited**]
[**no**] **autonegotiate**

Context config>port>ethernet

Description This command enables speed and duplex autonegotiation on Fast Ethernet ports and enables far-end fault indicator support on gigabit ports.

There are three possible settings for autonegotiation:

- "on" or enabled with full port capabilities advertised
- "off" or disabled where there are no autonegotiation advertisements
- "limited" where a single speed/duplex is advertised.

When autonegotiation is enabled on a port, the link attempts to automatically negotiate the link speed and duplex parameters. If autonegotiation is enabled, the configured duplex and speed parameters are ignored.

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. Note that disabling autonegotiation on gigabit ports is not allowed as the IEEE 802.3 specification for gigabit Ethernet requires autonegotiation be enabled for far end fault indication.

If the **autonegotiate limited** keyword option is specified the port will autonegotate but will only advertise a specific speed and duplex. The speed and duplex advertised are the **speed** and **duplex** 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.

7710 SR OS requires that autonegotiation be disabled or limited for ports in a Link Aggregation Group to guarantee a specific port speed.

The **no** form of this command disables autonegotiation on this port.

Default **autonegotiate**

Parameters **limited —** The Ethernet interface will automatically negotiate link parameters with the far end, but will only advertise the speed and duplex mode specified by the Ethernet **speed** and **duplex** commands.

dot1q-etype

Syntax **dot1q-etype** *0x0600..0xffff*
no dot1q-etype

Context config>port>ethernet

Description This command specifies the Ethertype expected when the port's encapsualtion type is dot1q. Dot1q encapsulation is supported only on Ethernet interfaces.

The **no** form of this command reverts the dot1q-etype value to the default.

Parameters *0x0600..0xffff* — Specifies the Ethertype to expect.

Default If the encap-type is dot1p, then the default is 0x8100.
If the encap-type is qinq, then the default is 0x8100.

duplex

Syntax **duplex** {**full** | **half**}

Context config>port>ethernet

Description This command configures the duplex of a Fast Ethernet port when autonegotiation is disabled.

This configuration command allows for the configuration of the duplex mode of a Fast Ethernet port. If the port is configured to autonegotiate this parameter is ignored.

Default **full**

Parameters **full —** Sets the link to full duplex mode.

half — Sets the link to half duplex mode.

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 OAM PDUs from peers.

The **no** form of this command disables reactions to loopback control OAM PDUs.

mode

Syntax **mode** {**active** | **passive**}

Context config>port>ethernet>efm-oam

Description This command configures the mode of OAM operation for this Ethernet port. These two modes differ in that active mode causes the port to continually send out efm-oam info PDUs while passive mode waits for the peer to initiate the negotiation process. A passive mode port cannot initiate monitoring activites (such as loopback) with the peer.

Default active

Parameters **active —** Provides capability to initiate negotiation and monitoring activities.

passive — Relies on peer to initiate negotiation and monitoring activities.

transmit-interval

Syntax [**no**] **transmit-interval** *interval* [**multiplier** *multiplier*]

Context config>port>ethernet>efm-oam

Description This command configures the transmit interval of OAM PDUs.

Parameters *interval* — Specifies the transmit interval.

Values 1 — 600 (in 100 milliseconds)

multiplier *multiplier* **—** Specifies the multiplier for transmit-interval to set local link down timer.

Values 2 — 5

tunneling

Syntax [**no**] **tunneling**

Context config>port>ethernet>efm-oam

Description This command enables EFM OAM PDU tunneling. Enabling tunneling will allow a port mode Epipe SAP to pass OAM frames through the pipe to the far end.

The **no** form of the command disables tunneling.

egress-rate

Syntax **egress-rate** *sub-rate*
no egress-rate

Context config>port>ethernet

Description This command configures the rate of traffic leaving the network.

The **no** form of this command returns the value to the default.

Default **no egress-rate**

Parameters *sub-rate* — The egress rate in Kbps.

Values 1 — 10000000 kbps

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, or different VLANs on a network port.

The **no** form of this command restores the default.

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 — Specifies qinq encapsulation.

hold-time

Syntax **hold-time** {[**up** *hold-time* **up**] [**down** *hold-time* **down**]}
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, it is immediately advertised to the rest of the system if the hold-time down interval is zero, but if the hold-time down interval is greater than zero, interface down transitions are not advertised to upper layers until the hold-time down interval has expired. Likewise, an interface is immediately advertised as up to the rest of the system if the hold-time up interval is zero, but if the hold-time up interval is greater than zero, up transitions are not advertised until the hold-time up interval has expired.

The **no** form of this command reverts to the default values.

Default **down 0** — No port link down dampening is enabled; link down transitions are immediately reported to upper layer protocols.

up 0 — No port link up dampening is enabled; link up transitions are immediately reported to upper layer protocols.

Parameters **up** *hold-time* **up — —** The delay, in seconds, to notify the upper layers after an interface transitions from a down state to an up state.

Values 0 — 50

down *hold-time* **down —** The delay, in seconds, to notify the upper layers after an interface transitions from an up state to a down state.

Values 0 — 50

ingress-rate

Syntax **ingress-rate** *sub-rate*
no ingress-rate

Context config>port>ethernet

Description This command configures the maximum amount of ingress bandwidth that this port can receive.

The ingress-rate command is only valid for oversubscribed Ethernet MDAs. See **Oversubscribed Ethernet MDAs on page 19** for details.

The **no** form of this command returns the value to the default.

Default **no ingress-rate**

Parameters *sub-rate* — The egress rate in mbps.

Values 1 — 10000 mbps

lacp-tunnel

Syntax [**no**] **lacp-tunnel**

Context config>port>ethernet

Description This command enables LACP packet tunneling for the Ethernet port. When tunneling is enabled, the port will not process any LACP packets but will tunnel them instead. The port cannot be added as a member to a LAG group.

The **no** form of the command disables LACP packet tunneling for the Ethernet port.

Default no lacp-tunnel

load-balancing-algorithm

Syntax **load-balancing-algorithm** *option*
no load-balancing-algorithm

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
config>port>tdm>e3

Description This command specifies the load balancing algorithm to be used on this port.

In the default mode, **no load-balancing-algorithm**, the port inherits the global settings. The value is not applicable for ports that do not pass any traffic.

The configuration of load-balancing-algorithm at logical port level has three possible values:

- **include-l4** — Enables inherits system-wide settings including Layer 4 source and destination port value in hashing algorithm.
- **exclude-l4 —** Layer 4 source and destination port value will not be included in hashing.
- **no load-balancing-algorithm** — Inherits system-wide settings.

The hashing algorithm addresses finer spraying granularity where many hosts are connected to the network. To address more efficient traffic distribution between network links (forming a LAG group), a hashing algorithm extension takes into account L4 information (i.e., src/dst L4-protocol port).
The hashing index can be calculated according to the following algorithm:

```
If [(TCP or UDP traffic) & enabled]
        hash (<TCP/UDP ports>, <IP addresses>)
else if (IP traffic)
        hash (<IP addresses>)
else
        hash (<MAC addresses>)
endif
```

This algorithm will be used in all cases where IP information in per-packet hashing is included (see LAG and ECMP Hashing on page 65) except in the following cases:

- Fragmented packets
- Packets received from a VPRN tunnel.

Use of Layer 4 information (TCP/UDP ports) will not be used in following cases:

- Fragmented packets.
- Packets received from a VPRN tunnel.

Default no load-balancing-algorithm

Parameters *option* — Specifies the load balancing algorithm to be used on this port.

Values **include-l4** — Specifies that the source and destination ports are used in the hashing algorithm.
exclude-l4 — Specifies that the source and destination ports are not used in the hashing algorithm.

pbb-etype

Syntax **pbb-etype** [**0x0600**..**0xffff**]
no pbb-etype

Context config>port>ethernet

Default 0x88E7

Description This command configures the Ethertype used for PBB encapsulation.

Values **0x0600**..**0xffff:** 1536 — 65535 (accepted in decimal or hex)

qinq-etype

Syntax **qinq-etype** *0x0600..0xffff*
no qinq-etype

Context config>port>ethernet

Description This command configures the Ethertype used for Q-in-Q encapsulation.

The **no** form of this command reverts the quinq-etype value to the default.

Parameters *0x0600..0xffff* — Specifies the quinq-etype to expect.

Values 1536 — 65535 in decimal or hex formats

report-alarm

Syntax [no] **report-alarm** [**signal-fail**] [**remote**] [**local**] [**no-frame-lock**] [**lcd**] [**high-ber**]

Context config>port>ethernet

Description This command specifies when and if to generate alarms and alarm clear notifications for this port.

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.

lcd — Reports a codegroup delineation error.

high-ber — Reports a high bit error rate alarm.

speed

Syntax **speed** {**10** | **100** | **1000**}

Context config>port>ethernet

Description This command configures the port speed of a Fast Ethernet port when autonegotiation is disabled.

If the port is configured to autonegotiate this parameter is ignored. Speed cannot be configured for ports that are part of a Link Aggregation Group (LAG).

Default **100**

Parameters **10 —** Sets the link to 10 mbps speed.

100 — Sets the link to 100 mbps speed.

1000 — Sets the link to 1000 mbps speed.

xgig

Syntax **xgig** {**lan** |**wan**}

Context config>port>ethernet

Description This command configures a 10 Gbps interface to be in Local or Wide Area Network (LAN or WAN) mode. When configuring the port to be in WAN mode certain SONET/SDH parameters can be changed to reflect the SONET/SDH requirements for this port.

When the port is configured for LAN mode, all SONET/SDH parameters are pre-determined and not configurable.

Default **lan**

Parameters **lan** **—** Sets the port to operate in LAN mode

wan — Sets the port to operate in WAN mode.

802.1x Port Commands

max-auth-req

Syntax **max-auth-req** *max-auth-request*

Context config>port>ethernet>dot1x

Description This command configures the maximum number of times that the 7710 SR 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* attempts, the 802.1x authentication procedure is considered to have failed.

The **no** form of this command returns the value to the default.

Default 2

Parameters *max-auth-request* — The maximum number of RADIUS retries.

Values 1 — 10

port-control

Syntax **port-control** [**auto** | **force-auth** | **force-unauth**]

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 **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.

force-unauth — Causes the port to remain in the unauthorized state, ignoring all attempts by the hosts to authenticate. The switch cannot provide authentication services to the host through the interface.

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 7710 SR and the host can initiate an authentication procedure. The port will remain in un-authorized state (no traffic except EAPOL frames is allowed) until the first client is authenticated successfully. After this, traffic is allowed on the port for all connected hosts.

quiet-period

Syntax **quiet-period** *seconds*
no quiet-period

Context config>port>ethernet>dot1x

Description This command configures the period between two authentication sessions during which no EAPOL frames are sent by the 7710 SR.

The **no** form of this command returns the value to the default.

Default 30

Parameters *seconds* — Specifies the quiet period in seconds.

Values 1 — 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>security>dot1x) before it can be associated to a 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 period after which re-authentication is performed. This value is only relevant if re-authentication is enabled.

The **no** form of this command returns the value to the default.

Default 3600

Parameters *seconds* — The re-authentication delay period in seconds.

Values 1 — 9000

re-authentication

Syntax [**no**] **re-authentication**

Context config>port>ethernet>dot1x

Description This command enables / disables periodic 802.1x re-authentication.

When re-authentication is enabled, the 7710 SR will re-authenticate clients on the port every re-auth-period seconds.

The **no** form of the command returns the value to the default.

Default re-authentication

server-timeout

Syntax **server-timeout** *seconds*
no server-timeout

Context config>port>ethernet>dot1x

Description This command configures the period during which the 7710 SR waits for the RADIUS server to responds to its AccessRequest message. When this timer expires, the 7710 SR will re-send the AccessRequest message, up to max-request-number times.

The **no** form of this command returns the value to the default.

Default 30

Parameters *seconds* — The server timeout period in seconds.

Values 1 — 300

supplicant-timeout

Syntax **supplicant-timeout** *seconds*
no supplicant-timeout

Context config>port>ethernet>dot1x

Description This command configures the period during which the 7710 SR waits for a client to respond to its EAPOL messages. When the supplicant-timeout 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* — The server timeout period in seconds.

Values 1 — 300

transmit-period

Syntax **transmit-period** *seconds*
no transmit-period

Context config>port>ethernet>dot1x

Description This command configures the period after which the 7710 SR sends a new EAPOL request message.

The **no** form of this command returns the value to the default.

Default 30

Parameters *seconds* — The server transmit period in seconds.

Values 1 — 300

down-when-looped

Syntax **down-when-looped**

Context config>port>ethernet

Description This command configures Ethernet loop detection attributes.

dot1x

Syntax **dot1x**

Context config>port>ethernet

Description This command enables access to the context to configure port-specific 802.1x authentication attributes. This context can only be used when configuring a Fast Ethernet, gigabit or 10Gig EthernetFast Ethernet, gigabit or 10Gig EthernetFast Ethernet or gigabit Ethernet LAN ports on an appropriate MDA.

keep-alive

Syntax **keep-alive** *timer*
no keep-alive

Context config>port>ethernet>dwl

Description This command configures the time interval between keep-alive PDUs.

Default no keep-alive

Parameters *timer* — Specifies the time interval, in seconds, between keep-alive PDUs.

Values 1 — 120

retry-timeout

Syntax **retry-timeout** timer
no retry-timeout

Context config>port>ethernet>dwl

Description This command configures the minimum wait time before re-enabling port after loop detection.

Default no retry-timeout

Parameters *timer* — Specifies the minimum wait time before re-enabling port after loop detection.

Values 0, 10 — 160

Network Port Commands

network

Syntax **network**

Context config>port>ethernet
config>port>sonet-sdh>path
config>port>tdm>ds1config>port>tdm>ds3
config>port>tdm>e31
config>port>tdm>e3

Description This command enables access to the context to configure network port parameters.

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>network
config>port>tdm>ds3>network
config>port>tdm>e1>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.

By default, no specific accounting policy is associated with the interface. If configured, the accounting policy configured as the default is used.

The **no** form of this command removes the accounting policy association from the network interface, and the acccounting policy reverts to the default.

policy-id — The accounting *policy-id* of an existing policy. Accounting policies record either service (access) or network information. A network accounting policy can only be associated with the network port configurations. Accounting policies are configured in the config>log>accounting-policy context.

Default No accounting policies are specified by default. You must explicitly specify a policy.

Values 1 — 99

collect-stats

Syntax [**no**] **collect-stats**

Context config>port>ethernet>network
config>port>sonet-sdh>path>network
config>port>tdm>ds3>network
config>port>tdm>e1>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 CFM 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**

queue-policy

Syntax **queue-policy** *name*
no queue-policy

Context config>port>ethernet>network
config>port>sonet-sdh>path>network
config>port>tdm>ds1>network
config>port>tdm>ds3>network
config>port>tdm>e1>network
config>port>tdm>e3>network

Description This command specifies the existing network queue policy which 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.

Default default

Parameters *name* — Specifies an exisiting network-queue policy name.

Multilink-Bundle Port Commands

multilink-bundle

Syntax [**no**] **multilink-bundle**

Context config>port

Description This command creates the context to configure bundle properties for this bundle port.

Default None

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 a multilink bundle.

The **no** form of this command resets the fragment threshold back to the default value.

Default 128

Parameters *fragment-threshold* — Specify the maximum fragment length, in bytes, to be transmitted across a multilink bundle.

Values 128 — 512 bytes

unlimited — This keyword disables fragmentation.

interleave-fragments

Syntax [**no**] **interleave-fragments**

Context config>port>multilink-bundle

Description This command enables Link Fragmentation and Interleaving on the multilink bundle.

The **no** form of this command disables Link Fragmentation and Interleaving on the multilink bundle.

member

Syntax [**no**] **member** *port-id*

Context config>port>multilink-bundle

Description This command binds a channel group filling up the entire DS1 or E1 to a multilink bundle.

Up to 8 channel groups can be bound to a given multilink bundle. All channel groups must be from the same MDA/CMA and of the same type (either E1 or DS1). There is a limit of 168 member links per MDA/CMA.

The **no** form of this command removes the specified channel group from the multilink bundle.

Default None

Parameters *port-id* — Specifies the physical port ID.

Syntax: *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.

If the number of active links drops below the configured minimum then the multilink bundle will transition to an operationally down state.

The **no** form of this command removes the minimum link limit.

Default 1

Parameters *minimum-link* — Specify the minimum link limit, expressed as an integer.

Values 1 — 8

mlppp

Syntax **mlppp**

Context config>port>ml-bundle

Description This command enables the context to configure multi-link PPP bundle attributes.

egress

Context config>port>ml-bundle>mlppp

Description This command enables the context to configure egress MLPPP QoS profile parameters for the multilink bundle.

Default none

ingress

Context config>port>ml-bundle>mlppp

Description This command enables the context to configure ingress MLPPP QoS profile parameters for the multilink bundle.

Default none

qos-profile

Syntax **qos-profile** *profile-id*
no qos-profile

Context config>port>ml-bundle>mlppp>egress

Description This command specifies the egress QoS profile to be used for the outgoing traffic over this MLPPP bundle.

The **no** form of the command removes the parameters from the configuration.

Values 1-3

Parameters *profile-id* — Specifies the egress QoS profile to be used for the outgoing traffic over this MLPPP bundle. The value can only be modified if no links are configured on the bundle and the bundle is shutdown.

endpoint-discriminator

Syntax **endpoint-discriminator class** {**ip-address** | **global-mac-address**} [**discriminator-id** *discriminator-id*]
no endpoint-discriminator

Context config>port>ml-bundle>mlppp

Description This command configures the endpoint-discriminator class and ID. The port must be shutdown to modify command parameters.

The **no** form of the command removes the parameters from the configuration.

Parameters **class —** Specifies the Link Control Protocol endpoint descriminator class field type.

Values ip-address, global-mac-address

Default

Bundle type	Default
Physical MLPPP bundle	ieee802dot1GlobalMacAddress
MLPPP bundle protection group	IP address

discriminator-id *discriminator-id* **—** Specifies the endpoint discriminator identifier value within the specified endpoint-discriminator class. The values below are only for the ip-address class.

Values Any valid IP address.

qos-profile

Syntax **qos-profile** *profile-id*
no qos-profile

Context config>port>ml-bundle>mlppp>ingress

Description This command specifies the ingress QoS profile to be used for the incoming traffic over this MLPPP bundle.

Parameters *profile-id* — Specifies the ingress QoS profile to be used for the incoming traffic over this MLPPP bundle.

The value can only be modified if no links are configured on the bundle and the bundle is shutdown. The only accepted value is 1.

multiclass

Syntax **multiclass** *count*
no multiclass

Context config>port>ml-bundle>multiclass

Description This command enables multi-class MLPPP as defined by RFC 2686, *The Multi-Class Extension to Multi-Link PPP,* on a MLPPP bundle (including MLPPP bundle protection groups) with 2, 3 or 4 classes.

For multiclass MLPPP bundles with a non-zero count, the class index takes valid values from 0 to one less than the maximum number of classes inclusive. For example a 4-class MLPPP bundle has 4 classes with indices 0, 1, 2, and 3. A bundle must be shutdown with no links for this value to be changed.

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 multi-class MLPPP.

Default 4

Parameters *count* — Specifies the number of classes in a MLPPP bundle.

Values 2 — 4

mrru

Syntax **mrru** *mrru*
no mrru

Context config>port>multilink-bundle

Description This command specifies the maximum received reconstructed unit (MRRU), 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 *bytes* — Specify the maximum received reconstructed unit size, expressed as an integer.

Values 1500 — 9206 bytes

protect-bundle

Syntax [**no**] **protect-bundle** *bundle-id*

Context config>port>multilink-bundle

Description This command configures a protect bundle that is part of this BPGRP.

Parameters *bundle-id* — Specifies the multilink bundle to be associated with this IP interface. The command syntax must be configured as follows:

Syntax: bundle-*type-slot/mda.bundle-num*
bundle-ima-*slot/mda.bundle-num* (Creates an IMA group bundle.)
bundle: keyword
slot: IOM/MDA slot numbers
bundle-num: 1 — 256

For example: router1>config>port>ml-bundle> protect-bundle bundle-ima-1/1.1

red-differential-delay

Syntax **red-differential-delay** *red-diff-delay* [**down**]
no red-differential-delay

Context config>port>multilink-bundle

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 None

Parameters *red-diff-delay* — Specify the maximum red differential delay value.

Values 0 — 25 milliseconds for all other bundles
0 — 50 milliseconds for IMA bundles

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).

short-sequence

Syntax [**no**] **short-sequence**

Context config>port>multilink-bundle

Description This command specifies that the Multi-link Point to Point Protocol (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

working-bundle

Syntax [**no**] **working-bundle** *bundle-id*

Context config>port>multilink-bundle

Description This command configures a working bundle that is part of this BPGRP.

Parameters *bundle-id* — Specifies the multilink bundle to be associated with this IP interface. The command syntax must be configured as follows:

Syntax: bundle-*type-slot/mda.bundle-num*
bundle-ima-*slot/mda.bundle-num* (Creates an IMA group bundle.)

bundle:	keyword
slot:	IOM/MDA slot numbers
bundle-num:	1 — 256

For example:
router1>config>port>ml-bundle> working-bundle bundle-ima-1/1.1

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 None

Parameters *yellow-diff-delay* — Specify the maximum yellow differential delay threshold value.

Values 1— 25 milliseconds

ima

Syntax **ima**

Context config>port>multilink-bundle

Description This command enables the context to configure parameters for an Inverse Multiplexing over ATM (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. Then they are reassembled as the original high-speed ATM channel. This command is only valid for IMA bundles.

link-delay

Syntax **link-delay** {**activate** | **deactivate**} *milli-seconds*
no link-delay {**activate** | **deactivate**}

Context config>port>multilink-bundle>ima

Description This command specifies the time to 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** *milli-seconds* **—** Specifies the time, in milli-seconds, 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 — 30000 milli-seconds

Default 1000

deactivate *milli-seconds* **—** Specifies the time, in milli-seconds, 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 — 30000 milli-seconds

Default 2000

max-bandwidth

Syntax **max-bandwidth** *number-links*
no max-bandwidth

Context config>port>ml-bundle>ima

Description This command specifies the number of links that are used to determine the maximum configurable bandwidth that is allowed to be used for this IMA group.

The maximum bandwidth is computed as:

Maximum Configurable ATM Bandwidth (MCAB) =

(number-links) * (M-1)/M * (2048/2049) * primary member link speed

where,

M is the IMA frame size (128)
primary member link speed is either E1 — 1920kbps or DS1 — 1539kbps. E1 speed is used for a group with no members.

The total ATM bandwidth of services over shaped VCs cannot exceed the MCAB value as result of adding more services or removing member links.

The **no** form of the command resets the max-bandwidth to its default value

Default 8

Parameters *number-links* — specifies the number of links that are used to determine the maximum configurable bandwidth that is allowed to be used for this IMA group.

Values 1 — 8

test-pattern-procedure

Syntax **test-pattern-procedure**

Context config>port>ml-bundle>ima

Description This command enables the context to configure IMA test pattern procedures. Note that this command and sub-commands are not saved in the router configuration between reboots.

test-link

Syntax **test-link** *port-id*
no test-link

Context config>port>ml-bundle>ima>test-pattern-procedure

Description This comand specifies IMA members on which an IMA test pattern procedure is to be performed.

The **no** form of this command deletes the link from test-pattern procedure. The test-pattern procedure must be shutdown first.

Default no test-link

Parameters *port-id* — The port ID to be used to verify link connectivity within an IMA group.

Values	port-id	slot/mda/port[.channel]		
	aps-id	aps-*group-id*[.*channel*]		
		aps	keyword	
		group-id	1 — 64	

test-pattern

Syntax **test-pattern** *pattern*
no test-pattern

Context config>port>ml-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:

Values 0 — 255

shutdown

Syntax [**no**] **shutdown**

Context config>port>ml-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>ml-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 become operationally down. Automatic version changing is not supported. To change the IMA version, all member links must be removed from the group first.

Parameters *IMA-version* — Specifies the IMA version for this group.

Values 1-0 — IMA version 1-0
1-1 — IMA version 1-1

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 OC-3, OC-12, and OC-48 SONET/SDH ports on an appropriate MDA/CMA.

clock-source

Syntax **clock-source** {**loop-timed | node-timed**}

Context config>port>sonet-sdh

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.

Note: When changing the clock source for a port on an OC-48 MDA, a brief transmit interruption can occur on all ports of that MDA. The following table show MDAs that support loop timing:

MDA Supports	Loop Timed	Default
OC-48	Yes	loop-timed
OC-12	No	node-timed
OC-3	No	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.

framing

Syntax **framing** {**sonet | sdh**}

Context config>port>sonet-sdh

Description This command specifies SONET/SDH framing to be either SONET or SDH.

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**}

Context config>port>sonet-sdh

Description This command configures payload of the SONET/SDH group.

For example:

```
config>port>sonet-sdh#
        group tug3-1.1 payload tu3
        group tug3-1.2 payload vt2
        group tug3-1.3 payload vt2
        group tug3-2.1 payload vt15
        group tug3-2.2 payload vt15
        group tug3-2.3 payload tu3
        group tug3-3.1 payload tu3
        group tug3-3.2 payload tu3
        group tug3-3.3 payload tu3
```

Default none

Parameters *sonet-sdh-index* — Specifies the components making up the specified SONET/SDH path. Depending on the type of SONET/SDH port the *sonet-sdh-index* must specify more path indexes to specify the payload location of the path.

tu3 — Specify the Tributary Unit Group (TUG3) on a path. Configures the port or channel for transport network use.

vt2 — Configures the path as a virtual tributary group of type vt2.

vt15 — Configures the path as a virtual tributary group of type vt15.

hold-time

Syntax **hold-time** *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. This guards against reporting excessive interface transitions. This is implemented by not advertising subsequent transitions of the interface to upper layer protocols until the configured timer has expired.

Default no hold-time

Parameters **up** *hold-time* **up —** Configures the hold-timer for link up event dampening. A value of zero (0) indicates that an up transition is reported immediately.

Values 0 — 100 in 100s of milliseconds

down *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 — 100 in 100s of milliseconds

Note: For APS configurations, the **hold-time down** and **up** default values are 100 ms and 500 ms respectively. But, if there is a large communication delay (time to exchange K1/K2 bytes) between the APS Controllers of the two endpoints of an APS link, it is highly suggested to increase the default hold-time down timer on the APS group port accordingly with the communication delay. See **aps** on page 175.

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 shut down state to activate any type of loopback. The loopback setting is never saved to the generated/saved configuration file.

Note that loopback mode changes on a SONET/SDH port can affect traffic on the remaining ports.

Default no loopback

Parameters **line —** Set the port into line loopback state.

internal — Set the port into internal loopback state.

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. Only line and section alarms can be configured in the SONET/SDH context, for path alarms see the **sonet-sdh**>**path** context.

The **no** form of this command disables logging of the specified alarms

Parameters *loc* — Reports a loss of clock which causes the operational state of the port to be shut down.

Default **loc** alarms are issued.

lais — Reports line alarm indication signal errors. When configured, **lais** alarms are raised and cleared.

Default **lais** alarms are not issued.

lrdi — Reports line remote defect indication errors. LRDI's are caused by remote LOF, LOC, LOS. When configured, **lrdi** alarms are raised and cleared.

Default **lrdi** alarms are issued.

ss1f — Reports section synchronization failure which is detected when the S1 byte is not consistent for 8 consecutive frames. When configured, **ss1f** alarms are raised and cleared.

Default **ss1f** alarms are not issued.

lb2er-sd — Reports line signal degradation BER (bit interleaved parity) errors. Use the threshold command to set the error rate(s) that when crossed determine signal degradation and signal failure. When configured, **lb2er-sd** alarms are raised and cleared.

Default **lb2er-sd** alarms are not issued.

lb2er-sf — Reports line signal failure BER errors. Use the threshold command to set the error rate(s) that when crossed determine signal degradation and signal failure.When configured, **lb2er-sf** alarms are raised and cleared.

Default **lb2er-sf** alarms are issued.

slof — Reports section loss of frame errors. When configured, **slof** alarms are raised and cleared.

Default **slof** alarms are issued.

slos — Reports a section loss of signal error on the transmit side. When configured, **slos** alarms are raised and cleared.

Default **slos** alarms are issued.

lrei — Reports a line error condition raised by the remote as a result of b1 errors received from this node. When configured, **lrei** traps are raised but not cleared

Default **lrei** traps 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 incrementing STM ID. You can explicitly configure an incrementing STM value rather than a static one in the SDH overhead by specifying the z0-increment.

Default byte *0x1*

Parameters *increment-z0* — Configure an incrementing STM ID instead of a static value.

byte *value* — Set values in SONET header bytes.

Default 0x1

Values 0 — 255 or 0x00 — 0xFF

string *string* — Specifies a text string that identifies the section.

Values A string up to 16 bytes.

single-fiber

Syntax [**no**] **single-fiber**

Context config>port>sonet-sdh

Description This command enables packet gathering and redirection of IP packets from a single fiber on RX port of the SONET interface and redistributes packets to other interfaces through either static routes or policy-based forwarding.

Default no single-fiber

speed

Syntax **speed** {**oc3** | **oc12**}
no speed

Context config>port>sonet-sdh

Description This command configures the speed of a SONET/SDH port as either OC3 or OC12. The framer for this MDA operates in groups of four. Changing the port speed for a port requires resetting the framer and causes a slight disruption on all four ports. The first framer controls ports 1,2,3,4, the second framer controls ports 5,6,7,8 etc.

To change the port speed on a SONET/SDH port, the port must be administratively shut down and all channels must be removed. When the port speed is changed, the default channel configuration is recreated.

The **no** form of this command reverts back to default.

Default oc12

Parameters **oc3 —** set the speed of the port to OC-3.

oc12 — Set the speed of the port to OC-12.

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 degradation bit error rate (BER) and line signal failure thresholds.

Line signal (b2) bit interleaved parity error rates are measured and when they cross either the degradation or failure thresholds alarms are raised (see the report-alarm line & section command), furthermore if the failure threshold is crossed the link will be set to operationally down.

Note: For APS configurations, if the **ber-sd** or **ber-sf** threshold rates must be modified, the changes must be performed at the line level on both the working and protect APS port member. See port aps-id on page 165.

The **no** form of this command reverts to the default value.

Default

threshold ber-sf 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 that specifies signal degradation

ber-sf — Specifies the BER that specifies signal failure

rate — The BER negative exponent (n in 10^{-n}), expressed as a decimal integer.

Values 3 — 9 (10^{-3} — 10^{-9})

SONET/SDH Path Commands

path

Syntax [**no**] **path** [*sonet-sdh-index*]

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 full channel (or clear channel)

Parameters *sonet-sdh-index* — Specifies the components making up the specified SONET/SDH path. Depending on the type of SONET/SDH port the *sonet-sdh-index* must specify more path indexes to specify the payload location of the path. The *sonet-sdh-index* differs for SONET and SDH ports.

Syntax: sts1-*x.x*

	SONET	SDH	
OC-48	STS-12-index STS-3-index STS-1-index	STM-16	AUG-4-index AUG-1-index AU-3-index
OC-12	STS-3-index STS-1-index	STM-4	AUG-1-index AU-3-index
OC-3	STS-1-index	STM-1	AU-3-index

In addition the support of virtual tributary circuits adds an additional level of complexity and several addition levels of indexes.

payload

Syntax **payload** {**sts3 | tug3 | ds3 | e3**}

Context config>port>sonet-sdh>path

Description This command specifies if the associated SONET/SDH path is an asynchronous circuit or a virtual tributary group (VT). This command is only applicable to channelized MDAs.

Default none

Parameters **sts3 —** Configures STS3/STM1 payload as clear channel.

tu3 — Configures STS3/STM1 payload as Tributary Unit Group 3 (TUG3).

ds3 — Configures the port or channel as DS3 STS1/VC3 payload as DS3.

e3 — Configures the port or channel as E3STS1/VC3 payload as E3.

vt2 — Configures the path STS1 payload as vt2 as a virtual tributary group. Only allowed on STS-1 nodes. (SONET VT container)

vt15 — Configures the path as a virtual tributary group. Only allowed on STS-1 nodes. (SONET VT container)

ds1 — Configures the port or channel as DS1.vt15 or vt2 payload as DS1

e1 — Configures VT2 payload as E1.

report-alarm

Syntax [**no**] **report-alarms** [**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. Only path alarms can be configured in the channel context.

The **no** form of this command disables logging of the specified alarms.

Parameters **pais** — Reports path alarm indication signal errors. When configured, **pais** alarms are raised and cleared.

Default **pais** alarms are not issued

plop — Reports path loss of pointer (per tributary) errors. When configured, **plop** traps are raised but not cleared.

Default **plop** traps are issued

prdi — Reports path remote defect indication errors. When configured, **prdi** alarms are raised and cleared.

Default **prdi** alarms are not issued

pplm — Reports a path payload mismatch, as a result the channel will be operationally downed. When configured, **pplm** traps are raised but not cleared.

Default **pplm** traps are issued

prei — Reports a path error condition raised by the remote as a result of b3 errors received from this node. When configured, **prei** traps are raised but not cleared.

Default **prei** traps are not issued

puneq — Reports path unequipped errors. Reports path unequipped signal errors.

Default puneq traps are issued

plcd — Reports path loss of codegroup delineation errors. It is applicable only when the value of xgig is set to WAN.

Default **plcd** traps are not issued

crc

Syntax **crc** {**16** | **32**}

Context config>port>sonet-sdh>path

Description A 16 bit CRC can only be configured on an OC-3 channel, all other channel speeds must use a 32 bit CRC except for the paths configured with encap-type atm at OC3 speed.

Default 16 for OC-3, DS1, DS3
32 for OC-12, OC-48, ATM-OC12/3, etc.

Note: The CRC default is 32 when the encap-type is set to ATM and also, the default cannot be changed when the encap-type is set to ATM.

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** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc**}

Context config>port>sonet-sdh>path

Description This command configures the encapsulation method used to distinguish customer traffic on an access SONET/SDH channel sub-port.

When the **encap-type** is set to ATM the CRC default cannot be changed.

When the **encap-type** is ATM, ATM sub-layer verification (GR-1248-CORE, *Generic Requirements for Operations of ATM Network Elements (NEs)*) 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*. Note that multiple events occurring within a second will be counted as 1 event for ATM MDAs as a result of a hardware limit.
- Loss of Cell Delineation 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 will be 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. Also a P-RDI is sent to indicate the defect to the remote end.

The **encap-type** is only required when configuring a SONET/SDH path for access mode.

The **no** form of this command restores the default.

Default bcp-null

Parameters **atm —** Specifies that the encapsulation on the port is ATM.

bcp-null — Only a single service is configured on this channel and IEEE 802.1Q tags are not used as a service delimiter. Any IEEE 802.1Q tags encountered are regarded as part of the customer payload and transparently forwarded. When **bcp-null** encapsulation is specified, the PPP Bridge Control Protocol (BCP) is activated and all packets on this access port will be encapsulated in accordance with the BCP protocol.

Note that null ports will accept q-tagged frames.

bcp-dot1q — Ingress frames carry IEEE 802.1Q tags and the tags are used as service delimiter. Any untagged packets are silently discarded with exception of protocol specific packets. When **bcp-dot1q** encapsulation is specified, the PPP Bridge Control Protocol (BCP) is activated and all packets on this access port will be encapsulated in accordance with the BCP protocol.

ipcp — Ingress frames are encapsulated according to the IP Control Protocol. When **ipcp** encapsulation is specified, the PPP IP Control Protocol will be activated and only packets that comply with IPCP encapsulation are processed; others are silently discarded.

ppp-auto — Enables PPP on the associated port/channel. The activation of ipcp and mplscp is automatically enabled depending on the protocol configuration. This encap type is only valid on ports/channels in network mode.

frame-relay — Enables frame relay on the associated port/channel.

wan-mirror — The port is used for mirroring of frame-relay and POS ports. On these ports, no link management protocol would run.

cisco-hdlc — Monitors line status on a serial interface by exchanging keepalive request messages with peer network devices.

ppp

Syntax **ppp**

Context config>port>sonet-sdh>path

Description This command enables access to the context to configure the LCP operational parameters for a SONET/SDH Point-to-Point Protocol (PPP) link.

keepalive

Syntax **keepalive** *time-interval* [**dropcount** *count*]
no keepalive

Context config>port>sonet-sdh>path>ppp

Description This command enables the sending of keepalive messages and configures the time between messages and how many reports can be missed before bringing the link 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 — 60

Default 10

dropcount *count* **—** The number of keepalive messages that can be missed before the line is brought down.

Values 1— 255

Default 3

report-alarm

Syntax [**no**] **report-alarm** {**pais** | **plop** | **prdi** | **pplm** | **prei**}

Context config>port>sonet-sdh>path

Description This command enables logging of SONET (SDH) path alarms for a SONET-SDH port. Only path alarms can be configured in the channel context.

The **no** form of this command disables logging of the specified alarms.

Parameters **pais —** Reports path alarm indication signal errors. When configured, **pais** alarms are raised and cleared.

Default pais alarms are not issued

plop — Reports path loss of pointer (per tributary) errors. When configured, **plop** traps are raised but not cleared.

Default plop traps are issued

prdi — Reports path remote defect indication errors. When configured, **prdi** alarms are raised and cleared.

Default prdi alarms are not issued

pplm — Reports a path payload mismatch, as a result the channel will be brought down. When configured, **pplm** traps are raised but not cleared.

Default pplm traps are issued

prei — Reports a path error condition raised by the remote as a result of b3 errors received from this node. When configured, **prei** traps are raised but not cleared

Default prei traps are not issued

scramble

Syntax [**no**] **scramble**

Context config>port>sonet-sdh>path

Description This command enables SONET/SDH payload scrambling.

Scrambling randomizes the pattern of 1s and 0s carried in a SONET frame. Rearranging or scrambling 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/descrambling using x43+1 polynomial as defined in ITU-T I.432.1. Scrambling is enabled by default for the ATM path/channel. Note that this scrambling is done in addition to SONET/SDH frame scrambling/descrambling, which is always enabled in the framer.

The **no** form of this command disables scrambling.

Default no scramble

signal-label

Syntax **signal-label** *value*

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 value in hex format.

Values 1 — 254 or 0x01 — 0xfe

trace-string

Syntax **trace-string** [*trace-string*]
no trace-string

Context config>port> sonet-sdh>path

Description This command specifies that a J1-path-trace that identifies the circuit is inserted continuously at source. This can be checked against the expected value by the receiver. If no trace string is entered then a null string is used.

The **no** form of this command resets the string to its default.

Default The default J1 value is Alcatel-Lucent XXX YYY (for example, Alcatel 7710 SR) where XXX is the platform name, such as "7750" or "7450" or "7710", and YYY is the product name, such as "SR" or

"ESS". The value does not change when the encap-type changes. The J1 string contains all zeros for a non-provisioned path.

Parameters *trace-string* — Specifies either a string up to 62 bytes for SONET or 15 bytes for SDH. If the string contains spaces, enclose it in quotation marks.

keepalive

Syntax **keepalive** *time-interval*
no keepalive

Context config>port>sonet-sdh>path>cisco-hdlc
config>port>tdm>ds1>channel-group>cisco-hdlc
config>port>tdm>ds3>cisco-hdlc
config>port>tdm>e1>channel-group>cisco-hdlc
config>port>tdm>e3>cisco-hdlc

Description This command specifies 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 "timeout interval". The link is declared up once the number of continual keepalive packets received equals to the up-count. It is expected that the nodes at the two endpoints of the cHDLC link are provisioned with the same values.

Default 10

Parameters *time-interval* — Specifies the interval used to send periodic keepalive packets.

Values 0 — 300 seconds. A value of 0 means no keepalive packets are sent.

up-count

Syntax **up-count** *up-count*
no up-count

Context config>port>sonet-sdh>path>cisco-hdlc
config>port>tdm>ds1>channel-group>cisco-hdlc
config>port>tdm>ds3>cisco-hdlc
config>port>tdm>e1>channel-group>cisco-hdlc
config>port>tdm>e3>cisco-hdlc

Description This command configures the number of continual keepalive packets that have to be received in order to declare the link up. It is expected that the nodes at the two endpoints of the cHDLC link are provisioned with the same values.

Default 1

Parameters *up-count* — Specifies the number of continual keepalive packets that have to be received in order to declare the link up.

Values 1 — 3

channelized

Syntax **channelized {ds1 | e1}**
no channelized

Context config>port>tdm>ds3

Description This command specifies that the associated DS3 is a channelized DS3 with DS1/E1 sub-channels. Depending on the MDA type, the DS3 parameters must be disabled if clear channel is the default (for example, on m12-ds3 MDAs). Clear channel is a channel that uses out-of-band signaling, not in-band signaling, so the channel's entire bit rate is available. Channelization must be explicitly specified. The no form specifies the associated DS3 is a clear channel circuit and cannot contain sub-channel DS1s/E1s. 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.

framing (E1)

Syntax **framing {no-crc-g704 | g704 | e1-unframed}**

Context config>port>tdm>e1

Description This command specifies the E1 framing to be used with the associated channel.

Default **g704**

Parameters **g704 —** Configure the E1 port for G.704 framing.

no-crc-g70 — Configures the E1 for G.704 with no CRC4.

e1-unframed — Specifies E1 unframed (G.703) mode for E1 interfaces. This parameter also allows the configuration of an unstructured E1 channel on an ASAP or CES MDA. In G.704, timeslot 0 is used to carry timing information by a service provider, thus, only 31 slots are made available to the end user. In G.703, all 32 time slots are available to the end user. Timing is provided by the end user. When an e1-unframed channel is shutdown, it sends the AIS pattern to the far-end E1 which does not react. The operational status remains up and no alarms are generated while the near-end (shutdown) is operationally down. This is normal behavior since the G.703 option does not have framing. G.703 framing is only applicable for FR, PPP, and CHDLC and CEM encapsulations.

idle-payload-fill

Syntax **idle-payload-fill** {**all-ones**}
idle-payload-fill 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 when the circuit emulation service is not operational or temporarily experiences under-run conditions. This command is only valid for cesopsn and cesopsn-cas circuit emulation services. It is blocked with a warning for unstructured (satop) circuit emulation services.

Default all-ones

Parameters **all-ones —** Defines the 8 bit value to be transmitted as 11111111.

pattern — Transmits a user-defined pattern.

idle-signal-fill

Syntax **idle-signal-fill** {**all-ones**}
idle-signal-fill 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 when the circuit emulation service is not operational or temporarily experiences under-run conditions. This command is only valid for cesopsn-cas circuit emulation services. It is blocked with a warning for unstructured (satop) and basic cesopsn circuit emulation services.

Default all-ones

Parameters **all-ones —** Defines the 8 bit value to be transmitted as 11111111.

pattern — Transmits a user-defined pattern.

threshold

Syntax **threshold** {**ber-sd | ber-sf**} **rate** {**1 | 5 | 10 | 50 | 100**}
no threshold {**ber-sd | ber-sf**}

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command configures the line signal degradation bit error rate (BER) and line signal failure thresholds.

Line signal (b2) bit interleaved parity error rates are measured and when they cross either the degradation or failure thresholds alarms are raised (see the report-alarm line & section command), furthermore 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 rate 5
threshold ber-sf rate 50

Parameters **ber-sd —** Specifies the BER that specifies signal degradation.

ber-sf — Specifies the BER that specifies signal failure.

rate — Specifies the number of errors, in millions.

ATM Interface Commands

atm

Syntax **atm**

Context config>port>sonet-sdh>path
config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e3
config>port>tdm>e1>channel-group

Description This command enables the context to configure ATM interface properties.

cell-format

Syntax **cell-format** *cell-format*

Context config>port>tdm>ds1>channel-group>atm
config>port>tdm>ds3>atm
config>port>tdm>e3>atm
config>port>tdm>e1>channel-group>atm

Description This command configures the ATM cell format.

Parameters **uni —** Specifies the user-to-network interface (UNI) cell format.

nni — Specifies the network-to-network interface (NNI) cell format.

mapping

Syntax **mapping** *mapping*

Context config>port>tdm>ds3>atm

Description This command configures the ATM cell mapping for DS3 channels. The mapping value specifies the cell mapping that is to be used on this ATM interface.

Default direct cell mapping

Parameters *mapping* — Specifies the cell mapping that is to be used on this ATM interface.

Values **direct** — Specifies direct cell mapping.
plcp — Specifies PLCP cell maping.

min-vp-vpi

Syntax **min-vp-vpi** *value*

Context config>port>sonet-sdh>path>atm
config>port>tdm>ds1>channel-group>atm
config>port>tdm>ds3>atm
config>port>tdm>e1>channel-group>atm
config>port>tdm>e3>atm

Description This command sets the minimum allowable virtual path identifier (VPI) value that can be used on the ATM interface for a VPC.

Parameters *value* — Specify the minimum allowable VPI value that can be used on the ATM interface for a VPC.

Values 0 — 4095 (NNI)
0 — 255 (UNI)

Default 0

ilmi

Syntax **ilmi** [*vpi/vci*]
no ilmi

Context config>port>sonet-sdh>path>atm

Description This command creates an ILMI link PVCC by default on VPI/VCI 0/16. Deleting an ILMI link deletes the PVCC. ILMI is supported only on ATM interfaces on SONET/SDH paths.

Parameters *vpi/vci* — Specifies the PVC identifier (vpi/vci).

Values vpi	0 — 4095 (NNI)
		0 — 255 (UNI)
	vci	1, 2, 5 — 65535

egress

Syntax **egress**

Context config>port>sonet-sdh>path>atm>ilmi

Description This command enables the context to configure egress traffic attributes for the ILMI link.

ingress

Syntax **ingress**

Context config>port>sonet-sdh>path>atm>ilmi

Description This command enables the context to configure ingress traffic attributes for the ILMI link.

traffic-desc

Syntax **traffic-desc** *traffic-desc-profile-id*
no traffic-desc

Context config>port>sonet-sdh>path>atm>ilmi>egress
config>port>sonet-sdh>path>atm>ilmi>ingress

Description This command associates an ATM traffic descriptor profile to an ILMI link. The default profile is atm-td-profile 1. It is recommended to change this to the traffic profile as defined in the ILMI specification.

Parameters *traffic-desc-profile-id* — Specifies an existing ATM traffic descriptor profile. Traffic descriptor profiles are configured in the **config>qos>atm-td-profile** context.

Values 1 — 1000

keep-alive

Syntax **keep-alive** [**poll-frequency** *seconds*] [**poll-count** *value*] **[test-frequency** *seconds*]
no keep-alive

Context config>port>sonet-sdh>path>atm>ilmi

Description This command configures keepalive parameters to monitor ILMI link connectivity.

The **no** form of this command resets the devault values on an ILMI link.

Last Config Change:	03/29/2007 20:35:19	Poll Count:	4
Poll Freq:	5	Test Freq:	1

Parameters **poll-frequency** *seconds* **—** Specifies the amount of time, in seconds, between successive transmissions of ILMI messages on this interface for the purpose of detecting the establishment of ILMI connectivity.

Values 1 — 255

poll-count *value* **—** Specifies the number of consecutive polls on this interface for which no ILMI response message is received before ILMI connectivity is declared lost.

Values 1 — 255

test-frequency *seconds* **—** Specifies the frequency for testing for connectivity when the link is establishing before polling begins.

Values 0 — 255

protocol

Syntax **protocol** *protocol-type*
no protocol

Context config>port>sonet-sdh>path>atm>ilmi

Description This command configures the protocol.

Parameters *protocol-type* — The *protocol-type* is an enumerated integer whose value indicates the ILMI version of either 3.1 or 4.0 that is advertised by IME and also indicates the ILMI IME type of either user-side or network-side.

Values 4_0-user, 4_0-network. 3_1-user, 3_1-network

Frame Relay Commands

frame-relay

Syntax **frame-relay**

Context config>port>sonet-sdh>path
config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command allows access to the context to configure the Frame Relay Local Management Interface (LMI) operational parameters for a SONET/SDH PoS link, a DS0 channel group, or a DS3/E3 port or channel.

The port's **mode** must be set to **access** in **config>port>sonet-sdh>path>mode access** context.

The port's encapsulation type must be set to **frame-relay** in the **config>port>sonet-sdh>path>encap-type frame-relay** context.

The **no** form of this command removes the Frame Relay LMI operational parameters.

lmi-type

Syntax **lmi-type** {**ansi** | **itu** | **none** | **rev1**}
no lmi-type

Context config>port>sonet-sdh>path>frame-relay
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

Description This command configures the Local Management Interface (LMI) type for Frame Relay interfaces. LMIs are sets of enhancements to the basic Frame Relay specification.

The **no** form of this command changes the LMI type back to the default value.

Default **itu**

Parameters **ansi** — Use ANSI T1.617 Annex D.

itu — Use ITU-T Q933 Annex A.

none — Disable Frame Relay LMI on the given port/channel.

rev1 — Use the Rev 1 version of the ANSI T1.617 Annex D.

mode

Syntax **mode** {**dce | dte | bidir**}

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the Frame Relay interface into 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 dte

Parameters **dce —** Enables the DCE mode.

dte — Enables the DTE mode.

bidir — Enables the bidirectional mode for LMI types ANSI and ITU.

n391dte

Syntax **n391dte** *intervals*
no n391dte

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the DTE full status polling interval for the Frame Relay Local Management Interface (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

Parameters *intervals* — 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 — 255

n392dce

Syntax **n392dce** *threshold*
no n392dce

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the DCE error threshold for the Frame Relay Local Management Interface (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* — Specifies the number of errors that will place the channel in an operationally down state.

Values 1 — 10

n392dte

Syntax **n392dte** *count*
no n392dte

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the DTE error threshold for the Frame Relay Local Management Interface (LMI).

The count 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 *count* — Specifies the number of errors that will place the path or channel in an operationally down state.

Values 1 — 10

n393dce

Syntax **n393dce** *count*
no n393dce

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the DCE monitored event count for the Frame Relay Local Management Interface (LMI).

The **no** form of this command returns the **n393dce** counter to the default value.

Default 4

Parameters *count* — Specify the diagnostic window used to verify link integrity on the DCE interface.

Values 1 — 10

n393dte

Syntax **n393dte** *number*
no n393dte

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the DTE monitored event count for the Frame Relay Local Management Interface (LMI).

The **no** form of this command returns the **n393dte** counter to the default value.

Default 4

Parameters *number* — Specify the diagnostic window used to verify link integrity on the DTE interface.

Values 1 — 10

t391dte

Syntax **t391dte** *seconds*
no t391dte

Context config>port>sonet-sdh>path>frame-relay

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

Description This command sets the DTE keepalive timer for the Frame Relay Local Management Interface (LMI).

This number specifies the period at which the DTE sends out a keepalive response request to the DCE and updates status depending on the DTE error threshold value.

The **no** form of this command returns the **t391dte** keepalive timer to the default value.

Default 10

Parameters *seconds* — Specifies the interval in seconds between status inquiries issued by the DTE.

Values 5 — 30

t392dce

Syntax **t392dce** *seconds*
no t392dce

Context config>port>sonet-sdh>path>frame-relay
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

Description This command sets the DCE keepalive timer for the Frame Relay Local Management Interface (LMI).

This number specifies the period at which the DCE checks for keepalive responses from the DTE and updates status depending on the DCE error threshold value.

The **no** form of this command returns the **t392dce** keepalive timer to the default value.

Default 15

Parameters *seconds* — Specify the expected interval in seconds between status inquiries issued by the DTE equipment.

Values 5 — 30

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 MDA. This context cannot be accessed on non-channelized MDAs.

TDM is a mechanism to divide the bandwidth of a stream into separate channels or time slots by assigning each stream a different time slot in a set. TDM repeatedly transmits a fixed sequence of time slots over a single transmission channel. Each individual data stream is reassembled at the receiving end based on the timing.

Default None

ds1

Syntax [**no**] **ds1** *ds1-id*

Context config>port>tdm

Description This command enables the context to configure digital signal level 1 (DS1) frame parameters. The T-Carrier system was the first successful system that supported digitized voice transmission. The original transmission rate (1.544 Mbps) in the T1 (DS1) line is commonly used by Internet service providers (ISPs) to connect to the Internet.

North America uses the T-Carrier system while Europe uses the E-Carrier system of transmission, using multiples of the DS system. Digital signals are carried inside the carrier systems.

T1 transmits DS1-formatted data at 1.544 Mbps through the network. The corresponding European carrier is E1 with a data rate of 2.048 Mbps. E1 and T1 (DS1) can be interconnected for international use.

The **no** form of this command disables DS1 capabilities.

Default None

Parameters *ds1-id* — Identifies the DS1 channel being created.

Values DS1: 1 — 28

ds3

Syntax [**no**] **ds3** [*sonet-sdh-index*]

Context config>port>tdm

Description This command enables the context to configure DS3 parameters. DS3 lines provide a speed of 44.736 Mbps and is also frequently used by service providers. DS3 lines carry 28 DS1 signals and a 44.736 Mbps data rate.

A DS3 connection typically supports data rates of about 43 Mbps. A T-3 line actually consists of 672 individual channels, each supporting 64 Kbps. T-3 lines are used mainly by Service Providers to connect to the Internet backbone and for the backbone itself.

Depending on the MDA type, the DS3 parameters must be disabled if clear channel is enabled by default (for example, on the m12-ds3 MDA). Clear channel is a channel that uses out-of-band signaling, not in-band signaling, so the channel's entire bit rate is available. Channelization must be explicitly specified. Note that if DS3 nodes are provisioned on a channelized SONET/SDH MDA you must provision the parent STS-1 SONET/STM0 SDH path first.

North America uses the T-Carrier system while Europe uses the E-Carrier system of transmission, using multiples of the DS system. Digital signals are carried inside the carrier systems.

The **no** form of this command disables DS3 capabilities.

Default none

Parameters *sonet-sdh-index* — Specifies the components making up the specified SONET/SDH Path. Depending on the type of SONET/SDH port the *sonet-sdh-index* must specify more path indexes to specify the payload location of the path. The *sonet-sdh-index* differs for SONET and SDH ports.

e1

Syntax **e1** [*e1-id*]

Context config>port>tdm

Description This command enables the context to configure E1 parameters. E1 is a basic time division multiplexing scheme used to carry digital circuits. It is also a standard WAN digital communication format designed to operate over copper facilities at a rate of 2.048 Mbps.

North America uses the T-Carrier system while Europe uses the E-Carrier system of transmission, using multiples of the DS system. Digital signals are carried inside the carrier systems.

The **no** form of this command disables E1 capabilities.

Default none

Parameters *e1-id* — Specifies the E1 channel being created.

Values E1: 1 — 21

e3

Syntax **e3** *sonet-sdh-index*

Context config>port>tdm

Description This command enables the context to configure E3 parameters. E3 lines provide a speed of 44.736 Mbps and is also frequently used by service providers. E3 lines carry 16 E1 signals with a data rate of 34.368 Mbps.

A E3 connection typically supports data rates of about 43 Mbps. A E3 line actually consists of 672 individual channels, each supporting 64 Kbps. E3 lines are used mainly by Service Providers to connect to the Internet backbone and for the backbone itself.

Depending on the MDA type, the E3 parameters must be disabled if clear channel is enabled by default (for example, on the m12-ds3e3 MDA). Clear channel is a channel that uses out-of-band signaling, not in-band signaling, so the channel's entire bit rate is available. Channelization must be explicitly specified. Note that if E3 nodes are provisioned on the channelized SONET/SDH MDA you must provision the parent STS-1 SONET/STM0 SDH path first.

North America uses the T-Carrier system while Europe uses the E-Carrier system of transmission, using multiples of the DS system. Digital signals are carried inside the carrier systems.

Note: On the E3 CMA, bit stuffing is not supported in G.751 framing mode. All of the 12 justification service bits and the 4 justification bits contain valid data on the transmitted signal. Incoming bitstreams should contain valid data in the 12 justification service bits and 4 justification bits, otherwise the link will not function.

The **no** form of this command disables E3 capabilities.

Default none

Parameters *sonet-sdh-index* — The index based on channelization.

bert

Syntax **bert** {**2e3**|**2e9**|**2e11**|**2e15**|**2e20**|**2e20q**|**2e23**|**ones**|**zeros**|**alternating**} **duration** *duration*
no bert

Context config>port>tdm>ds1
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e3

Description This command initiates or restarts a Bit Error Rate Test (BERT) on the associated DS1/E1 or DS3/E3 circuit.

The associated DS1, E1, DS3, or E3 must be in a shutdown (admin down) state to initiate this test.

The no form of the command terminates the BERT test if it has not yet completed.

NOTE: This command is not saved in the router configuration between boots.

Default 2e3

Parameters *duration* — Sets the duration for the BERT test.

Values Up to 24 hours, in seconds or hh:mm:ss format

ones — Sends an all ones pattern.

zeros — Sends an all zeroes pattern.

alternating — Sends an alternating ones and zeros pattern.

2e3 — Sends a pseudo-random 2^3 -1 pattern

2e9 — Sends a pseudo-random 2^9 -1 pattern

2e15 — Sends a pseudo-random 2^15 -1 pattern.

2e20 — Sends a pseudo-random 2^20 -1 pattern.

bit-error-insertion

Syntax **bit-error-insertion** *rate*
no bit-error-insertion

Context config>port>tdm>ds1
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e3

Description This command inserts bit errors into a running BERT test. The number of errors inserted corresponds to 10^(-rate). A rate of 0 will cause 1 error in every bit transmitted. A rate of 7 will cause an error rate of 10^(-7), or 1 error in every one billion bits transmitted.

The no command disables the insertion of bit errors into the bit error rate test stream.

NOTE: This command is not saved in the router configuration between boots.

Default no bit-error-insertion

Parameters *rate* — Specifies the bit error rate, expressed as an integer.

Values 2 — 7

buildout

Syntax **buildout** {**long** | **short**}

Context config>port>tdm

Description This command specifies line buildout (cable length) for physical DS1/DS3 ports.

Default short

Parameters **long** — Sets the line buildout for length runs up to 450 feet.

short — Sets the line buildout for length runs up to 225 feet.

lbo

Syntax **lbo** [**0dB | -7.5dB | -15.0dB | -22.5dB**]

Context config>port>tdm

Description This command applies only to a DS1 port configured with a 'long' buildout (see the **buildout** command).
tmnxDS1PortDbLoss configures the number of decibels the transmission signal decreases over the line.

For 'short' buildout the following values are valid:

lboNotApplicable — Not applicable

For 'long' buildout the following values are valid:

lbo0dB	For 0 dB
lboNeg7p5dB	For -7.5 dB
lboNeg15p0dB	For -15.0 dB
lboNeg22p5dB	For -22.5 dB

The default for 'short' build out is 'NotApplicable' while the default for 'long' buildout is 'lbo0dB'.

length

Syntax **length** {**133|266|399|533|655**}

Context config>port>tdm

Description This command applies only to a DS1 port configured with a 'short' buildout. The **length** command configures the length of the line (in feet). For line lengths longer than 655 feet, configure the DS1 port buildout as 'long'.

For 'long' buildout the following values are valid:

NotApplicable — Not applicable

For 'short' buildout the following values are valid:

0 — 133	For line length from 0 to 133 feet
134 — 266	For line length from 134 to 266 feet
267 — 399	For line length from 267 to 399 feet

400 — 533	For line length from 400 to 533 feet
534 — 655	For line length from 534 to 655 feet

The default for 'long' buildout is 'NotApplicable' while the default for 'short' buildout is '0 — 133'.

channel-group

Syntax [**no**] **channel-group** *channel-group-id*

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command creates DS0 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/E1 channel.

Default None

Description *channel-group-id* — Identifies the channel-group ID number.

Values DS1: 1 — 24
E1: 1 — 32

cisco-hdlc

Syntax **cisco-hdlc**

Context config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command enables the context to configure Cisco HDLC parameters. Cisco HDLC is an encapsulation protocol that governs information transfer. It 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. It also allows routers to discover IP addresses of neighbors by exchanging Serial Link Address Resolution Protocol (SLARP) address-request and address-response messages with peer network.

Only IES SAPs (including SAPs in VPRN service) can provision a Cisco-HDLC-capable configuration.

clock-source

Syntax **clock-source** {**loop-timed | node-timed | adaptive | differential**}

Context config>port>tdm>ds1
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e3

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.

For adaptive-timed or differential-timed options to be selected the CES CMA/MDA clock-mode must be set for adaptive or differential respectively.

Default loop-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 — The clock is adaptively recovered from the rate at which data is received and not from the physical layer.

differential — The clock is recovered from differential RTP timestamp header.

clock-source

Syntax **clock-source** {**loop-timed | node-timed**}

Context config>port>tdm>ds3
config>port>tdm>e3

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.

For adaptive-timed or differential-timed options to be selected the CES CMA/MDA clock-mode must be set for adaptive or differential respectively.

Default loop-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.

crc

Syntax **crc** {**16** | **32**}

Context config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command configures the precision of the cyclic redundancy check (CRC).

Default 16 for non-ATM channel groups configured under DS1, E1 and for non-ATM E3 and DS3 channel/ports.

32 for ATM channel-groups configured under DS1 and E1, and for ATM E3 and DS3 channels/ports. The default cannot be changed.

Parameters **16** — Use 16 bit checksum for the associated port/channel.

32 — Use 32 bit checksum for the associated port/channel.

down-count

Syntax **down-count** *down-coun***t**
no down-count

Context config>port>sonet-sdh>path>cisco-hdlc
config>port>tdm>ds1>channel-group>cisco-hdlc
config>port>tdm>ds3>cisco-hdlc
config>port>tdm>e1>channel-group>cisco-hdlc
config>port>tdm>e3>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. It is expected that the nodes at the two endpoints of the cHDLC link are provisioned with the same values.

Default 3

down-count — Specifies the number of keep alive intervals that must pass without receiving a keep alive packet before the link is declared down.

Values 3 — 16

encap-type

Syntax **encap-type** {**atm** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** **|cisco-hdlc** | **cem**}

Context config>port>tdm>ds1>channel-group
config>port>tdm>ds3

config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command configures the encapsulation method used to on the specified port, path, or channel. This parameter can be set on both access and network ports.

When the **encap-type** is set to ATM the CRC, timeslots, scrambling (if applicable), and idle-cycle-flags are set to ATM defaults respectively. When the encap-type is changed from ATM, those parameters are set to their non-ATM defaults.

When the **encap-type** is ATM, ATM sub-layer verification (GR-1248-CORE, *Generic Requirements for Operations of ATM Network Elements (NEs)*) is automatically enabled. When ATM PLCP cell mapping is used, the results of this verification include:

- PLCP Several Errored Framing Seconds
- PLCP Alarm State
- PLCP Unavailable Seconds Counter

When ATM direct cell mapping is used, 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*.
- Loss of Cell Delineation 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 will be 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. Also, a P-RDI is sent to indicate the defect to the remote end.

The **no** form of this command restores the default.

Default **bcp-null**

atm — Specifies the encapsulation on the port is ATM.

bcp-null — When selected, this keyword specifies that only a single service is configured on this channel and IEEE 802.1Q tags are not used as a service delimiter. Any IEEE 802.1Q tags encountered are regarded as part of the customer payload and transparently forwarded. When bcp-null encapsulation is specified, the PPP Bridge Control Protocol (BCP) is activated and all packets on this access port will be encapsulated in accordance with the BCP protocol.

bcp-dot1q — When selected, this keyword specifies that ingress frames carry IEEE 802.1Q tags and the tags are used as service delimiter. Any untagged packets are silently discarded with exception of protocol specific packets. When bcp-dot1q encapsulation is specified, the PPP Bridge Control Protocol (BCP) is activated and all packets on this access port will be encapsulated in accordance with the BCP protocol.

ipcp — Ingress frames are encapsulated according to the IP Control Protocol. When ipcp encapsulation is specified, the PPP IP Control Protocol will be activated and only packets that comply with IPCP encapsulation are processed; others are silently discarded.

ppp-auto — (Network mode) Enables PPP on the associated port/channel. The activation of ipcp and mplscp is automatically enabled depending on the protocol configuration. This encap type is only valid on ports/channels in network mode.

frame-relay — Enables frame relay on the associated port/channel.

wan-mirror — The port is used for mirroring of frame-relay and POS ports. On these ports, no link management protocol will run.

cisco-hdlc — Monitors line status on a serial interface by exchanging keepalive request messages with peer network devices.

cem — On circuit emulation CMAs and MDAs, only the **cem** encap-type is supported. All other values are blocked with an appropriate warning. The **cem** encap-type is not supported on other CMAs and MDAs and are blocked with an appropriate warning.

feac-loop-respond

Syntax [**no**] **feac-loop-respond**

Context config>port>tdm>ds3
config>port>tdm>e3

Description This command enables the associated DS3 interface to respond to remote loop signals.

The DS3 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 loopbacks at the far-end terminal from the local terminal are initiated.

The **no** form of this command prevents the associated DS3/E3 interface from responding to remote loop signals.

Default no feac-loop-respond

framing (DS1)

Syntax **framing** {**esf | sf | ds1-unframed**}

Context config>port>>tdm>ds1

Description This command specifies the DS1 framing to be used with the associated channel.

Default DS1: esf

Parameters **esf** — Configures the DS1 port for extended super frame framing.

sf — Configures the DS1 port for super frame framing.

ds1-unframed — Specifies ds-1 unframed (G.703) mode for DS-1 interfaces.

This parameter allows the configuration of an unstructured DS-1 channel on a CES MDA. In G.704, timeslot 0 is used to carry timing information by a service provider, thus, only 31 slots are made available to the end user. In G.703, all 32 time slots are available to the end user. Timing is provided by the end user. When an e1-unframed channel is shutdown, it sends the AIS pattern to the far-end DS-1 which does not react. The operational status remains up and no alarms are generated while the near-end (shutdown) is operationally down. This is normal behavior since the G.703 option does not have framing. G.703 framing is only applicable for FR, PPP, and C-HDLC encapsulations.

framing (DS3)

Syntax **framing** {**c-bit | m23**}

Context config>port>tdm>ds3

Description This command specifies DS3 framing for the associated DS3 port or channel.

Default **c-bit**

Parameters **c-bit —** Configures the DS3 port/channels for C-Bit framing.

m23 — Configures the DS3 port/channel for M23 framing.

framing (E3)

Syntax **framing** {**g751** | **g832**}

Context config>port>tdm>e3

Description This command specifies E3 framing for the associated E3 port or channel.

Default E3 non-ATM: g751 and cannot be changed.
E3 ATM: g832 and cannot be changed.

Parameters **g751 —** Configures the E3 port/channel for g751 framing.

g832 — Configures the E3 port/channel for g832 framing.

idle-cycle-flag

Syntax **idle-cycle-flag** {**flags** | **ones**}

Context config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e1>channel-group
config>port>tdm>e3

Description This command configures the value that the HDLC TDM DS-0, E1, E3, DS1, or DS3 interface transmits during idle cycles. For ATM ports/channels/channel-groups, the configuration does not apply and only the no form is accepted.

The **no** form of this command reverts the idle cycle flag to the default value.

Default flags (0x7E)

no flags (ATM)

Parameters **flags —** Specifies that 0x7E is used as the idle cycle flag.

ones — Specifies that 0xFF is used as the idle cycle flag.

insert-single-bit-error

Syntax **insert-single-bit-error**

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command inserts a single bit error for the BERT test.

Default no bit-error-insertion

invert-data

Syntax [**no**] **invert-data**

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command causes all data bits to be inverted, to guarantee ones density. Typically used with AMI line encoding.

Default no invert-data

loopback

Syntax **loopback** {**line** | **internal** | **fdl-ansi** | **fdl-bellcore** | **payload-ansi** | **inband-ansi** | **inband-bellcore**}
no loopback

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command puts the specified port or channel into a loopback mode.

The corresponding port or channel must be in a shutdown state in order for the loopback mode to be enabled. The upper level port or channel or parallel channels should not be affected by the loopback mode.

NOTE: This command is not saved in the router configuration between boots.

The **no** form of this command disables the specified type of loopback.

Default no loopback

Parameters **line** — Places the associated port or channel into a line loopback mode. A line loopback loops frames received on the corresponding port or channels back to the remote router.

internal — Places the associated port or channel into a internal loopback mode. A internal loopback loops the frames from the local router back at the framer.

fdl-ansi — Requests FDL line loopback according to ANSI T1.403.

fdl-bellcore — Requests FDL line loopback according to Bellcore TR-TSY-000312.

payload-ansi — Requests payload loopback using ANSI signaling.

inband-ansi — Requests inband line loopback according to ANSI T1.403.

inband-bellcore — Requests inband line loopback according to Bellcore signaling.

loopback

Syntax **loopback** {**line** | **internal** | **remote**}
no loopback

Context config>port>tdm>e3
config>port>tdm>ds3

Description This command puts the specified port or channel into a loopback mode.

The corresponding port or channel must be in a shutdown state in order for the loopback mode to be enabled. The upper level port or channel or parallel channels should not be affected by the loopback mode.

NOTE: This command is not saved in the router configuration between boots.

The **no** form of this command disables the specified type of loopback.

Default no loopback

Parameters **line** — Places the associated port or channel into a line loopback mode. A line loopback loops frames received on the corresponding port or channels back to the remote router.

internal — Places the associated port or channel into a internal loopback mode. A internal loopback loops the frames from the local router back at the framer.

remote — Sends a signal to the remote device to provide a line loopback.

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/E3.

This command is only applicable if the DS3/E3 is using C-bit framing (see the **framing e1** command).

The **no** form of this command removes the MDL string association and stops the transmission of any IDs.

Default no mdl

Parameters *mdl-string* — specify an MDL message up to 38 characters long on a DS3.

eic — Specifies the equipment ID code up to 10 characters long.

lic — Specifies the location ID code up to 11 characters long.

fic — Specifies the 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.

mdl-transmit

Syntax **mdl-transmit** {**path** | **idle-signal** | **test-signal**}
no mdl-transmit [**path** | **idle-signal** | **test-signal**]

Context config>port>tdm>ds3
config>port>tdm>e3

Description This command enables the transmission of an MDL message on a DS3/E3 over channelized interface.

The **no** form of this command disables transmission of the specified message or all messages.

Default no mdl-transmit

Parameters **path** — Specify the MDL path message.

idle-signal — Specify the MDL idle signal message.

test-signal — Specify the MDL test signal message.

remote-loop-respond

Syntax [**no**] **remote-loop-respond**

Context config>port>tdm>ds1

Description When enabled, the channel responds to requests for remote loopbacks.

Default no remote-loop-respond — The port will not respond.

report-alarm

Syntax [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command enables logging of DS1/DS3 or E1/E3 alarms for DS1/DS3 or E1/E3 ports or channels.

The **no** form of this command disables logging of the specified alarms.

Parameters **ais —** Reports alarm indication signal errors. When configured, **ais** alarms are not raised and cleared.

Default **ais** alarms are issued

los — Reports loss of signal errors. When configured, **los** traps are not raised and cleared.

Default **los** traps are issued.

oof — Reports out-of-frame errors. When configured, **oof** alarms are not raised and cleared.

Default **oof** alarms are not issued.

rai — Reports resource availability indicator events. When configured, **rai** events are not raised and cleared.

Default **rai** alarms are not issued

looped — Reports looped packets errors.

Default **looped** alarms are not issued

lof — Reports loss of frame errors. When configured, **lof** traps are not raised and cleared

Default **lof** traps are issued

signal-mode

Syntax **signal-mode** {**cas**}

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command activates the signal mode on the channel. When enabled, it uses routing information to direct the payload of voice or data to its destination

Parameters **cas —** Specifies channel associated signaling.

speed

Syntax **speed** {**56** | **64**}

Context config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

Description This command sets the speed of the DS0 channels used in the associated channel-group.

If the higher order channel is a channelized DS3 then the channels must be DS1s.

If the higher order channel is a channelized E3 then the channels must be E1s.

Default 64

Parameters **56 —** Specifies that 56k byte (7-bits per byte) encoding will be used for the associated DS0 channels.

64 — Specifies that 64k byte (8-bits per byte) encoding will be used for the associated DS0 channels.

subrate

Syntax **subrate** {**digital-link**} *rate-step*
no subrate

Context config>port>tdm>ds3

Description This command configures the channel service unit (CSU) compatibility mode to interoperate with existing DS3 subrate standards.

This configuration applies only for non-channelized DS3s.

The **no** form of this command remove the subrate functionality.

Default no subrate

Parameters *digital-link* — Enables the Digital-Link (Quick Eagle) CSU compatibility mode.

rate-step — Specify the subrate value for the associated DS3.

Values 1 — 147

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/E1 channel-group. The timeslots are defaulted as defined below when encap-type is set to/from atm. ATM channel groups do not allow timeslots to change.

The **no** form of this command removes DS0 timeslots from a channel group.

Default no timeslots — Non ATM channel groups.
1-24 — Channel groups configured under DS1 with encap set to ATM.
2-16,18-32 — Channel groups configured under E1 with encap set to ATM.

Parameters *timeslots* — Specifies the timeslot(s) 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 — 24 for DS1 interfaces (the full range is auto-configured for ATM channel groups and cannot be changed).
2 — 32 for E1 interfaces (the 2— 16,18 — 32 ranges are auto-configured for ATM channel groups and cannot be changed).

LAG Commands

lag

Syntax [**no**] **lag** [*lag-id*]

Context config

Description This command creates the context for configuring Link Aggregation Group (LAG) attributes.

A LAG can be used to group up to eight ports into one logical link. The aggregation of multiple physical links allows for load sharing and offers seamless redundancy. If one of the links fails, traffic will be redistributed over the remaining links. Up to 8 links can be supported in a single LAG, up to 64 LAGs can be configured on a node.

NOTE: All ports in a LAG group must have autonegotiation set to Limited or Disabled.

There are three possible settings for autonegotiation:

- "on" or enabled with full port capabilities advertised
- "off" or disabled where there is no autonegotiation advertisements
- "limited" where a single speed/duplex is advertised.

When autonegotiation is enabled on a port, the link attempts to automatically negotiate the link speed and duplex parameters. If autonegotiation is enabled, the configured duplex and speed parameters are ignored.

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. Note that disabling autonegotiation on gigabit ports is not allowed as the IEEE 802.3 specification for gigabit Ethernet requires autonegotiation be enabled for far end fault indication.

If the **autonegotiate limited** keyword option is specified the port will autonegotate but will only advertise a specific speed and duplex. The speed and duplex advertised are the **speed** and **duplex** settings configured for the port. One use for limited mode is for multispeed gigabit ports to force gigabit operation while keeping autonegotiation is enabled for compliance with IEEE 801.3.

7710 SR OS requires that autonegotiation be disabled or limited for ports in a Link Aggregation Group to guarantee a specific port speed.

The **no** form of this command deletes the LAG from the configuration. Deleting a LAG can only be performed while the LAG is administratively shut down. Any dependencies such as IP-Interfaces configurations must be removed from the configuration before issuing the **no lag** command.

Default No LAGs are defined.

Parameters *lag-id* — The LAG identifier, expressed as a decimal integer.

Values 1 — 64

access

Syntax **access**

Context config>lag

Description This command enables the context to configure access parameters.

adapt-qos

Syntax **adapt-qos** *type*

Context config>lag>access

Description This command specifies how the LAG SAP queue and virtual scheduler buffering and rate parameters are adapted over multiple active MDAs. This command applies only to access LAGs.

Default distribute

Parameters *type* — Specify the QoS adaptation type.

Values **link** — Specifies that the LAG will create the SAP queues and virtual schedulers with the actual parameters on each MDA.
distribute — Specifies that each MDA will receive a fraction of the SAP and scheduler parameters.

dynamic-cost

Syntax [**no**] **dynamic-cost**

Context config>lag *lag-id*

Description This command enables OSPF costing of a Link Aggregation Group (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, then 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 is provided that the number of links that are up exceeds the configured LAG threshold value at which time the configured threshold action determines if, and at what cost, this LAG will be advertised.

For example:

> Assume 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 then the cost would automatically be adjusted to 33.

If dynamic cost is not configured and OSPF autocost is configured, then costing is applied based on the total number of links configured. This cost will remain static provided the number of links that are up exceeds the configured LAG threshold value at which time the configured threshold action determines if and at what cost this LAG will be advertised.

If dynamic-cost is configured and OSPF autocost is not configured, the cost is determined by the cost configured on the OSPF metric provided the number of links available exceeds the configured LAG threshold value at which time the configured threshold action determines if this LAG will be advertised.

If neither dynamic-cost nor OSPF autocost are configured, the cost advertised is determined by the cost configured on the OSPF metric provided the number of links available exceeds the configured LAG threshold value at which time the configured threshold action determines if 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**}
no encap-type

Context config>lag

Description This command configures the encapsulation method used to distinguish customer traffic on a LAG. The encapsulation type is configurable on a LAG port. The LAG port and the port member encapsulation types must match when adding a port member.

If the encapsulation type of the LAG port is changed, the encapsulation type on all the port members will also change. The encapsulation type can be changed on the LAG port only if there is no interface associated with it. If the MTU is set to a non default value, it will be reset to the default value when the encap type is changed.

The **no** form of this command restores the default.

Default **null** — All traffic on the port belongs to a single service or VLAN.

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 — Specifies qinq encapsulation.

hold-time

Syntax **hold-time down** *hold-down-time*
no hold-time

Context config>lag

Description This command specifies the timer, in tenths of seconds, which controls the delay between detecting that a LAG is down (all active ports are down) and reporting it to the higher levels.

A non-zero value can be configured, for example, when active/standby signalling is used in a 1:1 fashion to avoid informing higher levels during the small time interval between detecting that the LAG is down and the time needed to activate the standby link.

Default 0

Parameters **down** *hold-down-time* **—** Specifies the hold-time for event reporting

Values 0 — 2000

lacp

Syntax **lacp** [*mode*] [**administrative-key** *admin-key*]
no lacp

Context config>lag

Description This command specifies the LACP mode for aggregated Ethernet interfaces only. This command enables the LACP protocol. Per the IEEE 802.3ad standard, the Link Aggregation Control Protocol (LACP) provides a standardized means for exchanging information between Partner Systems on a link to allow their Link Aggregation Control instances to reach agreement on the identity of the Link Aggregation Group to which the link belongs, move the link to that Link Aggregation Group, and enable its transmission and reception functions in an orderly manner. LACP can be enabled on a maximum of 256 ports.

Default no lacp

Parameters *mode* — Specifies the mode in which LACP will operate.

Values **passive** — Starts transmitting LACP packets only after receiving packets.
active — Initiates the transmission of LACP packets.

administrative-key *admin-key* **—** Specifies an administrative key value to identify the channel 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 — 65535

lacp-xmit-interval

Syntax **lacp-xmit-interval** {**slow | fast**}

Context config>lag

Description This command sepcifies the interval signaled to the peer and tells the peer at which rate it should transmit.

Default fast

Parameters **slow —** Transmits packets every 30 seconds.

fast — Transmits packets every second.

lacp-xmit-stdby

Syntax [**no**] **lacp-xmit-stdby**

Context config>lag

Description This command enables LACP message transmission on standby links.

The **no** form of this command disables LACP message transmission. This command should be disabled for compatibility when using active/standby groups. This forces a timeout of the standby links by the peer. Use the **no** form if the peer does not implement the correct behavior regarding the lacp sync bit.

Default lacp-xmit-stdby

mode

Syntax **mode** {**access** | **network**}
no mode

Context config>lag

Description This command configures the mode of the Link Aggregation Group (LAG).

Parameters **access —** Configures the mode as access for the LAG.

network — Configures the mode as network for the LAG.

port

Syntax **port** *port-id* [*port-id …*up to 8 total] [**priority** *priority*] [**subgroup** *sub-group-id*]
no port *port-id* [*port-id …*up to 8 total]

Context config>lag *lag-id*

Description This command adds ports to a Link Aggregation Group (LAG).

The port configuration of the first port added to the LAG is used as a basis to compare to subsequently added ports. If a discrepancy is found with a newly added port, that port will be not added to the LAG.

Up to eight (space separated) ports can be added or removed from the LAG link assuming the maximum of 8 ports is not exceeded.

All ports, when added to a LAG, must share the same characteristics (speed, duplex, etc.). An error message will be displayed when adding ports that do not share the same characteristics. Hold-timers must be 0. Ports that are part of a LAG must be configured with autonegotiate limited or disabled.

The **no** form of this command removes ports from the LAG.

Default No ports are defined as members of a LAG.

Parameters *port-id* — The port ID configured or displayed in the *slot/mda/port* format.

priority *priority* — Port priority used by LACP. The port priority is also used to determine the primary port. The port with the highest priority is the primary port. In the event of a tie, the smallest port ID becomes the primary port.

Values 1 — 65535

subgroup *sub-group-id* **—** This parameter identifies a LAG subgroup. When using subgroups in a LAG, they should only be configured on one side of the LAG, not both. Only having one side perform the active/standby selection will guarantee a consistent selection and fast convergence. The active/standby selection will be signalled through LACP to the other side. The hold time should be configured when using subgroups to prevent the LAG going down when switching between active and standby links in case no links are usable for a short time, especially in case a subgroup consists of one member.

Values 1 — 8 identifies a LAG subgroup.
The **auto-iom** subgroup is defined based on the CFM (all ports of the same CFM are assigned to the same subgroup).
The **auto-mda** subgroup is defined based on the MDA.

port-threshold

Syntax **port-threshold** *value* [**action** {**dynamic-cost** | **down**}
no port-threshold

Context config>lag *lag-id*

Description This command configures the behavior for the Link Aggregation Group (LAG) if the number of operational links is equal to or below a threshold level.

The **no** form of this command reverts to the default values.

Default **0 action down**

Parameters *value* — The decimal integer threshold number of operational links for the LAG at or below which the configured action will be invoked. If the number of operational links exceeds the port-threshold value, any action taken for being below the threshold value will cease.

Values 0 — 7

action {**dynamic-cost** | **down**} **—** Specifies the action to take if the number of active links in the LAG is at or below the threshold value.

When the **dynamic-cost** action is specified, then dynamic costing will be activated. As a result 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.

When the **down** action is specified, then the LAG will be brought operationally down if the number of operational links is equal to or less than the configured threshold value. The LAG will only be regarded as up once the number of operational links exceeds the configured threshold value.

port-type

Syntax **port-type** {**standard | hsmda-ports**}
no port-type

Context config>lag

Description This command specifies the type of ports allowed in this LAG.

Parameters **standard —** Allows all non-HSMDA type ports to be added to this LAG.

hsmda-ports — Limits the LAG members to be high-speed MDA (HSMDA) ports only.

selection-criteria

Syntax **selection-criteria** [**highest-count | highest-weight**] [**slave-to-partner**]
no selection-criteria

Context config>lag

Description This command specifies which selection criteria should be used to select the active sub-group.

Default highest-count

Parameters **highest-count —** Specifies sub-group with the highest number of eligible members.

highest-weight — Specifies sub-group with the highest aggregate weight.

slave-to-partner — The slave-to-partner keyword specifies that it, together with the selection criteria, should be used to select the active sub-group. An eligible member is a lag-member link which 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 or not this latter condition is taken into account.

Multi-Chassis Redundancy Commands

redundancy

Syntax **redundancy**

Context config

Description This command allows the user to perform redundancy operations.

Associated commands include the following in the **admin>redundancy** context:

force-switchover — Forces a switchover to the standby CFM card.

now — Switch to standby CFM.

NOTE: Switching to the standby displays the following message.

```
WARNING: Configuration and/or Boot options may have changed since the last save.
Are you sure you want to switchover (y/n)?
```

synchronize — Synchronizes the secondary CFM.

Values <*boot-env*|*config*> : keywords

Refer to the 7710 SR OS Basic System Configuration Guide.

synchronize

Syntax **synchronize** {**boot-env** | **config**}

Context config>redundancy

Description This command performs a synchronization of the standby CFM's images and/or config files to the active CFM. Either the **boot-env** or **config** parameter must be specified.

In the **config>redundancy** context, this command performs an automatically triggered standby CFM synchronization.

When the standby CFM takes over operation following a failure or reset of the active CFM, it is important to ensure that the active and standby CFMs have identical operational parameters. This includes the saved configuration and CFM images.
The active CFM ensures that the active configuration is maintained on the standby CFM. However, to ensure smooth operation under all circumstances, runtime images and system initialization configurations must also be automatically synchronized between the active and standby CFM.

If synchronization fails, alarms and log messages that indicate the type of error that caused the failure of the synchronization operation are generated. When the error condition ceases to exist, the alarm is cleared.

Only files stored on the router are synchronized. If a configuration file or image is stored in a location other than on a local compact flash, the file is not synchronized (for example, storing a configuration file on an FTP server).

Default enabled

Parameters **boot-env —** Synchronizes all files required for the boot process (loader, BOF, images, and configuration files).

config — Synchronize only the primary, secondary, and tertiary configuration files.

Default config

multi-chassis

Syntax **multi-chassis**

Context config>redundancy

Description This command enables the context to configure multi-chassis parameters.

peer

Syntax [**no**] **peer** *ip-address* **create**

Context config>redundancy>multi-chassis

Description Use this command to configure up to four multi-chassis redundancy peers.

Parameters *ip-address* — Specifies the IP address.

Values ipv4-address: a.b.c.d
ipv6-address: x:x:x:x:x:x:x:x (eight 16-bit pieces)
x:x:x:x:x:x:d.d.d.d
x: [0 — FFFF]H
d: [0 — 255]D

create — Keyword specifies to create the peer.

authentication-key

Syntax **authentication-key** [*authentication-key* **|** *hash-key*] [**hash | hash2**]
no authentication-key

Context config>redundancy>multi-chassis>peer

Description This command configures the authentication key used between this node and the multi-chassis peer. The authentication key can be any combination of letters or numbers.

Parameters *authentication-key* — Specifies the authentication key. Allowed values are any string up to 20 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

hash-key — The hash key. The key can be any combination of ASCII characters up to 33 (hash1-key) or 55 (hash2-key) characters in length (encrypted). If spaces are used in the string, enclose the entire string in quotation marks (“ ”).

hash — Specifies the key is entered in an encrypted form. If the hash or hash2 parameter is not used, the key is assumed to be in a non-encrypted, 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 the key is entered in a more complex encrypted form that involves more variables then the key value alone, this means that hash2 encrypted variable cannot be copied and pasted. If the hash or hash2 parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the hash or hash2 parameter specified.

mc-lag

Syntax [**no**] **mc-lag**

Context config>redundancy>multi-chassis>peer>mc-lag

Description This command enables the context to configure multi-chassis LAG operations and related parameters.

The **no** form of this command administratively disables multi-chassis LAG. MC-LAG can only be issued only when mc-lag is shutdown.

hold-on-neighbor-failure

Syntax **hold-on-neighbor-failure** *multiplier*
no hold-on-neighbor-failure

Context config>redundancy>multi-chassis>peer>mc-lag

Description This command specifies the interval that the standby node will wait for packets from the active node before assuming a redundant-neighbor node failure. This delay in switch-over operation is required to accommodate different factors influencing node failure detection rate, such as IGP convergence, or HA switch-over times and to prevent the standby node to take action prematurely.

The **no** form of this command sets this parameter to default value.

Default 3

Parameters *multiplier* — The time interval that the standby node will wait for packets from the active node before assuming a redundant-neighbor node failure.

Values 2 — 25

keep-alive-interval

Syntax **keep-alive-interval** *interval*
no keep-alive-interval

Context config>redundancy>multi-chassis>peer>mc-lag

Description This command sets the interval at which keep-alive messages are exchanged between two systems participating in MC-LAG. These keep-alive messages are used to determine remote-node failure and the interval is set in deci-seconds.

The **no** form of this command sets the interval to default value

Default 1s (10 hundreds of milliseconds means interval value of 10)

Parameters *interval* — The time interval expressed in deci-seconds

Values 5 — 500

lag

Syntax **lag** *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *lag-id*] **system-priority** *system-priority*
no lag *lag-id*

Context config>redundancy>multi-chassis>peer>mc-lag

Description This command defines a LAG which is forming a redundant-pair for MC-LAG with a LAG configured on the given peer. The same LAG group can be defined only in the scope of 1 peer.

The same **lacp-key**, **system-id**, and **system-priority** must be configured on both nodes of the redundant pair in order to MC-LAG to become operational. In order MC-LAG to become operational, all parameters (**lacp-key**, **system-id**, **system-priority**) must be configured the same on both nodes of the same redundant pair.

The partner system (the system connected to all links forming MC-LAG) will consider all ports using the same **lacp-key**, **system-id**, **system-priority** as the part of the same LAG. In order to achieve this in MC operation, both redundant-pair nodes have to be configured with the same values. In case of the mismatch, MC-LAG is kept in oper-down status.

Default none

Parameters *lag-id* — The LAG identifier, expressed as a decimal integer. Specifying the *lag-id* allows the mismatch between lag-id on redundant-pair. If no **lag-id** is specified it is assumed that neighbor system uses the same *lag-id* as a part of the given MC-LAG. If no matching MC-LAG group can be found between neighbor systems, the individual LAGs will operate as usual (no MC-LAG operation is established.).

Values 1 — 64

lacp-key ***admin-key*** **—** Specifies a 16 bit key that needs to be configured in the same manner on both sides of the MC-LAG in order for the MC-LAG to come up.

Values 1 — 65535

system-id ***system-id*** **—** Specifies a 6 byte value expressed in the same notation as MAC address

Values xx:xx:xx:xx:xx:xx - xx [00..FF]

remote-lag ***lag-id*** **—** Specifies the LAG ID on the remote system.

Values 1 — 64

system-priority ***system-priority*** **—** Specifies the system priority to be used in the context of the MC-LAG. The partner system will consider all ports using the same **lacp-key**, **system-id**, and **system-priority** as part of the same LAG.

Values 1 — 65535

source-address

Syntax **source-address** *ip-address*
no source-address

Context config>redundancy>multi-chassis>peer

Description This command specifies the source address used to communicate with the multi-chassis peer.

Parameters *ip-address* — Specifies the source address used to communicate with the multi-chassis peer.

sync

Syntax [**no**] **sync**

Context config>redundancy>multi-chassis>peer

Description This command enables the context to configure synchronization parameters.

igmp

Syntax [**no**] **igmp**

Context config>redundancy>multi-chassis>peer>sync

Description This command specifies whether IGMP protocol information should be synchronized with the multi-chassis peer.

Default no igmp

igmp-snooping

Syntax [**no**] **igmp-snooping**

Context config>redundancy>multi-chassis>peer>sync

Description This command specifies whether IGMP snooping information should be synchronized with the multi-chassis peer.

Default no igmp-snooping

mld-snooping

Syntax [**no**] **mld-snooping**

Context config>redundancy>multi-chassis>peer>sync

Description This command specifies whether MLD snooping information should be synchronized with the multi-chassis peer.

Default no mld-snooping

port

Syntax **port** [*port-id* **|** *lag-id*] [**sync-tag** *sync-tag*]
no port [*port-id* **|** *lag-id*]

Context config>redundancy>multi-chassis>peer>sync

Description This command specifies the port to be synchronized with the multi-chassis peer and a synchronization tag to be used while synchronizing this port with the multi-chassis peer.

Parameters *port-id* — Specifies the port to be synchronized with the multi-chassis peer.

lag-id — Specifies the LAG ID to be synchronized with the multi-chassis peer.

sync-tag *sync-tag* **—** Specifies a synchronization tag to be used while synchronizing this port with the multi-chassis peer.

range

Syntax **range** *encap-range* **sync-tag** *sync-tag*
no range *encap-range*

Context config>redundancy>multi-chassis>peer>sync>port

Description This command configures a range of encapsulation values.

Parameters *encap-range* — Specifies a range of encapsulation values on a port to be synchronized with a multi-chassis peer.

Values	Dot1Q	*start-vlan-end-vlan*
	QinQ	Q1.*start-vlan*-Q1.*end-vlan*

sync-tag ***sync-tag*** **—** Specifies a synchronization tag up to 32 characters in length to be used while synchronizing this encapsulation value range with the multi-chassis peer.

srrp

Syntax [**no**] **srrp**

Context config>redundancy>multi-chassis>peer>sync

Description This command specifies whether subscriber routed redundancy protocol (SRRP) information should be synchronized with the multi-chassis peer.

Default no srrp

sub-mgmt

Syntax [**no**] **sub-mgmt**

Context config>redundancy>multi-chassis>peer>sync

Description This command specifies whether subscriber management information should be synchronized with the multi-chassis peer.

Default no sub-mgmt

Multi-Chassis Ring Commands

mc-ring

Syntax [**no**] **mc-ring**

Context config>redundancy>mc>peer
config>redundancy>multi-chassis>peer>sync

Description This command enables the context to configure the multi-chassis ring parameters.

ring

Syntax **ring** *sync-tag* [**create**]
no ring *sync-tag*

Context config>redundancy>mc>peer>mcr

Description This command configures a multi-chassis ring.

Parameters *sync-tag* — Specifies a synchronization tag to be used while synchronizing this port with the multi-chassis peer.

create — Keyword used to create the multi-chassis peer ring instance. The **create** keyword requirement can be enabled/disabled in the **environment>create** context.

in-band-control-path

Syntax **in-band-control-path**

Context config>redundancy>mc>peer>mcr>ring

Description This command enables the context to configure multi-chassis ring inband control path parameters.

dst-ip

Syntax **dst-ip** *ip-address*
no dst-ip

Context config>redundancy>mc>peer>mcr>ring>in-band-control-path
config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the destination IP address used in the inband control connection. If the address is not configured, the ring cannot become operational.

Parameters *ip-address* — Specifies the destination IP address.

interface

Syntax **interface** *ip-int-name*
no interface

Context config>redundancy>mc>peer>mcr>ring>in-band-control-path

Description This command specifies the name of the IP interface used for the inband control connection. If the name is not configured, the ring cannot become operational.

service-id

Syntax **service-id** *service-id*
no service-id

Context config>redundancy>mc>peer>mcr>ring>ibc
config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the service ID if the interface used for the inband control connection belongs to a VPRN service. If not specified, the *service-id* is zero and the interface must belong to the Base router.

The **no** form of the command removes the service-id from the IBC configuration.

Parameters *service-id* — Specifies the service ID if the interface.

path-b

Syntax [**no**] **path-b**

Context config>redundancy>mc>peer>mcr>ring

Description This command specifies the set of upper-VLAN IDs associated with the SAPs that belong to path B with respect to load-sharing. All other SAPs belong to path A.

Default If not specified, the default is an empty set.

range

Syntax [**no**] **range** *vlan-range*

Context config>redundancy>mc>peer>mcr>ring>path-b
config>redundancy>mc>peer>mcr>ring>path-excl

Description This command configures a MCR b-path VLAN range.

Parameters *vlan-range* — Specifies the VLAN range.

Values [0 — 4094] — [0 — 4094]

path-excl

Syntax [**no**] **path-excl**

Context config>redundancy>mc>peer>mcr>ring

Description This command specifies the set of upper-VLAN IDs associated with the SAPs that are to be excluded from control by the multi-chassis ring.

Default If not specified, the default is an empty set.

ring-node

Syntax **ring-node** *ring-node-name* [**create**]
no ring-node *ring-node-name*

Context config>redundancy>mc>peer>mcr>ring

Description This command specifies the unique name of a multi-chassis ring access node.

Parameters *ring-node-name* — Specifies the unique name of a multi-chassis ring access node.

create — Keyword used to create the ring node instance. The **create** keyword requirement can be enabled/disabled in the **environment>create** context.

connectivity-verify

Syntax **connectivity-verify**

Context config>redundancy>mc>peer>mcr>ring>ring-node

Description This command enables the context to configure node connectivity check parameters.

interval

Syntax **interval** *interval*
no interval

Context config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the polling interval of the ring-node connectivity verification of this ring node.

Default 5

Parameters *interval* — Specifies the polling interval, in minutes.

Values 1 — 6000

service-id

Syntax **service-id** *service-id*
no service-id

Context config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the service ID of the SAP used for the ring-node connectivity verification of this ring node.

Default no service-id

Parameters *service-id* — Specifies the service ID of the SAP.

Values 1 — 2147483647

src-ip

Syntax **src-ip** *ip-address*
no src-ip

Context config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the source IP address used in the ring-node connectivity verification of this ring node.

Default no src-ip

Parameters *ip-address* — Specifies the source IP address.

src-mac

Syntax **src-mac** *ieee-address*
no src-mac

Context config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the source MAC address used for the Ring-Node Connectivity Verification of this ring node.

A value of all zeroes (000000000000 H (0:0:0:0:0:0)) specifies that the MAC address of the system management processor (CPM) is used.

Default no src-mac

Parameters *ieee-address* — Specifies the source MAC address.

vlan

Syntax **vlan** [*vlan-encap*]
no vlan

Context config>redundancy>mc>peer>mcr>node>cv

Description This command specifies the VLAN tag used for the Ring-node Connectivity Verification of this ring node. It is only meaningful if the value of service ID is not zero. A zero value means that no VLAN tag is configured.

Default no vlan

Parameters *vlan-encap* — Specifies the VLAN tag.

Values	vlan-encap:	dot1q	qtag
		qinq	qtag1.qtag2
		qtag	0 — 4094
		qtag1	1 — 4094
		qtag2	0 — 4094

Show Commands

Hardware Commands

chassis

Syntax **chassis** [**environment**] [**power-supply**] [**ccm**]

Context show

Description This command displays general chassis status information.

Parameters **environment —** Displays chassis environmental status information.

Default Displays all chassis information.

power-supply — Displays chassis power supply status information.

Default Displays all chassis information.

ccm — Displays chassis control module information.

Default Displays all chassis information.

Output **Chassis Output —** The following table describes chassis output fields.

Label	Description
`Name`	The system name for the router.
`Type`	Displays the 7710 SR-Series model number.
`Location`	The system location for the device.
`Coordinates`	A user-configurable string that indicates the Global Positioning System (GPS) coordinates for the location of the chassis. For example: N 45 58 23, W 34 56 12 N37 37' 00 latitude, W122 22' 00 longitude N36*39.246' W121*40.121'
`CLLI Code`	The Common Language Location Identifier (CLLI) that uniquely identifies the geographic location of places and certain functional categories of equipment unique to the telecommunications industry.
`Number of slots`	The number of slots in this chassis that are available for plug-in cards. The total number includes the CCM slot and the CFM slots.
`Number of ports`	The total number of ports currently installed in this chassis. This count does not include the Ethernet ports on the CFMs that are used for management access.

Label	Description (Continued)
Critical LED state	The current state of the Critical LED in this chassis.
Major LED state	The current state of the Major LED in this chassis.
Minor LED state	The current state of the Minor LED in this chassis.
Base MAC address	The base chassis Ethernet MAC address.
Admin chassis mode	The configured chassis mode.
Oper chassis mode	The current chassis mode.
Part number	The CFM part number.
CLEI code	The code used to identify the router.
Serial number	The CFM part number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
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.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Number of fan trays	The total number of fan trays installed in this chassis.
Number of fans	The total number of fans installed in this chassis.
Operational status	Current status of the fan tray.
Fan speed	Half speed — The fans are operating at half speed.
	Full speed — The fans are operating at full speed.
Number of power supplies	The number of power supplies installed in the chassis.
Power supply number	The ID for each power supply installed in the chassis.

Label	Description (Continued)
AC power	Within range — AC voltage is within range.
	Out of range — AC voltage is out of range.
DC power	Within range — DC voltage is within range.
	Out of range — DC voltage is out of range.
Over temp	Within range — The current temperature is within the acceptable range.
	Out of range — The current temperature is above the acceptable range.
Status	Up — The specified power supply is up.
	Down — The specified power supply is down
CCM (7710-only)	Number of Chassis Control Modules on this unit.
Equipped	Specifies whether or not the the 7710 SR is equipped with a CCM.
Type	The 7710 SR series model number associated with this CCM.
Part number	The CCM part number.
CLEI code	The code used to identify the router.
Serial number	The CCM serial number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
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.
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.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the CCM.

Sample Output

```
A:7710-3>config# show chassis
===============================================================================
Chassis Information
===============================================================================
    Name                            : 7710-3
    Type                            : 7710 SR-c12
    Location                        :
    Coordinates                     :
    CLLI code                       :
    Number of slots                 : 3
    Number of ports                 : 85
    Critical LED state              : Off
    Major LED state                 : Off
    Minor LED state                 : Off
    Over Temperature state          : OK
    Base MAC address                : 04:7b:ff:00:00:00

Hardware Data
    Part number                     : Sim Part#
    CLEI code                       : Sim CLEI
    Serial number                   : sim3
    Manufacture date                : 01012003
    Manufacturing string            : Sim MfgString sim3
    Manufacturing deviations        : Sim MfgDeviation sim3
    Time of last boot               : 2007/04/11 18:18:14
    Current alarm state             : alarm cleared
-------------------------------------------------------------------------------
Environment Information
    Number of fan trays             : 1
    Number of fans                  : 10

    Fan tray number                 : 1
    Status                          : up
    Speed                           : half speed
-------------------------------------------------------------------------------
Power Supply Information
    Number of power supplies        : 2

    Power supply number             : 1
    Defaulted power supply type     : dc
    Status                          : up
    Input power                     : within range
    Output power                    : within range

    Power supply number             : 2
    Defaulted power supply type     : dc
    Status                          : up
    Input power                     : within range
    Output power                    : within range
-------------------------------------------------------------------------------
Chassis Control Module (CCM) Information
    CCM number                      : 1
    Equipped                        : yes
    Type                            : ccm-c12-v1

Hardware Data
    Part number                     : Sim Part#
    CLEI code                       : Sim CLEI
    Serial number                   : ccm-0
```

```
    Manufacture date              : 01012003
    Manufacturing string          : Sim MfgString ccm-0
    Manufacturing deviations      : Sim MfgDeviation ccm-0
    Administrative state          : up
    Operational state             : up
    Temperature                   : 32C
    Temperature threshold         : 75C
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
===============================================================================
A:7710-3>config#

A:ALA-4# show chassis environment
==============================================================================
Chassis Information
==============================================================================
Environment Information
    Number of fan trays           : 1
    Number of fans                : 10

    Fan tray number               : 1
    Status                        : up
    Speed                         : half speed
==============================================================================
A:ALA-4#


A:ALA-4# show chassis power-supply
===============================================================================
Chassis Information
===============================================================================
Power Supply Information
    Number of power supplies      : 2

    Power supply number           : 1
    Defaulted power supply type   : none
    Status                        : not equipped

    Power supply number           : 2
    Defaulted power supply type   : dc
    Status                        : up
===============================================================================
A:ALA-4#
A:7710-3# show chassis ccm
===============================================================================
Chassis Information
===============================================================================
Chassis Control Module (CCM) Information
    CCM number                    : 1
    Equipped                      : yes
    Type                          : ccm-c12-v1

Hardware Data
    Part number                   : Sim Part#
    CLEI code                     : Sim CLEI
    Serial number                 : ccm-0
    Manufacture date              : 01012003
    Manufacturing string          : Sim MfgString ccm-0
    Manufacturing deviations      : Sim MfgDeviation ccm-0
    Administrative state          : up
    Operational state             : up
```

```
    Temperature                   : 32C
    Temperature threshold         : 75C
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
===============================================================================
A:7710-3>
```

card

Syntax **card** [*slot-number*] [**detail**]
card state

Context show

Description This command displays card information.

If no command line parameters are specified, a card summary for all cards is displayed.

Parameters *slot-number* — Displays information for the specified card slot.

Default Displays all cards.

Values 1

state — Displays provisioned and equipped card and MDA information.

detail — Displays detailed card information.

Default Displays summary information only

Output **Show Card Output —** The following table describes show card output fields.

Label	Description
`Slot`	The slot number of the card in the chassis.
`Provisioned Card-type`	The card type that is configured for the slot.
`Equipped Card-type`	The card type that is actually populated in the slot.
`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.

Sample Output

```
A:ALA-48# show card 1
===============================================================================
Card Summary
```

```
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-12g             iom-12g             up         up
A         cfm-12g             cfm-12g             up         up/active
B         cfm-12g                                 up         down/standby
===============================================================================
A:ALA-48#
```

Show Card State Output — The following table describes show card state output fields.

Label	Description
`Slot/MDA`	The slot number of the card in the chassis.
`Provisioned Type`	The card type that is configured for the slot.
`Equipped Type`	The card type that is actually populated in the slot.
`Admin State`	`Up` — The card is administratively up.
	`Down` — The card is administratively down.
`Operational State`	`Up` — The card is operationally up.
	`provisioned` — There is no card in the slot but it has been pre-configured.
`Num Ports`	The number of ports available on the MDA.
`Num MDA`	The number of MDAs installed.
`Comments`	Indicates whether the CFM is the active or standby.

Sample Output

The following example displays the card state for a 7710 SR-c12.

```
A:7710-3>config>card# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-12g          iom-12g          up    up                  12
1/1    mcm-v1           mcm-v1           up    up
1/3                     mcm-v1           up    unprovisioned
1/1    m60-10/100eth-tx m60-10/100eth-tx up    up         60
1/5    c8-10/100eth-tx  c8-10/100eth-tx  up    up         8
1/6                     c1-1gb-sfp       up    unprovisioned
1/7                     c8-chds1         up    unprovisioned
1/8                     c4-ds3           up    unprovisioned
1/9                     c8-10/100eth-tx  up    unprovisioned
1/10                    c1-1gb-sfp       up    unprovisioned
```

```
1/11                    c8-chds1         up    unprovisioned
1/12                    c4-ds3           up    unprovisioned
A      cfm-12g          cfm-12g          up    up                       Active
B      cfm-12g                           up    down                     Standby
===============================================================================
A:7710-3>
```

Show Card Detail Output — The following table describes detailed card output fields.

Label	Description
`Clock source`	The system's clock source.
`Available MDA slots`	The number of MDA slots available on the CFM.
`Installed MDAs`	The number of MDAs installed on the CFM.
`Part number`	The CCM part number.
`CLEI code`	The Common Language Location Identifier (CLLI) code string for the router.
`Serial number`	The serial number. Not user modifiable.
`Manufacture date`	The chassis manufacture date. Not user modifiable.
`Manufacturing string`	Factory-inputted manufacturing text string. Not user modifiable.
`Manufacturing deviations`	Displays a record of changes done by the manufacturing to the hardware or software and which 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.
`Temperature`	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 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.

Label	Description (Continued)
`Current alarm state`	Displays the alarm conditions for the specific board.
`Base MAC address`	Displays the base MAC address of the hardware component.
`Memory Capacity`	Displays the memory capacity of the card.

Sample Output

```
A:7710-3>config# show card 1 detail
===============================================================================
Card 1
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-12g             iom-12g             up         provisioned

IOM Card Specific Data
    Clock source                  : none
    Available MDA slots           : 12
    Installed MDAs                : 6

Hardware Data
    Part number                   : Sim Part#
    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                   : 40C
    Temperature threshold         : 75C
    Software boot version         : simulated
    Software version              : TiMOS-B-0.0.current both/i386 ALCATEL SR 7*
    Time of last boot             : 2007/04/11 18:18:18
    Current alarm state           : alarm cleared
    Base MAC address              : 04:7b:01:00:00:00
    Memory capacity               : 1,007 MB
===============================================================================
A:7710-3>config#
```

CPM Output — The following table describes the output fields for a CPM card.

Label	Description
`Slot`	The slot of the card in the chassis.
`Card Provisioned`	The SF/CPM type that is configured for the slot.
`Card Equipped`	The SF/CPM type that is actually populated in the slot.

Label	Description (Continued)
Admin State	Up — The SF/CPM is administratively up.
	Down — The SF/CPM is administratively down.
Operational State	Up — The SF/CPM is operationally up.
	Down — The SF/CPM is operationally down.
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 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.
CPM card status	active — The card is acting as the primary (active) CPM in a redundant system.
	standby — The card is acting as the standby (secondary) CPM in a redundant system.
Administrative state	Up — The CPM is administratively up.
	Down — The CPM is administratively down.
Operational state	Up — The CPM is operationally up.
	Down — The CPM is operationally down.
Serial number	The compact flash part number. Not user modifiable.
Firmware revision	The firmware version. Not user modifiable.
Model number	The compact flash model number. Not user modifiable.
Size	The amount of space available on the compact flash card.
Free space	The amount of space remaining on the compact flash card.
Part number	The SF/CPM part number.
CLEI code	The code used to identify the router.
Serial number	The SF/CPM part number. Not user modifiable.

Label	Description (Continued)
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
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.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Status	Displays the current status.
Temperature	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 version	The version of the boot image.
Memory capacity	The total amount of memory.

Sample Output

```
A:7710-3>config>card# show card a detail
===============================================================================
Card A
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
A         cfm-12g             cfm-12g             up         up/active

BOF last modified                 : N/A
Config file version               : Sun APR 11 18:11:49 2007 UTC
Config file last modified         : 2007/04/08 10:46:13
Config file last saved            : N/A
M/S clocking ref state            : primary

Flash - cf1:
    Administrative State          : up
    Operational state             : up
    Serial number                 : serial-1
    Firmware revision             : v1.0
```

```
    Model number                  : PC HD 1
    Size                          : 1,424 KB
    Free space                    : 996 KB

Hardware Data
    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                   : 40C
    Temperature threshold         : 75C
    Software boot version         : simulated
    Software version              : TiMOS-B-0.0.current both/i386 ALCATEL SR 7*
    Time of last boot             : 2007/04/08 10:46:13
    Current alarm state           : alarm cleared
    Base MAC address              : 04:7b:02:00:00:00
    Memory capacity               : 1,007 MB
===============================================================================
A:7710-3>config>card#
```

mcm

Syntax **mcm** [*slot* [**/***mcm*]] [**detail**]

Context show

Description This command displays MCM information.

If no command line options are specified, a summary output of all MCMs is displayed in table format.

Parameters *slot* — The slot number for which to display MCM information.

Values 1

mcm — The MCM number in the slot for which to display MCM information.

Values 7710 SR-c12 — 1, 3, 5, 7, 9, 11
7710 SR-c4 — 1, 3

detail — Displays detailed MDA information.

Output **MDA Output —** The following table describes MDA output fields.

Label	Description
`Slot`	The chassis slot number.
`MCM`	The MCM slot number.
`Provisioned MCM-type`	The MCM type provisioned.

Label	Description
Equipped MCM-type	The MCM type actually installed.
Admin State	Up — Administratively up. Down — Administratively down.
Ops State	Up — Operationally up. Down — Operationally down.

Sample Output

```
A:7710-3# show mcm
==========================================================================
MCM Summary
==========================================================================
Slot Mcm  Provisioned          Equipped             Admin    Operational
          Mcm-type             Mcm-type             State    State
--------------------------------------------------------------------------
1    1    mcm-v1               mcm-v1               up       up
     3                         mcm-v1               up       unprovisioned
==========================================================================
A:7710-3#

A:7710-3# show mcm 1
==========================================================================
MCM 1/1
==========================================================================
Slot Mcm  Provisioned          Equipped             Admin    Operational
          Mcm-type             Mcm-type             State    State
--------------------------------------------------------------------------
1    1    mcm-v1               mcm-v1               up       up
==========================================================================
MCM 1/3
==========================================================================
Slot Mcm  Provisioned          Equipped             Admin    Operational
          Mcm-type             Mcm-type             State    State
--------------------------------------------------------------------------
     3                         mcm-v1               up       unprovisioned
==========================================================================
A:7710-3#
```

mda

Syntax **mda** [*slot* [**/***mda*]] [**detail**]

Context show

Description This command displays MDA information.

If no command line options are specified, a summary output of all MDAs is displayed in table format.

Parameters *slot* — The slot number for which to display MDA information.

Values 1

mda — The MDA number in the slot for which to display MDA information.

Values 7710 SR-c12 - 1, 3, 5, 7, 9, 11
7710 SR-c4 — 1, 3

detail — Displays detailed MDA information.

Output **MDA Output —** The following table describes MDA output fields.

Label	Description
`Slot`	The chassis slot number.
`MDA`	The MDA slot number.
`Provisioned MDA-type`	The MDA type provisioned.
`Equipped MDA-type`	The MDA type actually installed.
`Admin State`	`Up` — Administratively up.
	`Down` — Administratively down.
`Ops State`	`Up` — Operationally up.
	`Down` — Operationally down.

Sample Output

```
A:7710-3# show mda
==========================================================================
MDA Summary
==========================================================================
Slot Mda  Provisioned           Equipped              Admin    Operational
          Mda-type              Mda-type              State    State
--------------------------------------------------------------------------
1    1    m60-10/100eth-tx      m60-10/100eth-tx      up       up
     5    c8-10/100eth-tx       c8-10/100eth-tx       up       up
     6                          c1-1gb-sfp            up       unprovisioned
     7                          c8-chds1              up       unprovisioned
     8                          c4-ds3                up       unprovisioned
     9                          c8-10/100eth-tx       up       unprovisioned
     10                         c1-1gb-sfp            up       unprovisioned
     11                         c8-chds1              up       unprovisioned
     12                         c4-ds3                up       unprovisioned
==========================================================================
A:7710-3#
```

MDA Detailed Output — The following table describes detailed MDA output fields.

Label	Description
Slot	The chassis slot number.
Slot	The MDA slot number.
Provisioned Pro-visioned-type	The provisioned MDA type.
Equipped Mda-type	The MDA type that is physically inserted into this slot in this chassis.
Admin State	Up — The MDA is administratively up.
	Down — The MDA is administratively down.
Operational State	Up — The MDA is operationally up.
	Down — The MDA is operationally down.
Maximum port count	The maximum number of ports that can be equipped on the MDA card.
Number of ports equipped	The number of ports that are actually equipped on the MDA.
Transmit timing selected	The transmit timing method which is presently selected and being used by this MDA.
Sync Interface timing status	Indicates the status of the synchronous equipment timing subsystem.
Network Ingress Queue Policy	Specifies the network queue policy applied to the MDA to define the queueing structure for this object.
Capabilities	Specifies the minimum size of the channel that can exist on the channelized MDA.
Max channel size	Specifies the maximum size of the channel that can exist on the channelized MDA.
Channels in use	Applicable for SONET and TDM MDAs only. Indicates the total number of leaf SONET paths, TDM channels and bundles on the MDA which are presently provisioned for passing traffic.
Part number	The hardware part number.
CLEI code	The code used to identify the MDA.
Serial number	The MDA part number. Not user modifiable.
Manufacture date	The MDA manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.

Label	Description (Continued)
Administrative state	`Up` — The MDA is administratively up.
	`Down` — The MDA is administratively down.
Operational state	`Up` — The MDA is operationally up.
	`Down` — The MDA is operationally down.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific MDA.
Base MAC address	The base chassis Ethernet MAC address. Special purpose MAC addresses used by the system software are constructed as offsets from this base address.

Sample Output

The following example shows the detail of an MDA in slot 1.

```
B:Dut-D# show mda 1/1 detail
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned            Equipped               Admin     Operational
            Mda-type               Mda-type               State     State
-------------------------------------------------------------------------------
1     1     m10-1gb-sfp            m10-1gb-sfp            up        up

MDA Specific Data
    Maximum port count            : 10
    Number of ports equipped      : 10
    Network ingress queue policy  : default
    Capabilities                  : Ethernet

Hardware Data
    Part number                   : 3HE00026AAAC01
    CLEI code                     :
    Serial number                 : NS042800525
    Manufacture date              : 07082004
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 42C
    Temperature threshold         : 75C
    Time of last boot             : 2007/04/11 09:37:52
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:0e:9e:03
===============================================================================
B:Dut-D#
```

The following example shows the detail of a CMA in slot 1.

```
A:7710-3# show mda 1/5 detail
===============================================================================
MDA 1/5 detail
===============================================================================
Slot Mda  Provisioned          Equipped             Admin    Operational
          Mda-type             Mda-type             State    State
-------------------------------------------------------------------------------
1    5    c8-10/100eth-tx      c8-10/100eth-tx      up       up

MDA Specific Data
    Maximum port count            : 8
    Number of ports equipped      : 8
    Network ingress queue policy  : default
    Capabilities                  : Ethernet

Hardware Data
    Part number                   : Sim Part#
    CLEI code                     : Sim CLEI
    Serial number                 : mda-5
    Manufacture date              : 01012003
    Manufacturing string          : Sim MfgString mda-5
    Manufacturing deviations      : Sim MfgDeviation mda-5
    Administrative state          : up
    Operational state             : up
    Temperature                   : 33C
    Temperature threshold         : 75C
    Time of last boot             : 2007/04/11 15:13:48
    Current alarm state           : alarm cleared
    Base MAC address              : 04:7b:01:05:00:01
===============================================================================
A:7710-3#
```

pools

Syntax **pools** *mda-id* [/*port*] [**access-app** [*pool-name* **| service** *service-id*]]
pools *mda-id* [/*port*] [**network-app** [[*pool-name*]]

Context show

Description This command displays pool information.

Parameters *mda-id*[/*port*] — Displays the pool information of the specified MDA.

access-app pool-name — Displays the pool information of the specified QoS policy.

Output **Show Pool Output —** The following table describes show pool output fields.

Label	Description
Type	Specifies the pool type.
ID	Specifies the card/mda or card/MDA/port designation.
Application/Type	Specifies the nature of usage the pool would be used for. The pools could be used for access or network traffic at either ingress or egress.
Pool Name	Specifies the name of the pool being used.
Resc CBS	Specifies the percentage of pool size reserved for CBS.

Label	Description (Continued)
`Utilization`	Specifies the type of the slope policy.
`State`	The administrative status of the port.
`Start-Avg`	Specifies the percentage of the buffer utilized after which the drop probability starts to rise above 0.
`Max-Avg`	Specifies the percentage of the buffer utilized after which the drop probability is 100 percent. This implies that all packets beyond this point will be dropped.
`Time Avg Factor`	Specifies the time average factor the weighting between the previous shared buffer average utilization result and the new shared buffer utilization in determining the new shared buffer average utilization.
`Actual ResvCBS`	Specifies the actual percentage of pool size reserved for CBS.
`Admin ResvCBS`	Specifies the percentage of pool size reserved for CBS.
`PoolSize`	Specifies the size in percentage of buffer space. The value '-1' implies that the pool size should be computed as per fair weighting between all other pools.
`Pool Total`	Displays the total pool size.
`Pool Shared`	Displays the amount of the pool which is shared.
`Pool Resv`	Specifies the percentage of reserved pool size.
`Pool Total In Use`	Displays the total amount of the pool which is in use.
`Pool Shared In Use`	Displays the amount of the pool which is shared that is in use.

```
*A:ALA-48# show pools 1/1
===============================================================================
Type    Id        App.    Pool Name                    Actual ResvCBS  PoolSize
                                                       Admin ResvCBS
-------------------------------------------------------------------------------
MDA     1/1       Acc-Ing default
                                                       Sum
MDA     1/1       Acc-Ing MC Path Mgnt
                                                       50
MDA     1/1       Acc-Egr default
                                                       Sum
MDA     1/1       Net-Ing default
                                                       Sum
MDA     1/1       Net-Egr default
                                                       50
Port    1/1/1     Acc-Ing default
                                                       Sum
Port    1/1/1     Acc-Egr default
                                                       Sum
Port    1/1/1     Net-Egr default
```

```
                                                                        Sum
Port    1/1/2     Acc-Ing default
                                                                        Sum
Port    1/1/2     Acc-Egr default
                                                                        Sum
Port    1/1/2     Net-Egr default
                                                                        Sum
Port    1/1/3     Acc-Ing default
                                                                        Sum
Port    1/1/3     Acc-Egr default
                                                                        Sum
Port    1/1/3     Net-Egr default
                                                                        Sum
Port    1/1/4     Acc-Ing default
                                                                        Sum
Port    1/1/4     Acc-Egr default
                                                                        Sum
...
Port    1/1/12    Acc-Egr default
                                                                        Sum
Port    1/1/12    Net-Egr default
                                                                        Sum
===============================================================================
*A:ALA-48#
*A:ALA-48# show pools 1/1/1 network-egress
===============================================================================
Pool Information
===============================================================================
Port                 : 1/1/1
Application          : Net-Egr           Pool Name          : default
Resv CBS             : Sum
-------------------------------------------------------------------------------
Utilization                  State       Start-Avg    Max-Avg    Max-Prob
-------------------------------------------------------------------------------
High-Slope                   Down              70%        90%         80%
Low-Slope                    Down              50%        75%         80%

Time Avg Factor      : 7
Pool Total          : 3072 KB                                              *See Note
Pool Shared          : 1536 KB           Pool Resv          : 1536 KB

Pool Total In Use    : 0 KB
Pool Shared In Use   : 0 KB              Pool Resv In Use   : 0 KB
WA Shared In Use     : 0 KB

Hi-Slope Drop Prob   : 0                 Lo-Slope Drop Prob : 0
-------------------------------------------------------------------------------
FC-Maps                        ID        MBS         Depth  A.CIR     A.PIR
                                         CBS                O.CIR     O.PIR
-------------------------------------------------------------------------------
be                             1/1/1     1536        0      0         100000
                                         28                 0         Max
l2                             1/1/1     1536        0      25000     100000
                                         96                 25000     Max
af                             1/1/1     1536        0      25000     100000
                                         320                25000     Max
l1                             1/1/1     768         0      25000     100000
                                         96                 25000     Max
h2                             1/1/1     1536        0      100000    100000
                                         320                Max       Max
ef                             1/1/1     1536        0      100000    100000
```

```
                                          320              Max        Max
h1                                1/1/1   768        0     10000      100000
                                          96               10000      Max
nc                                1/1/1   768        0     10000      100000
                                          96               10000      Max
===============================================================================
*A:ALA-48#
```

In Use Stat Note:

The pool shared in use stat only increases when a queue is asking for a buffer outside it's reserved size. If all the buffers in a pool are assigned to queues within their reserved size, then only the reserved in use size will increase. In case of resv CBS oversubscription (CBS sum for all queues is bigger then pool resvCbs), it is possible that pool resv in use stat can increase above the actual pool reserved size. For example:

```
Pool Total          : 57344 KB
Pool Shared         : 32768 KB        Pool Resv         : 24576 KB

Pool Total In Use    : 57344 KB
Pool Shared In Use   : 0 KB           Pool Resv In Use   : 57344 KB
```

APS Show Commands

aps

Syntax **aps** [*aps-id*] [**detail**]

Context show

Description This command displays Automated Protection Switching (APS) information.

Parameters *aps-id* — Displays information for the specified APS group ID.

Values aps-*group-id*
aps: keyword
group-id: 1 — 16

detail — Displays detailed APS information.

Output **APS Output —** The following table describes APS output fields.

Label	Description
`Interface`	Specifies the APS interface name (the APS group port).
`Admin State`	`Up` — APS is administratively up.
	`Down` — APS port is administratively down.
`Oper State`	`Up` — APS port is operationally up.
	`Down` — APS is operationally down.
`MC-CTL State`	Specifies the multi-chassis state.
`Work Circuit`	Specifies the working circuit ID.
`Prot Circuit`	Specifies the physical port that acts 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.
`Group Id`	Displays the APS group name.
`Protection Circuit`	Displays the physical port that will act as the protection circuit for this APS group.
`Switching-mode`	Displays the switching mode.
	`bidirectional` — The bidirectional mode provides protection in both directions.

Label	Description (Continued)
`Switching-arch`	The architecture of the APS group.
`Revertive-mode`	Displays the revertive mode of the APS group. `nonrevertive` — 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 will be 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.
`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 has 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.
`No. of Switchovers`	Displays the number of times a switchover has occurred.
`Last Switchover`	Displays the time stamp 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.

Label	Description (Continued)
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	The result of the last exercise request on a circuit.
Neighbor address	Displays the neighbor IP address.
Advertise Interval	Displays the advertise interval.
Hold time	Displays the hold time.

Sample Output

show aps on a working multi-chassis APS node:

```
B:Dut-B# show aps aps-1
===============================================================================
APS Group Info
===============================================================================
Interface Admin  Oper   MC-Ctl  Work      Prot      Active    Tx/Rx
          State  State  State   Circuit   Circuit   Circuit   K1 Byte
-------------------------------------------------------------------------------
aps-1     Down   Down   N/A     N/A       N/A       N/A       N/A
===============================================================================
B:Dut-B#


B:Dut-B# show aps aps-30 detail
===============================================================================
APS Group: aps-1
===============================================================================
Description         : APS Group
Group Id            : 1                      Active Circuit        : N/A
Admin Status        : Down                   Oper Status           : Down
Working Circuit     : N/A                    Protection Circuit    : N/A
Switching-mode      : Bi-directional         Switching-arch        : 1+1
Revertive-mode      : Non-revertive          Revert-time (min)     :
Rx K1/K2 byte       : N/A
Tx K1/K2 byte       : N/A
Current APS Status : OK
Multi-Chassis APS   : No
Neighbor            : 0.0.0.0
Control link state : N/A
Advertise Interval : 1000 msec               Hold time             : 3000 msec
Mode mismatch Cnt   : 0                      Channel mismatch Cnt : 0
PSB failure Cnt     : 0                      FEPL failure Cnt      : 0
===============================================================================
B:Dut-E#


B:Dut-E# show aps aps-1 detail
===============================================================================
APS Group: aps-1
```

```
===============================================================================
Description        : APS Group
Group Id           : 1                       Active Circuit       : N/A
Admin Status       : Down                    Oper Status          : Down
Working Circuit    : N/A                     Protection Circuit   : N/A
Switching-mode     : Bi-directional          Switching-arch       : 1+1
Revertive-mode     : Non-revertive           Revert-time (min)    :
Rx K1/K2 byte      : N/A
Tx K1/K2 byte      : N/A
Current APS Status : OK
Multi-Chassis APS  : No
Neighbor           : 0.0.0.0
Control link state : N/A
Advertise Interval : 1000 msec               Hold time            : 3000 msec
Mode mismatch Cnt  : 0                       Channel mismatch Cnt : 0
PSB failure Cnt    : 0                       FEPL failure Cnt     : 0
===============================================================================
B:Dut-E#
```

show aps on protect MC-APS node:

```
B:Dut-E# show aps
==================================================================================
APS Group Info
==================================================================================
Interface Admin  Oper    MC-Ctl   Work      Prot       Active     Tx/Rx
              State  State    State    Circuit    Circuit    Circuit K1 Byte
----------------------------------------------------------------------------------
aps-20    Up     Up      N/A      1/1/1     1/1/2      1/1/1      PC-Tx:  No-Req
==================================================================================
B:Dut-E#


B:Dut-E# show aps aps-30 detail
===============================================================================
APS Group: aps-30
===============================================================================
Description        : APS Group
Group Id           : 30                      Active Circuit       : N/A
Admin Status       : Up                      Oper Status          : Up
Working Circuit    : N/A                     Protection Circuit   : 1/2/2
Switching-mode     : Bi-directional          Switching-arch       : 1+1
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  : Yes
Neighbor           : 13.1.1.1
Control link state : Up
Advertise Interval : 1000 msec               Hold time            : 3000 msec
Mode mismatch Cnt  : 0                       Channel mismatch Cnt : 0
PSB failure Cnt    : 0                       FEPL failure Cnt     : 1
-------------------------------------------------------------------------------
 APS Working Circuit - Neighbor
-------------------------------------------------------------------------------
Admin Status       : N/A                     Oper Status          : N/A
Current APS Status : OK                      No. of Switchovers   : 0
Last Switchover    : None                    Switchover seconds   : 0
Signal Degrade Cnt : 0                       Signal Failure Cnt   : 0
Last Switch Cmd    : No Cmd                  Last Exercise Result : Unknown
```

```
Tx L-AIS           : None
-------------------------------------------------------------------------------
 APS Protection Circuit - 1/2/2
-------------------------------------------------------------------------------
Admin Status       : Up                         Oper Status          : Up
Current APS Status : OK                         No. of Switchovers   : 0
Last Switchover    : None                       Switchover seconds   : 0
Signal Degrade Cnt : 0                          Signal Failure Cnt   : 0
Last Switch Cmd    : No Cmd                     Last Exercise Result : Unknown
Tx L-AIS           : None
===============================================================================
B:Dut-E#
```

Port Show Commands

port

Syntax **port** *port-id* [**count**] [**detail**]
port *port-id* **description**
port *port-id* **associations**
port *port-id* **cisco-hdlc**
port *port-id* **ppp** [**detail**]
port *port-id* **frame-relay** [**detail**]
port *port-id* **dot1x** [**detail**]
port cem
port *port-id* **ethernet** [**efm-oam** | **detail**]

Context show

Description This command displays port or channel information.

If no command line options are specified, the command port displays summary information for all ports on provisioned MDAs.

Parameters *port-id* — Specifies the physical port ID in the form *slot/mda/port*.

Syntax	port-id	*slot*[/*mda*[/*port*]] or *slot*/*mda*/*port*[.*channel*]	
	aps-id	aps-*group-id*[.*channel*]	
		aps	keyword
		group-id	1 — 16
MDA Values		7710 SR-c12: 1, 3, 5, 7, 9, 11 7710 SR-c4: 1, 3	
CMA Values		7710 SR-c12: 1 — 12 7710 SR-c4: 1— 4	
Port Values	1 — 60 (depending on the MDA type)		

associations — Displays a list of current router interfaces to which the port is associated.

cisco-hdlc — Dispays Cisco HDLC port information.

count — Displays only port counter summary information.

description — Displays port description strings.

dot1x — Displays information.about 802.1x status and statistics.

down-when-looped — Displays status of port and whether the feature is enabled.

ethernet — Displays ethernet port information.

efm-oam — Displays EFM OAM information.

detail — Displays detailed information about the Ethernet port.

frame-relay — Displays Frame Relay information.

ppp — Displays PPP protocol information for the port.

detail — Provides detailed information.

Output **Port Output —** The following tables describe port output fields:

- General Port Output Fields on page 295
- Entering port ranges on page 297
- Specific Port Output Fields on page 297
- Detailed Port Output Fields on page 303
- Ethernet Output Fields on page 308
- Ethernet-Like Medium Statistics Output Fields on page 310
- Port Associations Output Fields on page 312
- Port Frame Relay Output Fields
- PPP Output Fields on page 313

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.
`Phy Link`	`Yes` — A physical link is present.
	`No` — A physical link is not present.
`Port State`	`Up` — The port is physically present and has physical link present.
	`Down` — The port is physically present but does not have a link.
	`Ghost` — A port that is not physically present.
	`None` — The port is in its initial creation state or about to be deleted.
	`Link Up` — A port that is physically present and has physical link present. Note that when `Link Up` appears at the lowest level of a SONET/SDH path or a TDM tributary, it means the physical connection is active but the port is waiting on some other state 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` — A port that is physically present but does not have a link.
`Cfg MTU`	The configured MTU.

Label	Description (Continued)
Oper MTU	The negotiated size of the largest packet which can be sent on the SONET/SDH channel, specified in octets. For channels that are used for transmitting network datagrams, this is the size of the largest network datagram that can be sent on the channel.
LAG ID	The LAG or multi-link trunk (MLT) that the port is assigned to.
Port Mode	`network` — The port is configured for transport network use. `access` — The port is configured for service access.
Port Encap	`Null` — Ingress frames will not use tags or labels to delineate a service. `dot1q` — Ingress frames carry 802.1Q tags where each tag signifies a different service.
Port Type	The type of port or optics installed.
SFP/MDI MDX	`GIGE` — Indicates the GigE SFP type. `FASTE` — Indicates the FastE SFP type. `GIGX` — Indicates the GigX SFP type. `MDI` — Indicates that the Ethernet interface is of type MDI (Media Dependent Interface). `MDX` — Indicates that the Ethernet interface is of type MDX (Media Dependent Interface with crossovers).

Sample Output

```
A:ALA-12# show port 1/1
============================================================================
Ports on Slot 1
============================================================================
Port       Admin Phys Port    Cfg  Oper LAG/ Port Port Port   SFP/
Id         State Link State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
----------------------------------------------------------------------------
1/1/1      Up    Yes   Ghost   1578 1578    1 netw null gige
1/1/2      Up    Yes   Ghost   1522 1522    - accs qinq gige
1/1/3      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/4      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/5      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/6      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/7      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/8      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/9      Up    Yes   Ghost   1518 1518    - accs dotq gige
1/1/10     Up    Yes   Ghost   1518 1518    - accs dotq gige
============================================================================
A:ALA-12#
```

Entering port ranges:

```
*A:7450-1# configure port 1/1/[1..3] shut
*A:7450-1# 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   Down    1518 1518    1 accs dotq gige
1/1/2       Down  No   Down    1578 1578    - netw null gige
1/1/3       Down  No   Down    1578 1578    - netw null gige
1/1/4       Up    No   Down    1514 1514    - accs null gige
1/1/5       Up    No   Down    1578 1578    - netw null gige
==============================================================================
*A:7450-1#
```

Specific Port Output — The following table describes port output fields for a specific port.

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.
Speed	The speed of the interface.
Link-level	Ethernet — The port is configured as Ethernet.
	SONET — The port is configured as SONET-SDH.
MTU	The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets.
Admin State	Up — The port is administratively up.
	Down — The port is administratively down.
Oper State	Up — The port is operationally up.
	Down — The port is operationally down.
Duplex	Full — The link is set to full duplex mode.
	Half — The link is set to half duplex mode.
Hold time up	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
Hold time down	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
Physical Link	Yes — A physical link is present.
	No — A physical link is not present.

Label	Description (Continued)
IfIndex	Displays the interface's index number which reflects its initialization sequence.
Last State chg	Displays the system time moment that the peer is up.
Last State Change	isplays the system time moment that the MC-LAG group is up.
Configured Mode	network — The port is configured for transport network use.
	access — The port is configured for service access.
Dot1Q Ethertype	Indicates the Ethertype expected when the port's encapsulation type is Dot1Q.
QinQ Ethertype	Indicates the Ethertype expected when the port's encapsulation type is QinQ.
Net. Egr. Queue Pol	Specifies the network egress queue policy or that the default policy is used.
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.
Active Alarms	The number of alarms outstanding on this port.
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.
Alarm State	The current alarm state of the port.
Collect Stats	Enabled — The collection of accounting and statistical data for the network Ethernet port is enabled. When applying accounting policies the data by default will be collected in the appropriate records and written to the designated billing file.
	Disabled — Collection is disabled. Statistics are still accumulated by the CFM cards, however, the CPU will not obtain the results and write them to the billing file.
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.
Egress Buf (Acc)	The access-buffer policy for the egress buffer.
Egress Buf (Net)	The network-buffer policy for the egress buffer.
Egress Pool Size	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.

Label	Description (Continued)
Ingress Buf (Acc)	The access-buffer policy for the ingress buffer.
Ingress Pool Size	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.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.
Transceiver Type	Type of the transceiver.
Model Number	The model number of the transceiver.
Transceiver Code	The code for the transmission media.
Laser Wavelength	The light wavelength transmitted by the transceiver's laser.
Connector Code	The vendor organizationally unique identifier field (OUI) contains the IEEE company identifier for the vendor.
Diag Capable	Indicates if the transceiver is capable of doing diagnostics.
Vendor OUI	The vendor-specific identifier field (OUI) contains the IEEE company identifier for the vendor.
Manufacture date	The manufacturing date of the hardware component in the mmddyyyy ASCII format.
Media	The media supported for the SFP.
Serial Number	The vendor serial number of the hardware component.
Part Number	The vendor part number contains ASCII characters, defining the vendor part number or product name.
Input/Output	When the collection of accounting and statistical data is enabled, then octet, packet, and error statistics are displayed.
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.
Speed	The speed of the interface
Link-level	Ethernet — The port is configured as Ethernet.
	SONET — The port is configured as SONET-SDH
MTU	The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets.
Admin State	Up — The port is administratively up.

Label	Description (Continued)
	`Down` — The port is administratively down.
`Oper State`	`Up` — The port is operationally up.
	`Down` — The port is operationally down.
`Duplex`	`Full` — The link is set to full duplex mode.
	`Half` — The link is set to half duplex mode.
`Hold time up`	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
`Hold time down`	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
`IfIndex`	Displays the interface's index number which reflects its initialization sequence.
`Phy Link`	`Yes` — A physical link is present.
	`No` — A physical link is not present.
`Configured Mode`	`network` — The port is configured for transport network use.
	`access` — The port is configured for service access.
`Network Qos Pol`	The network QoS policy ID applied to the port.
`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.
`Active Alarms`	The number of alarms outstanding on this port.
`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.
`Alarm State`	The current alarm state of the port.
`Collect Stats`	`Enabled` — The collection of accounting and statistical data for the network Ethernet port is enabled. When applying accounting policies the data by default will be collected in the appropriate records and written to the designated billing file.
	`Disabled` — Collection is disabled. Statistics are still accumulated by the CFM cards, however, the CPU will not obtain the results and write them to the billing file.
`Down-When-Looped`	Shows whether the feature is enabled or disabled.

Label	Description (Continued)
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.
Egress Buf (Acc)	The access-buffer policy for the egress buffer.
Egress Buf (Net)	The network-buffer policy for the egress buffer.
Ingress Buf (Acc)	The access-buffer policy for the ingress buffer.
Ingress Pool Size	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.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.
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.
Unicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sub-layer. 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 sub-layer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.

Label	Description (Continued)
`Broadcast Packets Input/Output`	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
`Discards Input/Output`	The number of inbound 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 which 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 which 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.
`Errors`	This field displays the number of cells discarded due to uncorrectable HEC errors. Errors do not show up in the raw cell counts.

Detailed Port Output — The following table describes detailed port output fields.

Label	Description
`Description`	A text description of the port.
`Interface`	The port ID displayed in the *slot/mda/port* format.
`Speed`	The speed of the interface.
`Link-level`	`Ethernet` — The port is configured as Ethernet.
	`SONET` — The port is configured as SONET-SDH.
`MTU`	The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets.
`Admin State`	`Up` — The port is administratively up.
	`Down` — The port is administratively down.
`Oper State`	`Up` — The port is operationally up.
	`Down` — The port is operationally down.
`Duplex`	`Full` — The link is set to full duplex mode.
	`Half` — The link is set to half duplex mode.
`Hold time up`	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
`Hold time down`	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
`IfIndex`	Displays the interface's index number which reflects its initialization sequence.
`Phy Link`	`Yes` — A physical link is present.
	`No` — A physical link is not present.
`Configured Mode`	`network` — The port is configured for transport network use.
	`access` — The port is configured for service access.
`Network Qos Pol`	The QoS policy ID applied to the port.
`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.
`Active Alarms`	The number of alarms outstanding on this port.

Label	Description (Continued)
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.
Alarm State	The current alarm state of the port.
Collect Stats	Enabled — The collection of accounting and statistical data for the network Ethernet port is enabled. When applying accounting policies the data by default will be collected in the appropriate records and written to the designated billing file. Disabled — Collection is disabled. Statistics are still accumulated by the CFM cards, however, the CPU will not obtain the results and write them to the billing file.
Down-When-Looped	Shows whether the feature is enabled or disabled.
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.
Egress Buf (Acc)	The access-buffer policy for the egress buffer.
Egress Buf (Net)	The network-buffer policy for the egress buffer.
Egress Pool Size	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.
Ingress Buf (Acc)	The access-buffer policy for the ingress buffer.
Ingress Pool Size	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.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.
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.

Label	Description (Continued)
Unicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sub-layer. 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 sub-layer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Broadcast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Discards Input/Output	The number of inbound 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 which 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 which 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.
Errors	For ATM, this field displays the number of cells discarded due to uncorrectable HEC errors. Errors do not show up in the raw cell counts.
LLF Admin State	Displays the Link Loss Forwarding administrative state.
LLF Oper State	Displays the Link Loss Forwarding operational state.

Sample Output

```
A:ALA-251# show port 1/2/1 detail
===============================================================================
Ethernet Interface
===============================================================================
```

```
Description        : 10/100 Ethernet TX
Interface          : 1/2/1                        Oper Speed       : 0 mbps
Link-level         : Ethernet                     Config Speed     : 100 mbps
Admin State        : up                           Oper Duplex      : N/A
Oper State         : down                         Config Duplex    : full
Physical Link      : No                           MTU              : 1514
IfIndex            : 37781504                     Hold time up     : 0 seconds
Last State Change  : 01/03/2008 15:17:00          Hold time down   : 0 seconds
Last Cleared Time  : 01/03/2008 15:17:01
Last Cleared Time  : 01/03/2008 15:17:01

Configured Mode    : network                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                       QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                          Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default
Egr. Sched. Pol    : n/a
Auto-negotiate     : false                        MDI/MDX          : unknown
Accounting Policy  : None                         Collect-stats    : Disabled
Egress Rate        : Default                      Ingress Rate     : Default
Load-balance-algo  : default                      LACP Tunnel      : Disabled

Down-when-looped   : Disabled                     Keep-alive       : 10
Loop Detected      : False                        Retry            : 120

Configured Address : 14:30:01:02:00:01
Hardware Address   : 14:30:01:02:00:01
Cfg Alarm          :
Alarm Status       :
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                                0                      0
Errors                                                 0                      0
===============================================================================
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
CSE              :                   0  Excess Collisns  :                     0
Too long Frames  :                   0  Int MAC Tx Errs  :                     0
Symbol Errors    :                   0  Int MAC Rx Errs  :                     0
================================================================================
Queue Statistics
================================================================================
Ingress Queue  1             Packets                 Octets
     In Profile  forwarded :    0                      0
     In Profile  dropped   :    0                      0
     Out Profile forwarded :    0                      0
...
Egress Queue  8              Packets                 Octets
     In Profile  forwarded :    0                      0
     In Profile  dropped   :    0                      0
     Out Profile forwarded :    0                      0
     Out Profile dropped   :    0                      0
================================================================================
A:ALA-251#


A:ALA-251# show port 1/1/1
================================================================================
Ethernet Interface
================================================================================
Description       : 1-Gig Ethernet SFP
Interface         : 1/1/5                        Oper Speed     : N/A
Link-level        : Ethernet                     Config Speed   : N/A
Admin State       : up                           Oper Duplex    : N/A
Oper State        : down                         Config Duplex  : N/A
Physical Link     : No                           MTU            : 1514
IfIndex           : 35815424                     Hold time up   : 0 seconds
Last State Change : 06/06/2007 13:35:41Hold time down           : 0 seconds
Last Cleared Time : N/A

Configured Mode   : access                       Encap Type     : null
Dot1Q Ethertype   : 0x8100                       QinQ Ethertype: 0x8100
Net. Egr. Queue Pol: default
Egr. Sched. Pol   : n/a
Auto-negotiate    : true                         MDI/MDX        : N/A
Accounting Policy : None                         Collect-stats  : Disabled
Egress Rate       : Default                      Ingress Rate   : Default
Load-balance-algo : default                      LACP Tunnel    : Disabled

Down-when-looped  : Disabled                     Keep-alive     : 10
Loop Detected     : False                        Retry          : 120

Configured Address: 8c:1f:01:01:00:05
Hardware Address  : 8c:1f:01:01:00:05
Cfg Alarm         :
Alarm Status      : linkLossFwd
```

```
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                                 0               42302904
Packets                                                0                 547917
Errors                                                 0                      0
===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                        0                      0
Multicast Packets                                      0                 296019
Broadcast Packets                                      0                 251898
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
CSE              :                  0  Excess Collisns  :                     0
Too long Frames  :                  0  Int MAC Tx Errs  :                     0
Symbol Errors    :                  0  Int MAC Rx Errs  :                     0
===============================================================================
A:ALA-251#
```

Ethernet Output — The following table describes Ethernet output fields.

Label	Description
Broadcast Pckts	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Multicast Pckets	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Undersize Pckets	The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed.

Label	Description (Continued)
Oversize Pckts	The total number of packets received that were longer than can be accepted by the physical layer of that port (9900 octets excluding framing bits, but including FCS octets for GE ports) and were otherwise well formed.
Collisions	The best estimate of the total number of collisions on this Ethernet segment.
Drop Events	The total number of events in which packets were dropped by the probe due to lack of resources. Note that this number is not necessarily the number of packets dropped; it is just the number of times this condition has been detected.
CRC Align 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 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 less than 64 octets in length (excluding framing bits but including FCS octets) and 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), and 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).
Ingress Pool Size	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.
Octets	The total number of octets received.
Packets	The total number of packets received.
Packets to	The number of packets received that were equal to or less than the displayed octet limit.

Sample Output

```
===============================================================================
Ethernet Statistics
===============================================================================
Broadcast Pckts  :              42621  Drop Events      :                    0
Multicast Pckts  :                  0  CRC/Align Errors :                    0
Undersize Pckts  :                  0  Fragments        :                    0
Oversize Pckts   :                  0  Jabbers          :                    0
Collisions       :                  0
```

```
Octets                         :          2727744
Packets                        :            42621
Packets of 64 Octets           :            42621
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                                   42621                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================
...
```

Ethernet-like Medium Statistics Output — The following table describes Ethernet-like medium statistics output fields.

Label	Description
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 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 on a particular interface 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 on a particular interface.
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame on a particular interface.
Too long Frames	The number of frames received on a particular interface 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.
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 on a particular interface later than one slotTime into the transmission of a packet.

Label	Description (Continued)
Excess Collisns	The number of frames for which transmission on a particular interface fails due to excessive collisions.
Int MAC Tx Errs	The number of frames for which transmission on a particular interface fails due to an internal MAC sublayer transmit error,
Int MAC Rx Errs	The number of frames for which reception on a particular interface fails due to an internal MAC sublayer receive error.

Sample Output

```
A:ALA-48# show port 1/3/1 detail
===============================================================================
...
===============================================================================
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
===============================================================================
Queue Statistics
===============================================================================
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
Ingress Queue  2             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  3             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  4             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  5             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
Ingress Queue  6             Packets                 Octets
     In Profile  forwarded :    0                       0
     In Profile  dropped   :    0                       0
     Out Profile forwarded :    0                       0
     Out Profile dropped   :    0                       0
```

```
...
===============================================================================
A:ALA-48#
```

Port Associations Output — The following table describes port associations output fields.

Label	Description
Svc ID	The service identifier.
Name	The name of the IP interface.
Encap Value	The dot1q or qinq encapsulation value on the port for this IP interface

Sample Output

```
A:ALA-1# show port 1/1/6 associations
==============================================================================
Interface Table
==============================================================================
Router/ServiceId                Name                            Encap Val
------------------------------------------------------------------------------
Router: Base                    if1000                          1000
Router: Base                    if2000                          2000
------------------------------------------------------------------------------
Interfaces
==============================================================================
A;ALA-1#
```

Port Frame Relay Output — The following table describes port Frame Relay output fields.

Label	Description
Mode	Displays the mode of the interface. It can be set as Data terminal equipment (dte) or Data circuit-terminating equipment (DCE).
LMI Type	Displays the LMI type.
FR Interface Status	Displays 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.

```
A:ALA-49>config>port# show port 1/1/2 frame-relay
===============================================================================
Frame Relay Info for 1/1/2
===============================================================================
Mode                    : dte          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
```

```
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
===============================================================================
A:ALA-49>config>port#
```

Port PPP Output — The following table describes port PPP output fields.

Label	Description
Protocol	Displays the applicable protocols for the specified port.
State	Displays the current status of a PPP link. Values include initial, starting, closed, stopped, closing, stopping, requestSent, ackReceived, ackSent, opened.
Last Change	Displays the last time the PPP link state changed.
Restart Count	Displays the number of times that this Control Protocol has reached the 'open' state.
Last Cleared	Displays the date and time the restart count was set to zero.
Local IP address	Displays the IP address assigned the local end of the PPP link.
Remote IP address	Displays the IP address of the remote end of the PPP link.
Local Mac address	Displays the MAC address assigned 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	Displays 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 of remote magic number, then it is possible that the link might be looped back. If the two magic numbers do not match, then the link is not looped back.
Remote Magic Number	Displays the magic number sent by the peer. If the value of 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, then the link is not looped back.
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	Displays the number of times that the drop count was reached.
Drop Count	Displays the number of keepalive or LQR messages that were missed before the line was brought down.

Label	Description (Continued)
In Packets	The number of echo-reply packets received.
Time to link drop	Displays the time remaining before the link will be declared dropped if a keepalive echo reply packet is not received.
Out packets	Displays the number of echo-request packets sent.
Last cleared time	Displays the time since the last clear.

Sample Output

```
A:SR-007# show port 1/1/1.1.1.1.1 ppp
===============================================================================
PPP Protocols for 1/1/1.1.1.1.1
===============================================================================
Protocol  State         Last Change         Restart Count   Last Cleared
-------------------------------------------------------------------------------
lcp       opened        03/28/2007 13:06:28          7      03/28/2007 12:12:11
ipcp      initial       03/28/2007 11:39:45          0      03/28/2007 12:12:11
mplscp    initial       03/28/2007 11:39:45          0      03/28/2007 12:12:11
bcp       initial       03/28/2007 11:39:45          0      03/28/2007 12:12:11
osicp     opened        03/28/2007 13:06:28         12      03/28/2007 12:12:11
ipv6cp    opened        03/28/2007 13:06:28          7      03/28/2007 12:12:11
===============================================================================
===============================================================================
PPP Statistics
===============================================================================
Local Mac address  : 00:03:fa:0e:76:e2  Remote Mac address : 00:00:00:00:00:00
Local Magic Number : 0x7e9a9            Remote Magic Number: 0x7e18b
Local IPv4 address : 0.0.0.0            Remote IPv4 address: 0.0.0.0
Local IPv6 address : FE80::203:FAFF:FE81:5888
Remote IPv6 address: FE80::203:FAFF:FE1A:7EE2
Line Monitor Method: keepalive
Keepalive statistics
Request interval   : 10           Threshold exceeded : 0
Drop Count         : 3            In packets         : 332
Time to link drop  : 00h00m30s    Out packets        : 332
Last cleared time  : 03/28/2007 12:12:11
===============================================================================
A:SR-007#


A:SR-007# show port 1/1/3 ppp detail
===============================================================================
PPP Protocols for 1/1/3.sts12
===============================================================================
Protocol  State         Last Change         Restart Count   Last Cleared
-------------------------------------------------------------------------------
lcp       initial       04/11/2007 10:56:11          0      04/11/2007 10:56:11
ipcp      initial       04/11/2007 10:56:11          0      04/11/2007 10:56:11
mplscp    initial       04/11/2007 10:56:11          0      04/11/2007 10:56:11
bcp       initial       04/11/2007 10:56:11          0      04/11/2007 10:56:11
osicp     initial       04/11/2007 10:56:11          0      04/11/2007 10:56:11
===============================================================================
PPP Statistics
===============================================================================
```

```
Local IP address   : 0.0.0.0            Remote IP address  : 0.0.0.0
Local Mac address  : 00:00:00:00:00:00  Remote Mac address : 00:00:00:00:00:00
Local Magic Number : 0x0                Remote Magic Number: 0x0
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  : 04/11/2007 10:56:11
===============================================================================
A:SR-007#
```

```
*A:Performance# show port 1/1/4 detail
===============================================================================
...
Transceiver Digital Diagnostics Monitoring
===============================================================================
                             Value   HighAlarm  High Warn  Low  Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)               +128   YES   +85  YES   +70  NO     -5  NO    -15
Supply Voltage (V)            6.55   YES  6.00  YES  4.50  NO    3.0  NO    1.0
Tx Bias Current (mA)           100   NO    128  NO    110  YES    50  NO     30
Tx Output Power (dBm)        -40.0   NO   +8.0  NO   +5.0  YES -10.0  YES -30.0
Rx Optical Power (dBm - yyy)   N/A   NO   +8.0  NO   +5.0  NO  -10.0  NO  -30.0
===============================================================================
...
*A:Performance#
```

cem

Syntax **cem**

Context show>port

Description This command displays CEM encap ports and channels.

Sample Output

```
*A:NS062480023# show port cem
==============================================================================
Ports on Slot 1
==============================================================================
Port              Admin Link Port    Clock        Master            Clock
Id                State      State   Src          Port Id           State
------------------------------------------------------------------------------
1/9/1.1.1         Up    No   Down    differential 1/9/1.1.2.1       hold-over
1/9/1.1.1.1       Up    No   Down
1/9/1.1.2         Up    No   Down    differential 1/9/1.1.2.1       hold-over
1/9/1.1.2.1       Up    No   Down
1/9/1.1.3         Up    No   Down    node-timed
1/9/1.1.3.1       Up    No   Down
1/9/1.1.4         Up    No   Down    node-timed
...
------------------------------------------------------------------------------
*A:NS062480023#
```

port

Syntax
port *port-id* **atm connections**
port *port-id* **atm ilmi**
port *port-id* **atm interlace-connection** [**detail**]
port *port-id* **atm pvc** [*vpi*[/*vci*]] [**detail**]
port *port-id* **atm pvp** [*vpi*] [**detail**]
port *port-id* **atm pvt** [*vpi-range*] [**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 MDAs.

Parameters *port-id* — Specifies the physical port ID.

Syntax *slot*[/*mda*[/*port*]]

atm — Displays ATM information.

connections — Displays ATM connection information.

port-connections — Displays ATM port connection information.

pvc — Displays ATM port PVC information.

pvp — Displays ATM port PVP information.

pvt — Displays ATM port PVT information.

vpi-range	vpi:	0 — 4095 (NNI) 0 — 255 (UNI)
	vpi:	0 — 4095 (NNI) 0 — 255 (UNI)
vpi/vci	vpi:	0 — 4095 (NNI) 0 — 255 (UNI)
	vci:	1, 2, 5 — 65534

detail — Provides detailed information.

Sample Output

```
A:ALA-2934 show mda 1/3 detail (ATM MDA)
===========================================================================
MDA 1/3 detail
===========================================================================
Slot Mda  Provisioned          Equipped             Admin    Operational
          Mda-type             Mda-type             State    State
---------------------------------------------------------------------------
1    3    m4-atmoc12/3-sfp     m4-atmoc12/3-sfp     up       up

MDA Specific Data
    Maximum port count            : 4
    Number of ports equipped      : 4
    Transmit timing selected      : CPM Card B
    Sync interface timing status  : Qualified
```

```
    Network ingress queue policy  : default
    Capabilities                  : Sonet, ATM
    Min channel size              : Sonet STS-12
    Max channel size              : Sonet STS-12
    Max number of channels        : 4
    Channels in use               : 0
Hardware Data
    Part number                   : 3HE00071AAAB01
    CLEI code                     : IPPAAAYBAA
    Serial number                 : NS051310104
    Manufacture date              : 03292005
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 32C
    Temperature threshold         : 75C
    Time of last boot             : 2007/04/11 13:46:57
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:4a:34:90
===========================================================================
A:ALA-2934#
```

Output **Port ATM Output —** The following table describes ATM output fields.

Label	Description
`Cell Mode`	Displays the cell format (UNI or NNI) that is used on the ATM interface.
`Configured VCs`	Displays the number of configured VCs.
`Max Supported VCs`	Indicates the maximum number of ATM VPCs that can be configured on this MDA.
`Interface Oper Status`	Indicates the status of the ATM interface. If the SONET-PATH layer and TC sublayer are operationally up, the ATM Interface is considered up. If the SONET-PATH layer and/or TC SubLayer is down, the ATM Interface is set to lowerLayerDown.
`Number OCD Events`	Displays the number of times the Out of Cell Delineation (OCD) events occurred
`TC Alarm State`	Displays notifications that are generated when the ATM interface indicates that the TC sublayer is currently in the Loss of Cell Delineation (LCD) defect maintenance state or when the TC sublayer is currently not in the Loss of Cell Delineation (LCD) defect maintenance state.
`Last Unknown VPI/VCI`	Indicates the last unknown VPI/VCI that was received on this interface.
`Ingress CBR`	Indicates the total CBR bandwidth consumed on this interface in the ingress direction.
`Egress CBR`	Indicates the total CBR bandwidth consumed on this interface in the egress direction.

Label	Description (Continued)
Ingress RT-VBR	Indicates the total real-time variable bit rate (rt-VBR) bandwidth consumed on this interface in the ingress direction.
Egress RT-VBR	Indicates the total real-time variable bit rate (rt-VBR) bandwidth consumed on this interface in the egress direction.
Ingress NRT-VBR	Indicates the total non-real-time variable bit rate (nrt-VBR) bandwidth consumed on this interface in the ingress direction.
Egress NRT-VBR	Indicates the total non-real-time variable bit rate (nrt-VBR) bandwidth consumed on this interface in the egress direction.
Ingress UBR	Indicates the total unspecified bit rate (UBR) bandwidth consumed on this interface in the ingress direction.
Egress UBR	Indicates the total unspecified bit rate (UBR) bandwidth consumed on this interface in the egress direction.
Ingress Total	Indicates the number of valid ATM cells received by the ATM interface including both CLP=0 and CLP=1 cells. If traffic policing is implemented, then cells are counted prior to the application of traffic policing.
ATM Link Bandwidth	Indicates the total ATM link bandwidth accepted on this interface.
Shaped Bandwidth	Indicates the total shaped bandwidth consumed on this interface in the egress direction.
HEC Errors (Dropped)	Indicates the number of cells with uncorrectable HEC errors on this interface.

Sample Output

```
A:ALA-1# show port 1/1/2 atm
===============================================================================
ATM Info for 1/1/2
===============================================================================
Cell Mode              : UNI
Configured VCs         : 1                   Max Supported VCs  : 2000
Interface Oper Status : lower layer down  Number OCD Events  : 0
TC Alarm State         : LCD Failure
Last Unknown VPI/VCI  : none
=========================================================================
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     : 4000       1%  Egress NRT-VBR     : 0          0%
Ingress UBR         : 0          0%  Egress UBR         : 0          0%
-------------------------------------------------------------------------
Ingress Total       : 4000       1%  Egress Total       : 0          0%
ATM Link Bandwidth : 599041 kbps
```

```
Shaped Bandwidth   : 0 kbps
=======================================================================
A:ALA-1#


A:SR1_2>config>port>sonet-sdh>path# show port 1/1/1 atm detail
=============================================================================
ATM Info for 1/1/1
=============================================================================
Cell Mode            : UNI
Configured VCs       : 2                  Max Supported VCs  : 510
Interface Oper Status: lower layer down   Number OCD Events  : 3333
TC Alarm State       : No Alarm
Last Unknown VPI/VCI : none
=======================================================================
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
=======================================================================
ATM Statistics
===============================================================================
                     Input    Output
-------------------------------------------------------------------------------
Octets               62900654400 62901900430
Cells                1186804800 1186828310
Unknown VPI/VCI Cells 0
HEC Errors (Dropped) 29
HEC Errors (Fixed)   0
===============================================================================
AAL-5 Packet Statistics
===============================================================================
                     Input    Output
-------------------------------------------------------------------------------
Packets              318307680 318331190
Dropped Packets      0        0
CRC-32 Errors        0
===============================================================================
A:SR1_2>config>port>sonet-sdh>path#
```

ATM PVC Output — The following table describes ATM PVC output fields.

Label	Description
`VPI/VCI`	Displays the VPI/VCI values.
`Owner`	Identifies the system entity that owns a specific ATM connection.
`Type`	Indicates the connection type.

Label	Description (Continued)
`Ing. TD`	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
`Egr. TD`	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
`Adm`	Displays the administrative state of the interface connection.
`OAM`	Indicates the OAM operational status of ATM connections. ETE indicates end-to-end connection. AIS denotes alarm indication signal. RDI denotes for remote defect indication. LOC indicates the alarm was due to loss of continuity.
`Opr`	Indicates the status of the ATM interface.

Sample Output

```
A:ALA-1# show port 1/1/2 atm pvc
================================================================
ATM Endpoints, Port 1/1/2
================================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
----------------------------------------------------------------
0/500      SAP    PVC      5       3       up   ETE-AIS     dn
================================================================
A:ALA-1#
```

Output **Port ATM PVC VP/VCI Output —** The following table describes port ATM PVC VPI/VCI output fields.

Label	Description
`Port Id`	The port ID configured or displayed in the *slot/mda/port* format.
`VPI/VCI`	Displays the VPI/VCI values.
`Admin State`	Displays the administrative state of the interface connection.
`Oper State`	Indicates the status of the ATM interface.
`OAM State`	Indicates the OAM operational status of ATM connections. ETE indicates end-to-end connection. AIS denotes alarm indication signal. RDI denotes for remote defect indication. LOC indicates the alarm was due to loss of continuity.
`Encap Type`	Indicates the encapsulation type.

Label	Description (Continued)
`Owner`	Identifies the system entity that owns a specific ATM connection.
`Type`	Indicates the connection type.
`Ing. TD`	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
`Egr. TD`	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
`ILMI Vpi/Vci Range`	On links that have ILMI enabled **ok** displays only if the VPI/VCI falls within the ILMI links valid range for a connection. If n/a displays, then ILMI is not available to check.
`Adm`	Displays the administrative state of the interface connection.
`OAM`	Indicates the OAM operational status of ATM connections. ETE indicates end-to-end connection. AIS denotes alarm indication signal. RDI denotes for remote defect indication. LOC indicates the alarm was due to loss of continuity.

Sample Output

```
B:Dut-D# show port 1/1/1.1.1.1 atm
===============================================================================
ATM Info for 1/1/1.1.1.1
===============================================================================
Cell Mode             : UNI                Mapping            : Direct
Configured VCs        : 16                 Configured VPs     : 0
Configured VTs        : 0                  Configured IFCs    : 0
Configured minimum VPI: 0
Last Unknown VPI/VCI  : none
===============================================================================
TC Sublayer Information
===============================================================================
TC Alarm State        : No Alarm           Number OCD Events  : 0
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 : 1920 kbps
Shaped Bandwidth   : 0 kbps
===============================================================================
B:Dut-D#
```

```
B:Dut-D# show port 1/1/1.1.1.1 atm detail
===============================================================================
ATM Info for 1/1/1.1.1.1
===============================================================================
Cell Mode              : UNI                Mapping            : Direct
Configured VCs         : 16                 Configured VPs     : 0
Configured VTs         : 0                  Configured IFCs    : 0
Configured minimum VPI: 0
Last Unknown VPI/VCI  : none
===============================================================================
TC Sublayer Information
===============================================================================
TC Alarm State         : No Alarm           Number OCD Events  : 0
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 : 1920 kbps
Shaped Bandwidth   : 0 kbps
================================================================================
ATM Statistics
================================================================================
                                                   Input               Output
--------------------------------------------------------------------------------
Octets                                      228425945553         228453511542
Cells                                         4309923501           4310443614
Unknown VPI/VCI Cells                         4294967295
================================================================================
AAL-5 Packet Statistics
================================================================================
                                                   Input               Output
--------------------------------------------------------------------------------
Packets                                       4302445396           4302705455
Dropped Packets                                        0                    0
CRC-32 Errors                                          0
================================================================================
A:timetra-sim110#

B:Dut-D# show port 1/1/1.1.1.1 atm connections
================================================================
ATM Connections, Port 1/2/1.1.1.1
================================================================
           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
0/113      SAP    PVC      101      201      up   up          up
0/114      SAP    PVC      101      201      up   up          up
0/115      SAP    PVC      101      201      up   up          up
===============================================================
B:Dut-D#


B:Dut-D# show port 1/1/1.1.1.1 atm pvc 0/100
==============================================================================
ATM PVC
==============================================================================
Port Id            : 1/1/1.1.1.1         VPI/VCI            : 0/100
Admin State        : up                  Oper state         : up
OAM State          : up                  Encap Type         : llc
Owner              : SAP                 AAL Type           : AAL-5
Endpoint Type      : PVC                 Cast Type          : P2P
Ing. Td Idx        : 101                 Egr. Td Idx        : 201
Last Changed       : 04/11/2007 22:09:11 ILMI Vpi/Vci Range : n/a
==============================================================================
B:Dut-D#


B:Dut-D# show port 1/1/1.1.1.1 atm pvc 0/100 detail
==============================================================================
ATM PVC
==============================================================================
Port Id            : 1/1/1.1.1.1         VPI/VCI            : 0/100
Admin State        : up                  Oper state         : up
OAM State          : up                  Encap Type         : llc
Owner              : SAP                 AAL Type           : AAL-5
Endpoint Type      : PVC                 Cast Type          : P2P
Ing. Td Idx        : 101                 Egr. Td Idx        : 201
Last Changed       : 04/11/2007 22:09:11 ILMI Vpi/Vci Range : n/a
==============================================================================
ATM Statistics
===============================================================================
                                                    Input               Output
-------------------------------------------------------------------------------
Octets                                           57173273             58892699
Cells                                             1078741              1111183
===============================================================================
AAL-5 Packet Statistics
===============================================================================
                                                    Input               Output
-------------------------------------------------------------------------------
Packets                                            539382               555603
Dropped Packets                                         0                    0
CRC-32 Errors                                           0
Reassembly Timeouts                                     0
Over Sized SDUs                                         0
===============================================================================
ATM OAM Statistics
===============================================================================
                                                    Input               Output
-------------------------------------------------------------------------------
```

```
AIS                                                         0                        0
RDI                                                         0                        1
Loopback                                                    0                        0
CRC-10 Errors                                               0
Other                                                       0
===============================================================================
B:Dut-D#
```

Output **Port ATM PVC Detail Output —** The following table describes port ATM PVC detail output fields.

Label	Description
Port Id	The port ID configured or displayed in the *slot/mda/port* format.
VPI/VCI	Displays the VPI/VCI values.
Admin State	Displays the administrative state of the interface connection.
Oper State	Indicates the status of the ATM interface.
OAM State	Indicates the OAM operational status of ATM connections. ETE indicates end-to-end connection. AIS denotes alarm indication signal. RDI denotes for remote defect indication. LOC indicates the alarm was due to loss of continuity.
Encap Type	Indicates the encapsulation type.
Owner	Identifies the system entity that owns a specific ATM connection.
AAL Type	Displays ATM Adaptation Layer 5 (AAL5) information.
Endpoint Type	Displays the endpoint type.
Cast Type	Indicates the connection topology type.
Type	Indicates the connection type.
Ing. Td Idx	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
Egr. Td Idx	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
Last Changed	Indicates the date and time when the interface connection entered its current operational state.
Octets	Displays the number of input and output octets. HEC discarded cells are not included in the input octet numbers
Cells	Displays the number of input and output cells. HEC discarded cells are not included in the input cell numbers

Label	Description (Continued)
Packets	Displays the number of input and output packets. Packets discarded due to HEC or oversize discards are not counted. CRC errors are also in the packet counts show up on the VC level statistics but not on the port level.
Dropped Packets	Displays the number of packets dropped by the ATM SAR device.
CRC-32 Errors	Displays the number of valid AAL-5 SDUs and AAL-5 SDUs with CRC-32 errors received by the AAL-5 VCC.
Reassembly Time-outs	Displays the number of reassembly timeout occurrences.
Over Sized SDUs	Displays the total number of oversized SDU discards.
AIS	Displays the number of AIS cells transmitted and received on this connection for both end to end and segment.
RDI	Displays the number of RDI cells transmitted and received on this connection for both end to end and segment.
Loopback	Displays the number of loopback requests and responses transmitted and received on this connection for both end to end and segment.
CRC-10 Errors	Displays the number of cells discarded on this VPL with CRC 10 errors.
Other	Displays the number of OAM cells that are received but not identified.

Sample Output

```
A:ALA-1# show port 1/1/2 atm pvc 0/500 detail
===============================================================================
ATM Endpoint
===============================================================================
Port Id            : 1/1/2                 VPI/VCI            : 0/500
Admin State        : up                    Oper state         : down
OAM State          : ETE-AIS               Encap Type         : llc
Owner              : SAP                   AAL Type           : AAL-5
Endpoint Type      : PVC                   Cast Type          : P2P
Ing. Td Idx        : 5                     Egr. Td Idx        : 3
Last Changed       : 04/11/2007 14:15:12
===============================================================================
ATM Statistics
================================================================================
                                                    Input                 Output
--------------------------------------------------------------------------------
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
-------------------------------------------------------------------------------
AIS                                                    0                      0
RDI                                                    0                      0
Loopback                                               0                      0
CRC-10 Errors                                          0
Other                                                  0
===============================================================================
A:ALA-1#
```

Output **Port ATM PVT Detail Output —** The following table describes port ATM PVT detail output fields.

Label	Description
Port Id	The port ID configured or displayed in the *slot/mda/port* format.
VPI/VCI	Displays the VPI/VCI values.
Admin State	Displays the administrative state of the interface connection.
Oper State	Indicates the status of the ATM interface.
Encap Type	Indicates the encapsulation type.
Owner	Identifies the system entity that owns a specific ATM connection.
Endpoint Type	Displays the endpoint type.
Cast Type	Indicates the connection topology type.
Ing. Td Idx	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
Egr. Td Idx	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
Last Changed	Indicates the date and time when the interface connection entered its current operational state.
Octets	Displays the number of input and output octets. HEC discarded cells are not included in the input octet numbers.
Cells	Displays the number of input and output cells. HEC discarded cells are not included in the input cell numbers.
Dropped CLP	Displays the number of times the CLP1 cells have been dropped. CLP1 cells have lower priority than CLP0 cells and are expected to be discarded first in times of congestion.
Dropped Cells	Displays the number of cells dropped by the ATM SAR device.

Label	Description (Continued)
`Tagged Cells`	Displays the number of cells that have been demoted from CLP0 to CLP1.

Sample Output

```
A:SR1_5>config>service# show port 1/1/2 atm pvt 0.0 detail
==============================================================================
ATM PVT
==============================================================================
Port Id            : 1/2/2                 VPI Range          : 0.0
Admin State        : up                    Oper state         : up
Owner              : SAP
Endpoint Type      : PVT                   Cast Type          : P2P
Ing. Td Idx        : 1                     Egr. Td Idx        : 1
Last Changed       : 04/11/2007 01:59:21
==============================================================================

===============================================================================
ATM Statistics
===============================================================================
                                                  Input                  Output
-------------------------------------------------------------------------------
Octets                                                0                       0
Cells                                                 0                       0
CLP=0 Cells                                           0                       0
Dropped CLP=0 Cells                                   0                       0
Dropped Cells (CLP=0+1)                               0
Tagged Cells                                          0
===============================================================================
A:SR1_5>config>service#
```

port-tree

Syntax **port-tree** *port-id*

Context show

Description This command displays the tree for SONET/SDH.

Parameters *port-id* — Specifies the physical port ID.

Syntax: *slot/mda/port*[.*channel*]

MDA Values 7710 SR-c12: 1, 3, 5, 7, 9, 11
7710 SR-c4: 1, 3

CMA Values 7710 SR-c12: 1-12
7710 SR-c4: 1-4

MDA Values

Output **Show Port Tree Output —** The following table describes show port tree output fields.

Label	Description
`IfIndex`	Displays the interface's index number which reflects its initialization sequence.
`type`	Specifies the type.
`sonet-sdh-index`	Specifies the sonet-sdh-index.
`*`	When a * is displayed after the sonet-sdh-index, the port/channel is provisioned.

Sample Output

```
A:ALA-48>config# show port-tree 1/1/1

    ifIndex  type, sonet-sdh-index (* = provisioned)
===========  =====================================
  119570432  Port, N/A *
  656441345      DS3, none *
  656441405          DS1, 1 *
  656441430          DS1, 2
  656441455          DS1, 3
  656441480          DS1, 4
  656441505          DS1, 5
  656441530          DS1, 6
  656441555          DS1, 7
  656441580          DS1, 8
  656441605          DS1, 9
  656441630          DS1, 10
  656441655          DS1, 11
  656441680          DS1, 12
  656441705          DS1, 13
  656441730          DS1, 14
  656441755          DS1, 15
  656441780          DS1, 16
  656441805          DS1, 17
  656441830          DS1, 18
  656441855          DS1, 19
  656441880          DS1, 20
  656441905          DS1, 21
  656441930          DS1, 22
  656441980          DS1, 24
  656442005          DS1, 25
  656442030          DS1, 26
  656442055          DS1, 27
  656442080          DS1, 28
A:ALA-48>config#
```

redundancy

Syntax **redundancy**

Context show

Description This command enables the context to show multi-chassis redundancy information.

multi-chassis

Syntax **multi-chassis all**
mult-chassis mc-lag peer *ip-address* [**lag** *lag-id*]
mult-chassis mc-lag [**peer** *ip-address* [**lag** *lag-id*]] **statistics**
mult-chassis sync [**peer** *ip-address*] [**detail**]
mult-chassis sync [**peer** *ip-address*] **statistics**

Context show>redundancy

Description This command displays multi-chassis redundancy information.

Parameters **all —** Displays all multi-chassis information.

mc-lag — Displays multi-chassis LAG information.

peer *ip-address* **—** Displays the address of the multi-chassis peer.

lag *lag-id* **—** Displays the specified LAG ID on this system that forms an multi-chassis LAG configuration with the indicated peer.

statistics — Displays statistics for the multi-chassis peer.

sync — Displays synchronization information.

detail — Displays detailed information.

Sample Output

```
A:pc1# show redundancy multi-chassis all
===============================================================================
Multi-Chassis Peers
===============================================================================
Peer IP          Src IP           Auth             Peer Admin
  MCS Admin        MCS Oper         MCS State        MC-LAG Admin    MC-LAG Oper
-------------------------------------------------------------------------------
10.10.10.102     10.10.10.101     hash             Enabled
  Enabled          Enabled          inSync           Enabled         Enabled
10.10.20.1       0.0.0.0          None             Disabled
  --               --               --               Disabled        Disabled
===============================================================================
A:pc1#


*A:Dut-C# show redundancy multi-chassis mc-lag peer 10.10.10.1
===============================================================================
Multi-Chassis MC-Lag Peer 10.10.10.1
===============================================================================
Last State chg: 09/24/2007 07:58:03
Admin State: Up      Oper State    : Up
KeepAlive: 10 deci-seconds     Hold On Ngbr Failure : 3
-------------------------------------------------------------------------------
Lag Id Lacp Key Remote Lag Id System Id  Sys Prio Last State Changed
```

```
-------------------------------------------------------------------------------
1      32666    1      00:00:00:33:33:33  32888  09/24/2007 07:56:35
-------------------------------------------------------------------------------
Number of LAGs : 1
===============================================================================
*A:Dut-C#

A:pc1# show redundancy multi-chassis mc-lag statistics
===============================================================================
Multi-Chassis Statistics
===============================================================================
Packets Rx                         : 129816
Packets Rx Keepalive               : 129798
Packets Rx Config                  : 3
Packets Rx Peer Config             : 5
Packets Rx State                   : 10
Packets Dropped KeepaliveTask      : 0
Packets Dropped Packet Too Short   : 0
Packets Dropped Verify Failed      : 0
Packets Dropped Tlv Invalid Size   : 0
Packets Dropped Out of Seq         : 0
Packets Dropped Unknown Tlv        : 0
Packets Dropped Tlv Invalid LagId  : 0
Packets Dropped MD5                : 0
Packets Dropped Unknown Peer       : 0
Packets Tx                         : 77918
Packets Tx Keepalive               : 77879
Packets Tx Config                  : 6
Packets Tx Peer Config             : 26
Packets Tx State                   : 7
Packets Tx Failed                  : 0
===============================================================================
A:pc1#


A:pc1# show redundancy multi-chassis mc-lag peer 10.10.10.102 lag 2 statistics
===============================================================================
Multi-Chassis Statistics, Peer 10.10.10.102 Lag 2
===============================================================================
Packets Rx Config                  : 1
Packets Rx State                   : 4
Packets Tx Config                  : 2
Packets Tx State                   : 3
Packets Tx Failed                  : 0
===============================================================================
A:pc1#


A:pc1#show redundancy multi-chassis mc-lag peer 10.10.10.102 statistics
===============================================================================
Multi-Chassis Statistics, Peer 10.10.10.102
===============================================================================
Packets Rx                         : 129918
Packets Rx Keepalive               : 129900
Packets Rx Config                  : 3
Packets Rx Peer Config             : 5
Packets Rx State                   : 10
Packets Dropped State Disabled     : 0
Packets Dropped Packets Too Short  : 0
Packets Dropped Tlv Invalid Size   : 0
Packets Dropped Tlv Invalid LagId  : 0
```

```
Packets Dropped Out of Seq        : 0
Packets Dropped Unknown Tlv       : 0
Packets Dropped MD5               : 0
Packets Tx                        : 77979
Packets Tx Keepalive              : 77940
Packets Tx Peer Config            : 26
Packets Tx Failed                 : 0
===============================================================================
A:pc1#


A:pc1# show redundancy multi-chassis sync
===============================================================================
Multi-chassis Peer Table
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 10.10.10.102
Description             : CO1
Authentication          : Enabled
Source IP Address       : 10.10.10.101
Admin State             : Enabled
-------------------------------------------------------------------------------
Sync-status
-------------------------------------------------------------------------------
Client Applications     :
Sync Admin State        : Up
Sync Oper State         : Up
DB Sync State           : inSync
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 10.10.20.1
Authentication          : Disabled
Source IP Address       : 0.0.0.0
Admin State             : Disabled
===============================================================================
A:pc1#

pc1# show redundancy multi-chassis sync peer 10.10.10.102
===============================================================================
Multi-chassis Peer Table
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 10.10.10.102
Description             : CO1
Authentication          : Enabled
Source IP Address       : 10.10.10.101
Admin State             : Enabled
-------------------------------------------------------------------------------
Sync-status
-------------------------------------------------------------------------------
Client Applications     :
Sync Admin State        : Up
```

```
Sync Oper State         : Up
DB Sync State           : inSync
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
===============================================================================
MCS Application Stats
===============================================================================
Application             : igmp
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
-------------------------------------------------------------------------------
Application             : igmpSnooping
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
-------------------------------------------------------------------------------
Application             : subMgmt
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
-------------------------------------------------------------------------------
Application             : srrp
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
===============================================================================
A:pc1#

A:pc1# show redundancy multi-chassis sync peer 10.10.10.102 detail
===============================================================================
Multi-chassis Peer Table
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 10.10.10.102
Description             : CO1
Authentication          : Enabled
Source IP Address       : 10.10.10.101
Admin State             : Enabled
-------------------------------------------------------------------------------
```

```
Sync-status
-------------------------------------------------------------------------------
Client Applications     :
Sync Admin State        : Up
Sync Oper State         : Up
DB Sync State           : inSync
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
===============================================================================
MCS Application Stats
===============================================================================
Application             : igmp
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
-------------------------------------------------------------------------------
Application             : igmpSnooping
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
-------------------------------------------------------------------------------
Application             : subMgmt
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
-------------------------------------------------------------------------------
Application             : srrp
Num Entries             : 0
Lcl Deleted Entries     : 0
Alarm Entries           : 0
-------------------------------------------------------------------------------
Rem Num Entries         : 0
Rem Lcl Deleted Entries : 0
Rem Alarm Entries       : 0
===============================================================================
Ports synced on peer 10.10.10.102
===============================================================================
Port/Encap                    Tag
-------------------------------------------------------------------------------
1/1/1
  1-2                         r1
===============================================================================
A:pc1#
```

```
A:pc1# show redundancy multi-chassis sync statistics
===============================================================================
Multi-chassis Peer Sync Stats
===============================================================================
Peer IP Address         : 10.10.10.102
Packets Tx Total        : 511
Packets Tx Hello        : 510
Packets Tx Data         : 0
Packets Tx Other        : 1
Packets Tx Error        : 0
Packets Rx Total        : 511
Packets Rx Hello        : 510
Packets Rx Data         : 0
Packets Rx Other        : 1
Packets Rx Error        : 0
Packets Rx Header Err   : 0
Packets Rx Body Err     : 0
Packets Rx Seq Num Err  : 0
===============================================================================
Peer IP Address         : 10.10.20.1
Packets Tx Total        : 0
Packets Tx Hello        : 0
Packets Tx Data         : 0
Packets Tx Other        : 0
Packets Tx Error        : 0
Packets Rx Total        : 0
Packets Rx Hello        : 0
Packets Rx Data         : 0
Packets Rx Other        : 0
Packets Rx Error        : 0
Packets Rx Header Err   : 0
Packets Rx Body Err     : 0
Packets Rx Seq Num Err  : 0
===============================================================================
A:pc1#

A:pc1# show redundancy multi-chassis sync peer 10.10.10.102 statistics
===============================================================================
Multi-chassis Peer Sync Stats
===============================================================================
Peer IP Address         : 10.10.10.102
Packets Tx Total        : 554
Packets Tx Hello        : 553
Packets Tx Data         : 0
Packets Tx Other        : 1
Packets Tx Error        : 0
Packets Rx Total        : 554
Packets Rx Hello        : 553
Packets Rx Data         : 0
Packets Rx Other        : 1
Packets Rx Error        : 0
Packets Rx Header Err   : 0
Packets Rx Body Err     : 0
Packets Rx Seq Num Err  : 0
===============================================================================
A:pc1#
```

mc-ring

Syntax **mc-ring peer** *ip-address* **statistics**
mc-ring peer *ip-address* [**ring** *sync-tag* [**detail|statistics**]]
mc-ring peer *ip-address* **ring** *sync-tag* **ring-node** [*ring-node-name* [**detail|statistics**]]
mc-ring global-statistics

Context show>redundancy>multi-chassis

Description This command displays multi-chassis ring information.

Parameters *ip-address* — Specifies the address of the multi-chassis peer to display.

ring *sync-tag* **—** Specifies a synchronization tag to be displayed that was used while synchronizing this port with the multi-chassis peer.

node *ring-node-name* **—** Specifies a ring-node name.

global-statistics — Displays global statistics for the multi-chassis ring.

detail — Displays detailed peer information for the multi-chassis ring.

Output **Show mc-ring peer ip-address ring Output —** The following table describes mc-ring peer ip-address ring output fields.

Label	Description
`Sync Tag`	Displays the synchronization tag that was used while synchronizing this port with the multi-chassis peer.
`Oper State`	`noPeer` – The peer has no corresponding ring configured. `connected` – The inband control connection with the peer is operational. `broken` – The inband control connection with the peer has timed out. `conflict` – The inband control connection with the peer has timed out but the physical connection is still OK; the failure of the inband signaling connection is caused by a misconfiguration. For example, a conflict between the configuration of this system and its peer, or a misconfiguration on one of the ring access node systems. `testingRing` – The inband control connection with the peer is being set up. Waiting for result. `waitingForPeer` – Verifying if this ring is configured on the peer. `configErr` – The ring is administratively up, but a configuration error prevents it from operating properly. `halfBroken` – The inband control connection indicates that the ring is broken in one direction (towards the peer). `localBroken` – The inband control connection with the peer is known to be broken due to local failure or local administrive action.

Label	Description (Continued)
	`shutdown` — The ring is shutdown.
`Failure Reason`	Displays the failure reason.
`Last Debounce`	Displays the last time that the debounce mechanism (protecting the router from overload situations in case of a flapping ring) was activated.
`Debounce Period`	Displays the duration that the debounce mechanism was in action since the "Last Debounce".

Sample Output

```
*A:ALA-48# show redundancy multi-chassis mc-ring peer 10.0.0.2 ring ring11 detail
==============================================================================
Multi-Chassis MC-Ring Detailed Information
==============================================================================
Peer           : 10.0.0.2
Sync Tag       : ring11
Port ID        : 1/1/3
Admin State    : inService
Oper State     : connected
Admin Change   : 01/07/2008 21:40:07
Oper Change    : 01/07/2008 21:40:24
Last Debounce  : 02/15/2008 09:28:42
Debounce Period: 0d 00:00:00
Failure Reason : None
------------------------------------------------------------------------------
In Band Control Path
------------------------------------------------------------------------------
Service ID     : 10
Interface Name : to_an1
Oper State     : connected
Dest IP        : 10.10.0.2
Src  IP        : 10.10.0.1
------------------------------------------------------------------------------
VLAN Map B Path Provisioned
------------------------------------------------------------------------------
range 13-13
range 17-17
------------------------------------------------------------------------------
VLAN Map Excluded Path Provisioned
------------------------------------------------------------------------------
range 18-18
------------------------------------------------------------------------------
VLAN Map B Path Operational
------------------------------------------------------------------------------
range 13-13
range 17-17
------------------------------------------------------------------------------
VLAN Map Excluded Path Operational
------------------------------------------------------------------------------
range 18-18
```

```
===============================================================================
*A:ALA-48#

*A:ALA-48>show>redundancy>multi-chassis# mc-ring peer 192.251.10.104
===============================================================================
MC Ring entries
===============================================================================
Sync Tag                         Oper State      Failure Reason
-------------------------------------------------------------------------------
No. of MC Ring entries: 0
===============================================================================
*A:ALA-48#

*A:ALA-48# show redundancy multi-chassis mc-ring peer 10.0.0.2
==============================================================================
MC Ring entries
===============================================================================
Sync Tag                         Oper State      Failure Reason
-------------------------------------------------------------------------------
ring11                           connected       None
ring12                           shutdown        None
-------------------------------------------------------------------------------
No. of MC Ring entries: 4
===============================================================================
*A:ALA-48#


*A:ALA-48# show redundancy multi-chassis mc-ring peer 10.0.0.2 ring ring11 ring-node
an1 detail
===============================================================================
Multi-Chassis MC-Ring Node Detailed Information
===============================================================================
Peer            : 10.0.0.2
Sync Tag        : ring11
Node Name       : an1
Oper State Loc  : connected
Oper State Rem  : notTested
In Use          : True
Admin Change    : 01/07/2008 21:40:07
Oper Change     : 01/07/2008 21:40:25
Failure Reason  : None
-------------------------------------------------------------------------------
Ring Node Connectivity Verification
-------------------------------------------------------------------------------
Admin State     : inService
Service ID      : 11
VLAN Tag        : 11
Dest IP         : 10.11.3.1
Src  IP         : None
Interval        : 1 minutes
Src MAC         : None
===============================================================================
*A:ALA-48#

*A:ALA-48# show redundancy multi-chassis mc-ring peer 10.0.0.2 ring ring11 ring-node
===============================================================================
MC Ring Node entries
===============================================================================
Name                             Loc Oper St.      Failure Reason
  In Use                           Rem Oper St.
-------------------------------------------------------------------------------
```

```
an1                                 connected          None
  Yes                                 notTested
an2                                 connected          None
  Yes                                 notTested
-------------------------------------------------------------------------------
No. of MC Ring Node entries: 2
===============================================================================
*A:ALA-48#
```

Show Redundancy Multi-Chassis Ring Peer Statistics Output — The following table describes multi-chassis ring peer output fields.

Label	Description
Message	Displays the message type.
Received	Indicates the number of valid MC-Ring signalling messages received from the peer.
Transmitted	Indicates the number of valid MC-Ring signalling messages transmitted from the peer.
MCS ID Request	Displays the number of valid MCS ID requests were received from the peer.
MCS ID Response	Displays the number of valid MCS ID responses were received from the peer.
Ring Exists Request	Displays the number of valid 'ring exists' requests were received from the peer.
Ring Exists Response	Displays the number of valid ring exists' responses were received from the peer.
Keepalive	Displays the number of valid MC-Ring control packets of type 'keepalive' were received from the peer.

```
*A:ALA-48>show>redundancy>multi-chassis# mc-ring peer 192.251.10.104 statistics
===============================================================================
MC Ring statistics for peer 192.251.10.104
===============================================================================
Message                                                     Received     Transmitted
-------------------------------------------------------------------------------
MCS ID Request                                              0            0
MCS ID Response                                             0            0
Ring Exists Request                                         0            0
Ring Exists Response                                        0            0
Keepalive                                                   0            0
-------------------------------------------------------------------------------
Total                                                       0            0
===============================================================================
*A:ALA-48>show>redundancy>multi-chassis#
```

Show MC-Ring Ring-Node Field Output

Label	Description
`Oper State`	Displays the state of the connection verification (both local and remote). `notProvisioned` — Connection verification is not provisioned. `configErr` — Connection verification is provisioned but a configuration error prevents it from operating properly. `notTested` — Connection verification is administratively disabled or is not possible in the current situation. `testing` — Connection Verification is active, but no results are yet available. `connected` — The ring node is reachable. `disconnected` — Connection verification has timed out.
`In Use`	Displays “True” if the ring node is referenced on an e-pipe or as an inter-dest-id on a static host or dynamic lease.

Show MC-Ring Global-Statistics Field Output

Label	Description
`Rx`	Displays the number of MC-ring signalling packets were received by this system.
`Rx Too Short`	Displays the number of MC-ring signalling packets were received by this system that were too short.
`Rx Wrong Authentication`	Displays the number of MC-ring signalling packets were received by this system with invalid authentication.
`Rx Invalid TLV`	Displays the number of MC-ring signalling packets were received by this system with invalid TLV.
`Rx Incomplete`	Displays the number of MC-ring signalling packets were received by this system that were incomplete.
`Rx Unknown Type`	Displays the number of MC-ring signalling packets were received by this system that were of unknown type.
`Rx Unknown Peer`	Displays the number of MC-ring signalling packets were received by this system that were related to an unknown peer.
`Rx Unknown Ring`	Displays the number of MC-ring signalling packets were received by this system that were related to an unknown ring.
`Rx Unknown Ring Node`	Displays the number of MC-ring signalling packets were received by this system that were related to an unknown ring node.

Label	Description (Continued)
Tx	Displays the number of MC-ring signalling packets were transmitted by this system.
Tx No Buffer	Displays the number of MC-ring signalling packets could not be transmitted by this system due to a lack of packet buffers.
Tx Transmission Failed	Displays the number of MC-ring signalling packets could not be transmitted by this system due to a transmission failure.
Tx Unknown Destination	Displays the number of MC-ring 'unknown destination' signalling packets were transmitted by this system.
Missed Configuration Events	Displays the number of missed configuration events on this system.
Missed BFD Events	Displays the number of missed BFD events on this system.

Sample Output

```
*A:ALA-48>show>redundancy>multi-chassis# mc-ring global-statistics
===============================================================================
Global MC Ring statistics
===============================================================================
Rx                             : 0
Rx Too Short                   : 0
Rx Wrong Authentication        : 0
Rx Invalid TLV                 : 0
Rx Incomplete                  : 0
Rx Unknown Type                : 0
Rx Unknown Peer                : 0
Rx Unknown Ring                : 0
Rx Unknown Ring Node           : 0
Tx                             : 36763
Tx No Buffer                   : 0
Tx Transmission Failed         : 0
Tx Unknown Destination         : 0
Missed Configuration Events    : 0
Missed BFD Events              : 0
===============================================================================
*A:ALA-48>show>redundancy>multi-chassis#
```

switch-fabric

Syntax **switch-fabric**
switch-fabric high-bandwidth-multicast

Context show>system

Description This command displays switch fabric information.

Parameters **high-bandwidth-multicast —** Displays MDA information about switch-fabric plane's high bandwidth multicast traffic tap allocation.

Multilink Bundle Commands

multilink-bundle

Syntax **multilink-bundle** [*bundle-id* | *slot/mda* | **type** {**mlppp** | **ima-grp**}] [**detail**]
multilink-bundle {*bundle-id* | *slot/mda*} [**ppp** | **ima**]
multilink-bundle *bundle-id* **relations**
multilink-bundle *bundle-id* **ppp** [**multiclass**]

Context show

Description This comand displays multilink bundle information. An operator can display:

- All bundles on the system/MDA 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 (example PPP or IMA) for the specified bundle
- ATM interface information for IMA groups see show port atm command for more details

Parameters *bundle-id* — Specifies the multilink (PPP or IMA) bundle to be associated with this IP interface. The command syntax must be used as follows:

Syntax: bundle-*type-slot/mda.bundle-num*
bpgrp-*type-bpgrp-num*
bundle-ppp-*slot/mda.bundle-num* (Creates a multilink PPP bundle.)
bundle-ima-*slot/mda.bundle-num* (Creates an IMA group bundle.)
bundle: keyword
slot: IOM/MDA slot numbers
bundle-num: 1 — 128

ppp — Displays PPP bundle information.

ima, ima-grp — Displays IMA-type groups.

mlppp — Display MLPPP-type groups.

detail — Provides detailed information.

relations — Displays the working and protection bundles associated with this bundle-id.

Multilink Bundle Output — The following table describes multilink bundle output fields.

Label	Description
`Type`	Specifies the type of this multilink bundle.* `mlppp` – Indicates that the bundle is of type MLPPP. `ima` – Indicates that the bundle is of type IMA group.

Label	Description (Continued)
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	Displays the state level of the port. none — Indicates that the port is either in its initial creation state or is just about to 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 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 — Indicates that 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 Minimum Links	Displays the minimum number of links that must be active for a bundle to be active. If the number of active links drop below the given minimum then the multilink bundle will transition to an operation down state.)
Bundle IfIndex	Displays the bundle’s interface index number which reflects its initialization sequence.
Total Links	Displays the total number of member links configured for this bundle.
Active Links	Displays the total number of active links for the bundle.
Description	Displays configured description for this bundle.
Bundle Id	Displays the **port ID** for this bundle.
Red Diff Delay	Displays the maximum acceptable differential delay for individual circuits within this multilink bundle. If the delay exceeds this threshold, a trap is issued. The differential delay is calculated as the round-trip differential delay for MLPPP bundles, and as uni-directional differential delay for IMA bundles.
Fragment Threshold	Displays configured fragment threshold value for this bundle.
Up Time	Displays time elapsed since the last bundle transition to Up when part of bundle information. Displays time elapsed since the last link transition to active when part of member information.

Label	Description (Continued)
Bandwidth	Displays bandwidth configured for this IMA bundle in Kbytes.
Primary Port Member	Displays the portId of the IMA group member chosen as a Primary Port.
Member Port Id	Displays portId of each member of this bundle.
Admin	Displays administrative port status of a member link.
Oper	Displays operational port status of a member link.
Active	Displays whether a member link is active or not.
Down Reason	Displays the reason for why a member link is not active.
Traffic and Port statistics	The traffic and port statistics information displayed for bundles when detail option is selected is the same as information displayed for physical ports.

*.Bundle or Bundle Protection Group.

Sample Output

```
A:timetra-sim110# 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-ima-1/1.2    ima     Down      Down      Link Up   1      1/0
-------------------------------------------------------------------------------
Bundles : 2
===============================================================================
A:timetra-sim110#

A:timetra-sim110# show multilink-bundle type ima-grp
===============================================================================
Bundle Summary
===============================================================================
Bundle              Type    Admin     Oper      Port      Min    Total/
Id                          State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ima-1/1.2    ima     Down      Down      Link Up   1      1/0
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
A:timetra-sim110#


A:timetra-sim110# show multilink-bundle bundle-ppp-1/1.1
===============================================================================
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
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
A:timetra-sim110#


A:timetra-sim110# show multilink-bundle bundle-ppp-1/1.1 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     : 555745281
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            : 1522               Fragment Threshold : 128 bytes
Up Time             : N/A                Bandwidth          : 0 KBit
PPP Input Discards  : 0                  Primary Member Port: None
Interleave-Frag     : false
===============================================================================
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:timetra-sim110#


A:timetra-sim110# show multilink-bundle bundle-ppp-1/1.1 ppp
===============================================================================
PPP Protocols for bundle-ppp-1/1.1
===============================================================================
Protocol  State        Last Change         Restart Count   Last Cleared
-------------------------------------------------------------------------------
ipcp      initial      02/16/2007 06:11:44         0       02/16/2007 06:11:44
mplscp    initial      02/16/2007 06:11:44         0       02/16/2007 06:11:44
bcp       initial      02/16/2007 06:11:44         0       02/16/2007 06:11:44
osicp     initial      02/16/2007 06:11:44         0       02/16/2007 06:11:44
ipv6cp    initial      02/16/2007 06:11:44         0       02/16/2007 06:11:44
===============================================================================
Local Mac address  : 8c:6e:01:01:00:3d  Remote Mac address : 00:00:00:00:00:00
Local IPv4 address : 0.0.0.0            Remote IPv4 address: 0.0.0.0
```

```
Local IPv6 address : ::
Remote IPv6 address: ::
===============================================================================

*A:mlppp_top# show multilink-bundle bundle-ppp-3/1.1 ppp multiclass
===============================================================================
MLPPP Per Class Traffic Statistics for bundle-ppp-3/1.1
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Class  0
  Octets                                               0                      0
  Packets                                              0                      0
  Errors                                               0                      0
Class  1
  Octets                                               0                      0
  Packets                                              0                      0
  Errors                                               0                      0
Class  2
  Packets                                              0                      0
  Errors                                               0                      0
Class  3
  Octets                                               0                 270400
  Packets                                              0                   2704
  Errors                                               0                      0
===============================================================================
*A:mlppp_top#
```

relations

Syntax **relations**

Context show>multilink-bundle

Description This command displays the working and protection bundles associated with this bundle-id.

Output **Show Mutlilink-Bundle Relations Output —** The following table describes show multilink-bundle relations output fields.

Label	Description
BundleID	Displays the bundle number.
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.
Working BundleID	Displays the bundle that is currently in working mode.
Protect BundleID	Displays the bundle that is currently in protect mode.
Active Bundle	Displays the mode of the active bundle.

Sample Output

```
A:ALA-48>show# show multilink-bundle bundle-ima-6/1.2 relations
===============================================================================
Bundle Relationship
===============================================================================
Bundle          Admin   Oper    Working             Protect             Active
Id              State   State   Bundle Id           Bundle Id           Bundle
-------------------------------------------------------------------------------
bpgrp-ima-1     Down    Down    bundle-ima-6/1.1    bundle-ima-6/1.2    Protect
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
A:ALA-48>show#
```

ima

Syntax **multilink-bundle ima**

Context show>multilink-bundle

Description This command enables the context to display IMA group data.

MDA Values 1, 2

Output **Show Mutlilink-bundle IMA Connections Output —** The following table describes show multilink-bundle IMA output fields.

Label	Description
`BundleId`	Displays the bundle ID number.
`Type`	Specifies the type of this multilink bundle. `mlppp` — Indicates that the bundle is of type MLPPP. `ima` — Indicates that the bundle is of type IMA group.
`Admin State`	`ima` — Indicates that the bundle is of type IMA group.
	`Down` — The bundle is administratively down.
`Oper State`	`Up` — The bundle is operationally up.
	`Down` — The bundle is operationally down.
`Port State`	Displays the state level of the port.
	`none` — Indicates that the port is either in its initial creation state or is just about to 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.

Label	Description (Continued)
	`linkUp` — At least one member link is in port state "link up" but the bundle protocol is not yet operationally up (due to 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` — Indicates that 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` `Minimum Links`	Displays 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/Active Links`	Displays the total number of active links for the bundle.

Sample Output

```
A:timetra-sim110# show multilink-bundle bundle-ima-1/1.2
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
-------------------------------------------------------------------------------
bundle-ima-1/1.2     ima     Down      Down      Link Up   1      1/0
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
A:timetra-sim110#

A:timetra-sim110# show multilink-bundle bundle-ima-1/1.2 detail
===============================================================================
Bundle bundle-ima-1/1.2 Detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-ima-1/1.2   Type               : ima
Admin Status       : down               Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 555749378
Total Links        : 1                  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: 1/1/1.1.1.1
Interleave-Frag    : N/A
-------------------------------------------------------------------------------
Member Port Id              Admin Oper  Active  Down Reason       Up Time
-------------------------------------------------------------------------------
1/1/1.1.1.1                 up    up    no      oper down         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:timetra-sim110#

A:timetra-sim110# show multilink-bundle bundle-ima-1/1.2 ima
===============================================================================
Bundle bundle-ima-1/1.2 IMA group information
===============================================================================
Version             : 1.1
Current State       : Startup Near-end
Near-end State      : Startup
Far-end State       : Not configured
Group Test State    : Disabled
Max BW Links        : 8
Operational Secs    : N/A                 Down Secs           : 2811
Tx IMA Id           : 0                   Rx IMA Id           : 255
Tx Timing Ref Link  : N/A                 Rx Timing Ref Link  : N/A
Tx Oam Label        : 3                   Rx Oam Label        : 0
Test Link           : N/A                 Test Pattern        : 0
Near-End Clock-Mode: ctc                  Far-End Clock-Mode  : itc
Link Deact Timer    : 2000                Link Act Timer      : 10000
Alpha-value         : 2                   Beta-value          : 2
Gamma-value         : 1                   Symmetry Mode       : symmetric
Tx CR Available     : 0 KBit              Rx CR Available     : 0 KBit
Least Delayed Link  : N/A                 Max Obs Diff Delay  : 0
Near-End Fails      : 1                   Far-end Fails       : 0
Tx Icp Cells        : 0                   Rx Icp Cells        : 0
Errored Icp Cells   : 0                   Rx Lost Icp Cells   : 0
===============================================================================
A:timetra-sim110#
```

The following stats display when the bundle type is mlppp-lfi and the The following stats should only be displayed if the bundle type is mlppp-lfi and the detail keyword is issued.

```
LFI Statistics
                       Ingress                     Egress
                       Packet    Bytes             Packet    Byte
High                   5000      5000000           2000      2000000
Normal                 10000     10000000          5000      5000000
===============================================================================
```

ppp

Syntax **multilink-bundle ppp**

Context show>multilink-bundle

Description This command enables the context to display PPP group data.

MDA Values 1, 2

Sample Output

```
A:ALA-49# show multilink-bundle bundle-ppp-6/1.1
===============================================================================
Bundle Summary
===============================================================================
Bundle                Type    Admin      Oper       Port       Min    Total/
Id                            State      State      State      Links  Active Links
-------------------------------------------------------------------------------
bundle-ppp-6/1.1      mlppp   Down       Down       Ghost      1      0/0
-------------------------------------------------------------------------------
Bundles : 1
===============================================================================
A:ALA-49#
```

atm

Syntax **atm** [**detail**]

Context show>multilink-bundle>ima

Description This command displays multilink bundle IMA ATM information.

Parameters **detail —** Displays detailed information.

Output **Show Mutlilink-bundle IMA ATM Output —** The following table describes show multilink-bundle IMA ATM output fields.

Label	Description
`Cell Mode`	Displays the cell format (UNI or NNI) that is used on the ATM interface.
`Configured VCs`	Displays the number of configured VCs.
`Configured VTs`	Displays the number of configured VTs.
`Configured minimum VPI`	Displays the minimum VPI configured for this bundle.
`Last Unknown VPI/VCI`	Indicates the last unknown VPI/VCI that was received on this interface.

Label	Description (Continued)
`Mapping`	Displays ATM cell mapping used on this interface: Direct or PLCP.
`Configured VPs`	Displays the number of configured VPs,
`Configured IFCs`	Displays the number of configured IFCs.

Sample Output

```
A:NS052651098# show multilink-bundle bundle-ima-3/1.1 ima atm
===============================================================================
ATM Info for bundle-ima-3/1.1
===============================================================================
Cell Mode             : UNI               Mapping            : Direct
Configured VCs        : 1                 Configured VPs     : 0
Configured VTs        : 0                 Configured IFCs    : 0
Configured minimum VPI: 0
Last Unknown VPI/VCI  : none
===============================================================================
ATM Bandwidth Info
===============================================================================
                     kbps      %                                kbps      %
-------------------------------------------------------------------------------
Ingress CBR        : 15232     100%     Egress CBR         : 15232     100%
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      : 15232     100%     Egress Total       : 15232     100%
ATM Link Bandwidth : 15232 kbps
Shaped Bandwidth   : 15232 kbps
===============================================================================
A:NS052651098#
```

connections

Syntax **connections**

Context show>multilink-bundle>ima>atm

Description This command displays connection information.

Parameters **pvc** — Displays ATM port PVC information.

pvp — Displays ATM port PVP information.

pvt — Displays ATM port PVT information.

vpi-range — Displays the VPI range.

Values vpi: 0 — 4095 (NNI)
0 — 255 (UNI)

vpi — Displays the VPI values.

Values vpi: 0 — 4095 (NNI)
0 — 255 (UNI)

vci: — Displays the VCI values.

Values 1, 2, 5 — 65534

detail — Provides detailed information.

MDA Values 1, 2

Output **Show Mutlilink-bundle IMA ATM Connections Output —** The following table describes show multilink-bundle IMA ATM connections output fields.

Label	Description
`Owner`	Identifies the system entity that owns a specific ATM connection.
`Type`	Specifies the type of this multilink bundle. `mlppp` – Indicates that the bundle is of type MLPPP. `ima` – Indicates that the bundle is of type IMA group.
`Ing.TD`	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
`Egr.TD`	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
`Adm`	`ima` – Indicates that the bundle is of type IMA group.
	`Down` – The bundle is administratively down.
`Opr`	`Up` – The bundle is operationally up.
	`Down` – The bundle is operationally down.
`OAM`	Indicates the OAM operational status of ATM connections.

Sample Output

```
A:NS052651098# show multilink-bundle bundle-ima-3/1.1 ima atm connections
================================================================
ATM Connections, Port bundle-ima-3/1.1
================================================================
           Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
----------------------------------------------------------------
1/100      SAP    PVC      2       2       up   up          up
================================================================
A:NS052651098#
```

port-connection

Syntax **port-connection** [**detail**]

Context show>multilink-bundle>ima>atm

Description This command displays port connection information.

Parameters **detail** — Displays detailed information.

Output **Show Mutlilink-Bundle IMA ATM Port-Connection Output —** The following table describes show multilink-bundle IMA ATM port-connection output fields.

Label	Description
`Port ID`	Displays the port ID for this bundle.
`Admin State`	`ima` — Indicates that the bundle is of type IMA group.
	`Down` — The bundle is administratively down.
`Oper State`	`Up` — The bundle is operationally up.
	`Down` — The bundle is operationally down.
`Owner`	Identifies the system entity that owns a specific ATM connection.
`Endpoint Type`	Displays the endpoint type.
`Cast Type`	Indicates the connection topology type.
`Ing. Td Idx`	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
`Egr. Td Idx`	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
`Last Changed`	Indicates the date and time when the interface connection entered its current operational state.

Sample Output

```
A:NS052651098# show multilink-bundle bundle-ima-3/1.1 ima atm port-connection
===============================================================================
ATM Port Connection
===============================================================================
Port Id            : bundle-ima-3/1.1
Admin State        : up                  Oper state         : up
Owner              : SAP
Endpoint Type      : Port                Cast Type          : P2P
Ing. Td Idx        : 2                   Egr. Td Idx        : 2
Last Changed       : 01/16/2007 14:24:00
===============================================================================
A:NS052651098#
```

pvc

Syntax **pvc** [*vpi*[/*vci*] [**detail**]

Context show>multilink-bundle>ima>atm

Description This command displays ATM port PVC information.

Parameters **vpi** — Displays the VPI values.

Values vpi: 0 — 4095 (NNI)
0 — 255 (UNI)

vci: — Displays the VCI values.

Values 1, 2, 5 — 65534

detail — Provides detailed information.

MDA Values 1, 2

Output **Show Mutlilink-Bundle IMA ATM PVC Output —** The following table describes show multilink-bundle IMA ATM port-connection output fields.

Label	Description
`VPI/VCI`	Displays the VPI/VCI value.
`Owner`	Identifies the system entity that owns a specific ATM connection.
`Type`	Specifies the type of this multilink bundle. `mlppp` — Indicates that the bundle is of type MLPPP. `ima` — Indicates that the bundle is of type IMA group.
`Ing.TD`	Specifies the ATM traffic descriptor profile that applies to the receive direction of the interface connection.
`Egr.TD`	Specifies the ATM traffic descriptor profile that applies to the transmit direction of the interface connection.
`Adm`	`ima` — Indicates that the bundle is of type IMA group.
	`Down` — The bundle is administratively down.
`Opr`	`Up` — The bundle is operationally up.
	`Down` — The bundle is operationally down.
`OAM`	Indicates the OAM operational status of ATM connections.

Sample Output

```
A:NS052651098# show multilink-bundle bundle-ima-3/1.1 ima atm pvc
================================================================
ATM PVCs, Port bundle-ima-3/1.1
================================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
----------------------------------------------------------------
1/100      SAP    PVC      2       2       up   up          up
================================================================
A:NS052651098#


A:NS052651098# show multilink-bundle bundle-ima-3/1.1 ima atm pvc detail
================================================================
ATM PVCs, Port bundle-ima-3/1.1
================================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
----------------------------------------------------------------
1/100      SAP    PVC      2       2       up   up          up

===============================================================================
ATM Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
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
-------------------------------------------------------------------------------
AIS                                                    0                      0
RDI                                                    0                      0
Loopback                                               0                      0
CRC-10 Errors                                          0
Other                                                  0
===============================================================================
A:NS052651098#
```

pvp

Syntax **pvp** [*vpi*] [**detail**]

Context show>multilink-bundle>ima>atm

Description This command displays ATM port PVP information.

Parameters **vpi** — Displays the VPI values.

Values vpi: 0 — 4095 (NNI) 0 — 255 (UNI)

detail — Provides detailed information.

MDA Values 1, 2

Output **Show Mutlilink-bundle IMA ATM PVP Output —** The following table describes show multilink-bundle IMA ATM port-connection output fields.

Sample Output

```
A:ima2# show multilink-bundle bundle-ima-3/1.1 ima atm pvp
================================================================
ATM PVPs, Port bundle-ima-3/1.1
================================================================
VPI        Owner  Type     Ing.TD  Egr.TD  Adm  OAM         Opr
----------------------------------------------------------------
2          SAP    PVP      1       1       up   up          up
================================================================
A:ima2#
```

pvt

Syntax **pvt** [*vpi.vpi*] [**detail**]

Context show>multilink-bundle>ima>atm

Description This command displays ATM port PVT information.

Parameters **vpi** — Displays the VPI values.

Values vpi: 0 — 4095 (NNI)
0 — 255 (UNI)

detail — Provides detailed information.

MDA Values 1, 2

Output **Show Mutlilink-bundle IMA ATM PVT Output —** The following table describes show multilink-bundle IMA ATM port-connection output fields.

Sample Output

```
A:ima2# show multilink-bundle bundle-ima-3/1.1 ima atm pvt
================================================================
ATM PVTs, Port bundle-ima-3/1.1
================================================================
VPI Range  Owner  Type     Ing.TD  Egr.TD  Adm              Opr
----------------------------------------------------------------
4.5        SAP    PVT      1       1       up               up
================================================================
A:ima2#
```

LAG Commands

lag

Syntax **lag** [*lag-id*] [**detail**] [**statistics**]
lag *lag-id* **associations**

Context show

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 only information on the specified LAG ID.

Default Display information for all LAG IDs.

Values 1 — 64

detail — Displays detailed LAG information.

Default Displays summary information.

statistics — Displays LAG statistics information.

associations — Displays a list of current router interfaces to which the LAG is assigned.

Output **LAG Output —** The following table describes LAG output fields.

Label	Description
`LAG ID`	The LAG or multi-link bundle ID that the port is assigned to.
`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 for the LAG at or below which the configured action will be invoked.
`Up-Link-Count`	The number of ports that are physically present and have physical links present.
`MC Act/Stdby`	Member port is selected as active or standby link.

Sample Output

```
A:ALA-48>config# show lag
===============================================================================
Lag Data
===============================================================================
Lag-id         Adm     Opr     Port-Threshold   Up-Link-Count   MC Act/Stdby
-------------------------------------------------------------------------------
1              up      down    0                0               N/A
2              up      up      0                1               active
3              up      down    0                0               standby
4              up      down    0                0               standby
10             up      down    0                0               N/A
-------------------------------------------------------------------------------
Total Lag-ids: 5       Single Chassis: 2        MC Act: 1       MC Stdby: 2
===============================================================================
A:ALA-48>config# show lag
```

Detailed LAG Output — The following table describes detailed LAG output fields. The output is dependent on whether or not the LAG was configurd as a multi-chassis LAG.

Label	Description
LAG ID	The LAG or multi-link trunk (MLT) that the port is assigned to.
Adm	Up — The LAG is administratively up. Down — The LAG is administratively down.
Port Threshold	If the number of available links is equal or below this number, the threshold action is executed.
Thres. Last Cleared	The last time that keepalive stats were cleared.
Dynamic Cost	The OSPF costing of a link aggregation group based on the available aggregated, operational bandwidth.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The hardware address.
Hold-Time Down	The timer, in tenths of seconds, which controls the delay between detecting that a LAG is down and reporting it to the higher levels.
LACP	Enabled — LACP is enabled. Down — LACP is disabled.
LACP Transmit Intvl	LACP timeout signalled to peer.
Selection Crite-ria	Configured subgroup selection criteria.

Label	Description (Continued)
Number of sub-groups	Total subgroups in LAG.
System ID	System ID used by actor in LACP messages.
Admin Key	Configured LAG key.
Oper Key	Key used by actor in LACP messages.
System Priority	System priority used by actor in LACP messages.
Prtr System ID	System ID used by partner in LACP messages.
Prtr Oper Key	Key used by partner in LACP messages.
Prtr System Priority	System priority used by partner in LACP messages.
Mode	LAG in access or network mode.
Opr	Up — The LAG is operationally up.
	Down — The LAG is operationally down.
Port Threshold	Configured port threshold.
Thres. Exceeded Cnt	The number of times that the drop count was reached.
Threshold Action	Action to take when the number of available links is equal or below the port threshold.
Encap Type	The encapsulation method used to distinguish customer traffic on a LAG.
Lag-IFIndex	A box-wide unique number assigned to this interface.
Adapt QoS	Displays the configured QoS mode.
Port ID	The specific slot/MDA/port ID.
(LACP) Mode	LACP active or passive mode.
LACP xmit standby	LACP transmits on standby links enabled / disabled.
Slave-to-partner	Configured enabled/disabled.
Port-id	Displays the member port ID.
Adm	Displays the member port administrative state.
Active/stdby	Indicates that the member port is selected as the active or standby link.
Opr	Indicates that the member port operational state.
Primary	Indicates that the member port is the primary port of the LAG.

Label	Description (Continued)
Sub-group	Displays the member subgroup where the member port belongs to.
Priority	Displays the member port priority.

Sample Output

```
*A:ALA-48>show# lag  1 detail
===============================================================================
LAG Details
===============================================================================
Description:
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 1                      Mode                 : access
Adm                 : up                     Opr                  : down
Thres. Exceeded Cnt : 0                      Port Threshold       : 3
Thres. Last Cleared : 02/21/2007 12:39:36   Threshold Action     : dynamic cost
Dynamic Cost        : false                  Encap Type           : null
Configured Address  : 04:67:01:01:00:01      Lag-IfIndex          : 1342177281
Hardware Address    : 14:30:ff:00:01:41      Adapt Qos            : distribute
Hold-time Down      : 0.0 sec
LACP                : enabled                Mode                 : active
LACP Transmit Intvl : fast                   LACP xmit stdby      : enabled
Selection Criteria  : highest-count          Slave-to-partner     : enabled
Number of sub-groups: 0                      Forced               : -
System Id           : 14:30:ff:00:00:00      System Priority      : 1
Admin Key           : 32768                  Oper Key             : 32666
Prtr System Id      :                        Prtr System Priority : 0
Prtr Oper Key       : 0

MC Peer Address     : 10.10.10.2             MC Peer Lag-id       : 1
MC System Id        : 00:00:00:33:33:33      MC System Priority   : 32888
MC Admin Key        : 32666                  MC Active/Standby    : active
MC Lacp ID in use   : true                   MC extended timeout  : false
MC Selection Logic  : peer timed out (no route to peer), selected local
                      subgroup
MC Config Mismatch  : no mismatch
-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced   Prio
-------------------------------------------------------------------------------
===============================================================================
*A:ALA-48>show#
```

LAG Statistics Output — The following table describes detailed LAG statistics output fields.

Label	Description
`LAG ID`	The LAG or multi-link trunk (MLT) that the port is assigned to.
`Port ID`	The port ID configured or displayed in the *slot/mda/port* format.
`Input Bytes`	The number of incoming bytes for the LAG on a per-port basis.
`Input Packets`	The number of incoming packets for the LAG on a per-port basis.
`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/Output Errors`	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.
`Totals`	Displays the column totals for bytes, packets, and errors.

Sample Output

```
ALA-1# show lag statistics
===============================================================================
LAG Statistics
===============================================================================
Description:
Lag-id Port-id   Input     Input      Output    Output     Input     Output
                 Bytes     Packets    Bytes     Packets    Errors    Errors
-------------------------------------------------------------------------------
1      1/1/3     0         1006       0         2494       0         0
       1/1/4     0         435        0         401        0         0
       1/1/5     0         9968       0         9833       0         0
-------------------------------------------------------------------------------
Totals           0         11409      0         12728      0         0
===============================================================================
ALA-1#
```

LAG Associations Output — The following table describes LAG associations output fields.

Label	Description
`Service ID`	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.

Sample Output

```
A:ALA-1# show lag 5 associations
==============================================================================
Interface Table
==============================================================================
Router/ServiceId                Name                            Encap Val
------------------------------------------------------------------------------
Router: Base                    LAG2West                        0
------------------------------------------------------------------------------
Interfaces
==============================================================================
A:ALA-1#
```

LAG Details with MC-LAG Output — The following example displays LAG output with MC LAG:

```
*A:pc5# show lag 2 detail
===============================================================================
LAG Details
===============================================================================
Description:
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 2                      Mode                 : access
Adm                 : up                     Opr                  : up
Thres. Exceeded Cnt : 2                      Port Threshold       : 0
Thres. Last Cleared : 04/11/2007 21:50:55    Threshold Action     : down
Dynamic Cost        : false                  Encap Type           : dot1q
Configured Address  : 8e:8b:ff:00:01:42      Lag-IfIndex          :
1342177282
Hardware Address    : 8e:8b:ff:00:01:42      Adapt Qos            :
distribute
Hold-time Down      : 0.0 sec
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           : 8e:8b:ff:00:00:00      System Priority      : 32768
Admin Key           : 32768                  Oper Key             : 32768
Prtr System Id      : 8e:89:ff:00:00:00      Prtr System Priority : 32768
Prtr Oper Key       : 32768

MC Peer Address     : 10.10.10.101           MC Peer Lag-id       : 2
MC System Id        : 01:01:01:01:01:01      MC System Priority   : 2
MC Admin Key        : 1                      MC Active/Standby    : active
MC Lacp ID in use   : false                  MC extended timeout  : false
MC Selection Logic  : waiting for peer info MC Config Mismatch  : no mismatch
-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced
Prio
-------------------------------------------------------------------------------
1/1/1          up     active    up     yes       7             -        99
1/1/2          up     standby   down             8             -        100
-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout
Activity
-------------------------------------------------------------------------------
1/1/1          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
```

```
1/1/1          partner   No     No     Yes    Yes    Yes    Yes    Yes      Yes
1/1/2          actor     No     No     No     No     No     Yes    Yes      Yes
1/1/2          partner   No     No     No     No     Yes    Yes    Yes      Yes
===============================================================================
*A:pc5#
```

LAG Details without MC-LAG Output — The following example displays LAG output without MC LAG:

```
*A:pc5# show lag 2 detail
===============================================================================
LAG Details
===============================================================================
Description:
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 2                      Mode                 : access
Adm                 : up                     Opr                  : up
Thres. Exceeded Cnt : 4                      Port Threshold       : 0
Thres. Last Cleared : 04/11/2007 02:03:49    Threshold Action     : down
Dynamic Cost        : false                  Encap Type           : dot1q
Configured Address  : 8e:8b:ff:00:01:42      Lag-IfIndex          :
1342177282
Hardware Address    : 8e:8b:ff:00:01:42      Adapt Qos            :
distribute
Hold-time Down      : 0.0 sec
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           : 8e:8b:ff:00:00:00      System Priority      : 32768
Admin Key           : 32768                  Oper Key             : 32768
Prtr System Id      : 8e:89:ff:00:00:00      Prtr System Priority : 32768
Prtr Oper Key       : 32768
-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced
Prio
-------------------------------------------------------------------------------
1/1/1          up     active    up     yes       7             -        99
1/1/2          up     standby   down             8             -        100
-------------------------------------------------------------------------------
Port-id        Role      Exp    Def    Dist   Col    Syn    Aggr   Timeout
Activity
-------------------------------------------------------------------------------
1/1/1          actor     No     No     Yes    Yes    Yes    Yes    Yes      Yes
1/1/1          partner   No     No     Yes    Yes    Yes    Yes    Yes      Yes
1/1/2          actor     No     No     No     No     No     Yes    Yes      Yes
1/1/2          partner   No     No     No     No     Yes    Yes    Yes      Yes
===============================================================================
*A:pc5#
```

Port Monitor Commands

port

Syntax **port** *port-id* [*port-id*...(up to 5 max)] [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**] [**multiclass**]

Context monitor

Description This command enables port traffic monitoring. The specified port(s) statistical information displays at the configured interval until the configured count is reached.

The first screen displays the current statistics related to the specified port(s). The subsequent statistical information listed for each interval is displayed as a delta to the previous display.

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 displays. Monitor commands display the selected statistics according to the configured number of times at the interval specified.

Parameters **port** *port-id* — Specify up to 5 port IDs. Port-IDs are only MLPPP bundles or bundle protection groups when the multiclass keyword is specified.

Syntax:	*port-id*	slot/mda/port[.channel]		
	aps-id	aps-*group-id*[.*channel*]		
			aps	keyword
			group-id	1 — 16
		bundle ID	bundle-*type-slot/mda.bundle-num*	
			bpgrp-*type-bpgrp-num*	
			bundle	keyword
			bundle-num	1 — 16
			type	ppp

interval *seconds* — Configures the interval for each display in seconds.

Default 10 seconds

Values 3 — 60

repeat *repeat* — Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

Sample Output

```
A:ALA-12>monitor# port 1/1/4 interval 3 repeat 3 absolute
===============================================================================
Monitor statistics for Port 1/1/4
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                               39                    175
Errors                                                 0                      0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                               39                    175
Errors                                                 0                      0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                               39                    175
Errors                                                 0                      0
-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                               39                    175
Errors                                                 0                      0
===============================================================================
A:ALA-12>monitor#

A:ALA-12>monitor# port 1/1/4 interval 3 repeat 3 rate
===============================================================================
Monitor statistics for Port 1/1/4
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                               39                    175
Errors                                                 0                      0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                                0                      0
Errors                                                 0                      0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Packets                                                0                      0
Errors                                                 0                      0
-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                                 0                      0
```

```
Packets                                                 0                            0
Errors                                                  0                            0
===============================================================================
A:ALA-12>monitor#
```

port (ATM)

Syntax **atm** [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Context monitor>port

Description This command enables ATM port traffic monitoring.

Parameters **interval** *seconds* **—** Configures the interval for each display in seconds.

Default 5 seconds

Values 3 — 60

repeat *repeat* — Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

Sample Output

```
A:ALA-49# monitor port 1/1/1 atm interval 3 repeat 2 absolute
===============================================================================
Monitor ATM statistics for Port 1/1/1
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Cells                                                  0                      0
Unknown VPI/VCI Cells                                  0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Cells                                                  0                      0
Unknown VPI/VCI Cells                                  0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                 0                      0
Cells                                                  0                      0
Unknown VPI/VCI Cells                                  0
===============================================================================
A:ALA-49#
```

Clear Commands

card

Syntax **card** *slot-number*

Context clear

Description This command reinitializes the card.

Parameters *slot-number* — Clears information for the card.

Values 1

lag

Syntax **lag** *lag-id* **statistics**

Context clear

Description This command clears statistics for the specified LAG ID.

Parameters *lag-id* — The LAG ID to clear statistics.

Values 1 — 64

statistics — Specifies to clear statistics for the specified LAG ID.

mda

Syntax **mda** *mda-id*

Context clear

Description This command reinitializes the specified MDA in a particular slot.

Parameters *mda-id* — Clears information for the specified MDA/CMA slot. MDAs are displayed with an “m” in the card-type description. CMAs are displayed with a “c” in the card-type.

port

Syntax **port** *port-id* **statistics**
port *port-id* **atm pvc** [*vpi[/vci*]] **statistics**
port *port-id* **atm pvp** [*vpi*] **statistics**
port *port-id* **atm pvt** [*vpi1.vpi2*] **statistics**
port *port-id* **atm ilmi statistics**
port *port-id* **atm port-connection statistics**

Context **clear**

Description This command clears port statistics for the specified port(s).

Parameters *port-id* — The port identifier.

Values	port-id	slot[/mda[/port]] or slot/mda/port[.channel]	
	aps-id	aps-group-id[.channel]	
		aps	keyword
		group-id	1 — 16
	bundle-type-slot/mda.bundle-num		
		bundle	keyword
		type	ima, ppp
		bundle-num	1 — 16

statistics — Specifies that port statistics will be cleared.

atm — Specifies that ATM port statistics will be cleared.

ilmi — Clears ILMI information. This parameter is only applicable for ports/bundles that support ILMI.

vpi — Specifies the ATM network virtual path identifier (VPI) for this PVC.

vci — Specifies the ATM network virtual channel identifier (VCI) for this PVC.

slot — The slot number.

Values 1

mda — The MDA number.

Default All MDAs.

MDA Values 7710 SR-c12: 1, 3, 5, 7, 9, 11
7710 SR-c4: 1, 3

CMA Values 7710 SR-c12: 1-12
7710 SR-c4: 1-4

pvc — Clears PVC statistics.

port-connection — Clears port-connection statistics.

Tools Commands

redundancy

Syntax **redundancy**

Context tools>dump

Description This command enables the context to dump redundancy parameters.

multi-chassis

Syntax **multi-chassis**

Context tools>dump>redundancy

Description This command enables the context to dump multi-chassis parameters.

mc-ring

Syntax **mc-ring**

Context tools>dump>redundancy>multi-chassis

Description This command dumps multi-chassis ring data.

sync-database

Syntax **sync-database** [**peer** *ip-address*] [**port** *port-id* **|** *lag-id*] [**sync-tag** *sync-tag*] [**application** {**dhcps|igmp|igmp-snooping|srrp|sub-mgmt|mld-snooping|mc-ring**}] [**detail**] [**type** {**alarm-deleted|local-deleted**}]

Context tools>dump>redundancy>multi-chassis

Description This command dumps multi-chassis sync database information.

Parameters **peer** *ip-address* — Dumps the specified address of the multi-chassis peer.

port *port-id* — Dumps the specified port ID of the multi-chassis peer.

port *lag-id* — Dumps the specified Link Aggregation Group (LAG) on this system.

sync-tag *sync-tag* — Dumps the synchronization tag used while synchronizing this port with the multi-chassis peer.

application — Dumps the specified application information that was synchronized with the multi-chassis peer.

Values dhcps, igmp, igmp-snooping, mc-ring, srrp, sub-mgmt, mld-snooping, all

detail — Displays detailed information.

alarm-deleted|local-deleted — Filters by entry type.

srrp-sync-data

Syntax **srrp-sync-database** [**instance** *instance-id*] [**peer** *ip-address*]

Context tools>dump>redundancy>multi-chassis

Description This command dumps multi-chassis SRRP sync database information.

Parameters *instance-id* — [1..4294967295]

ip-address — Dumps the specified address (in the form of a.b.c.d).

ima

Syntax **ima**

Context tools>perform

Description This command allows the use of IMA operations.

reset

Syntax **reset** *bundle-id*

Context tools>perform>ima

Description This command sets an IMA-bundle to the Start Up state.

Parameters *bundle-id* — bundle-ima-slot/mda.*bundle-num*

bundle-num — [1..256]

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*]

Context debug

Description This command enables debugging for LAG.

Parameters *lag-id* — Specifies the link aggregation group ID.

port-id — Specifies the physical port ID.

Syntax: *slot/mda/port*[.*channel*]

sm — Specifies to display trace LACP state machine.

pkt — Specifies to display trace LACP packets.

cfg — Specifies to display trace LAG configuration.

red — Specifies to display trace LAG high availability.

iom-upd — Specifies to display trace LAG IOM updates.

port-state — Specifies to display trace LAG port state transitions.

timers — Specifies to display trace LAG timers.

sel-logic — Specifies to display trace LACP selection logic.

mc — Specifies to display multi-chassis parameters.

mc-packet — Specifies to display the MC-LAG control packets with valid authentication were received on this system.

lmi

Syntax **lmi** [*port-id*]
no lmi

Context debug>frame-relay

Description This debug command enables tracing of all the LMI messages in both receive and transmit directions for one or all of the Frame Relay interfaces. All types of Frame Relay interfaces are supported. If the port ID is not specified, debug is enabled on all Frame Relay interfaces.

The **no** form of the command turns off LMI and Frame-Relay debugging, **debug>frame-relay>no lmi** and **debug>no frame-relay**.

Parameters *port-id* — Specifies the ILMI-supporting port ID.

Syntax: *slot/mda/port*[.*channel*]

Sample Output

```
2959 2007/04/11 23:01:34.63 MINOR: DEBUG #2001 - FR
"FR: TX STATUS Msg on dce Port: 1/1/1 LMI: itu
FR Hdr: 00 01 03 08 00 7D
Rpt IE: 51 01 01 LINK_INT_VERIFY
KA IE: 53 02 31 45 TxSeqNo=49 RxSeqNo=69"

2960 2007/04/11 23:01:44.63 MINOR: DEBUG #2001 - FR
"FR: RX STATUS ENQ Msg on dce Port: 1/1/1 LMI: itu
FR Hdr: 00 01 03 08 00 75
Rpt IE: 51 01 01 LINK_INT_VERIFY
KA IE: 53 02 46 31 TxSeqNo=70 RxSeqNo=49"
```

ilmi

[**no**] **ilmi** *port-id*

Context debug>atm

Description This command enables debugging for ATM ILMI.

The **no** form of the command turns off ILMI and debugging,.

Parameters *port-id* — Specifies the ILMI-supporting port ID.

Values *slot/mda/port*[.*channel*]

Sample Output

```
A:CHRISILMI# debug atm ilmi 1/3/4

In kernel:
ILMI_DEBUG_LOG {557907970}: 21:32:28
PDU DUMP (RAW):
 30 77 02 01 00 04 04 49 4c 4d 49 a4
 6c 06 07 2b 06 01 04 01 82 61 40 04
 00 00 00 00 02 01 06 02 01 02 43 03
 1b 24 b1 30 50 30 12 06 0d 2b 06 01
 04 01 82 61 02 05 01 01 01 00 02 01
 00 30 12 06 0d 2b 06 01 04 01 82 61
 02 05 01 01 03 00 02 01 21 30 12 06
 0d 2b 06 01 04 01 82 61 02 05 01 01
 02 00 02 01 00 30 12 06 0d 2b 06 01
 04 01 82 61 02 05 01 01 04 00 02 01

 00 00 00
PDU DUMP (DECODED):
  PDU Length: 123
   Community: ILMI
     Version: 1
    Msg Type: SNMP TRAP
```

```
    ObjectId: 1.3.6.1.4.1.353.2.5.1.1.1.0
    ObjectId: 1.3.6.1.4.1.353.2.5.1.1.3.0
    ObjectId: 1.3.6.1.4.1.353.2.5.1.1.2.0
    ObjectId: 1.3.6.1.4.1.353.2.5.1.1.4.0
...
```

cisco-hdlc

Syntax **cisco-hdlc** [*port-id*]
no cisco-hdlc

Context debug

Description This command configures debugging for Cisco-HDLC encapsulation.

Parameters *port-id* — Specifies the physical port ID.

Syntax: *slot/mda/port*[.*channel*]

ppp

Syntax [**no**] **ppp** *port-id*

Context debug

Description This command enables/disables and configures debugging for PPP.

Parameters *port-id* — Specifies the physical port ID

Syntax:	*port-id*	slot/mda/port[.channel]	
	aps-id	aps-*group-id*[.*channel*]	
			aps keyword
			group-id 1 — 16
		bundle ID	bundle-*type-slot/mda.bundle-num*
			bpgrp-*type-bpgrp-num*
			bundle keyword
			bundle-num 1 — 16
			type ppp

Standards and Protocol Support

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IEEE 802.1d Bridging
IEEE 802.1p/Q VLAN Tagging
IEEE 802.1s Multiple Spanning Tree
IEEE 802.1w Rapid Spanning Tree Protocol
IEEE 802.1x Port Based Network Access Control
IEEE 802.3 10BaseT
IEEE 802.3ad Link Aggregation
IEEE 802.3ae 10Gbps Ethernet
IEEE 802.3ah Ethernet OAM
IEEE 802.3u 100BaseTX
IEEE 802.3x Flow Control
IEEE 802.3z 1000BaseSX/LX

Protocol Support

OSPF

RFC 1765 OSPF Database Overflow
RFC 2328 OSPF Version 2
RFC 2370 Opaque LSA Support
RFC 2740 OSPF for IPv6 (OSPFv3) draft-ietf-ospf-ospfv3-update-14.txt
RFC 3101 OSPF NSSA Option
RFC 3137 OSPF Stub Router Advertisement
RFC 3623 Graceful OSPF Restart GR helper
RFC 3630 Traffic Engineering (TE) Extensions to OSPF V2
RFC 4203 for Shared Risk Link Group (SRLG) sub-TLV

BGP

RFC 1397 BGP Default Route Advertisement
RFC 1772 Application of BGP in the Internet
RFC 1965 Confederations for BGP
RFC 1997 BGP Communities Attribute
RFC 2385 Protection of BGP Sessions via MD5
RFC 2439 BGP Route Flap Dampening
RFC 2547bis BGP/MPLS VPNs
RFC 2796 BGP Route Reflection: Alternative to Full-mesh IBGP (previously RFC 1966)
draft-ietf-idr-rfc2796bis-02.txt.
draft-ietf-idr-rfc2858bis-09.txt.
RFC 2918 Route Refresh Capability for BGP-4
RFC 3065 Confederations for BGP
draft-ietf-idr-rfc3065bis-05.txt.
RFC 3392 Capabilities Advertisement with BGP4
RFC 4271 BGP-4 (previously RFC 1771)
RFC 4360 BGP Extended Communities Attribute
RFC 4364 BGP/MPLS IP Virtual Private Networks (VPNs)(previously RFC 2547bis BGP/MPLS VPNs)
RFC 4724 Graceful Restart Mechanism for BGP - GR helper
RFC 4760 Multi-protocol Extensions for BGP (previously RFC 2858)

IS-IS

RFC 1142 OSI IS-IS Intra-domain Routing Protocol (ISO 10589)
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
RFC 3567 Intermediate System to Intermediate System (ISIS) Cryptographic Authentication
RFC 3719 Recommendations for Interoperable Networks using IS-IS
RFC 3784 Intermediate System to Intermediate System (IS-IS) Extensions for Traffic Engineering (TE)
RFC 3787 Recommendations for Interoperable IP Networks
RFC 3847 Restart Signaling for IS-IS - GR helper
RFC 4205 for Shared Risk Link Group (SRLG) TLV
draft-ietf-isis-igp-p2p-over-lan-05.txt

LDP

RFC 3036 LDP Specification
RFC 3037 LDP Applicability
RFC 3478 Graceful Restart Mechanism for LDP - GR helper
draft-jork-ldp-igp-sync-03

IS-IS

RFC 1981 Path MTU Discovery for IPv6
RFC 2375 IPv6 Multicast Address Assignments
RFC 2460 Internet Protocol, Version 6 (IPv6) Specification
RFC 2461 Neighbor Discovery for IPv6
RFC 2462 IPv6 Stateless Address Auto configuration
RFC 2463 Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 Specification
RFC 2464 Transmission of IPv6 Packets over Ethernet Networks
RFC 2529 Transmission of IPv6 over IPv4 Domains without Explicit Tunnels
RFC 2545 Use of BGP-4 Multiprotocol Extension for IPv6 Inter-Domain Routing
RFC 2710 Multicast Listener Discovery (MLD) for IPv6
RFC 2740 OSPF for IPv6
RFC 3306 Unicast-Prefix-based IPv6 Multicast Addresses
RFC 3315 Dynamic Host Configuration Protocol for IPv6
RFC 3587 IPv6 Global Unicast Address Format
RFC3590 Source Address Selection for the Multicast Listener Discovery (MLD) Protocol
RFC 3810 Multicast Listener Discovery Version 2 (MLDv2) for IPv6

RFC 4007 IPv6 Scoped Address Architecture
RFC 4193 Unique Local IPv6 Unicast Addresses
RFC 4291 IPv6 Addressing Architecture
RFC 4659 BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN
RFC 5072 IP Version 6 over PPP
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draft-ietf-isis-wg-multi-topology-xx.txt

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RFC 3031 MPLS Architecture
RFC 3032 MPLS Label Stack
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RFC 4182 Removing a Restriction on
the use of MPLS Explicit NULL

RIP

RFC 1058 RIP Version 1
RFC 2082 RIP-2 MD5 Authentication
RFC 2453 RIP Version 2

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RFC 2430 A Provider Architecture DiffServ & TE
RFC 2702 Requirements for Traffic Engineering over MPLS
RFC2747 RSVP Cryptographic Authentication
RFC3097 RSVP Cryptographic Authentication
RFC 3209 Extensions to RSVP for Tunnels
RFC 4090 Fast reroute Extensions to RSVP-TE for LSP Tunnels

DIFFERENTIATED SERVICES

RFC 2474 Definition of the DS Field the IPv4 and IPv6 Headers (Rev)
RFC 2597 Assured Forwarding PHB Group (rev3260)
RFC 2598 An Expedited Forwarding PHB
RFC 3140 Per-Hop Behavior Identification Codes
RFC 768 UDP
RFC 1350 The TFTP Protocol (Rev.
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RFC 1812 Requirements for IPv4 Routers
RFC 2347 TFTP option Extension
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RFC 2349 TFTP Timeout Interval and Transfer Size option
RFC 2401 Security Architecture for Internet Protocol
draft-ietf-bfd-mib-00.txtBidirectional Forwarding Detection Management Information Base
draft-ietf-bfd-base-02.txtBidirectional Forwarding Detection
draft-ietf-bfd-v4v6-1hop-02.txtBFD IPv4 and IPv6 (Single Hop)

VRRP

RFC 2787 Definitions of Managed Objects for the Virtual Router Redundancy Protocol
RFC 3768 Virtual Router Redundancy Protocol

PPP

RFC 1332 PPP IPCP
RFC 1377 PPP OSINLCP
RFC 1638/2878PPP BCP
RFC 1661 PPP (rev RFC2151)
RFC 1662 PPP in HDLC-like Framing
RFC 1989 PPP Link Quality Monitoring
RFC 1990 The PPP Multilink Protocol (MP)
RFC 2516 A Method for Transmitting PPP Over Ethernet
RFC 2615 PPP over SONET/SDH

ATM

RFC 1626 Default IP MTU for use over ATM AAL5
RFC 2514 Definitions of Textual Conventions and OBJECT_IDENTITIES for ATM Management
RFC 2515 Definition of Managed Objects for ATM Management RFC 2684 Multiprotocol Encapsulation over ATM Adaptation Layer 5
AF-TM-0121.000 Traffic Management Specification Version 4.1
ITU-T Recommendation I.610 - B-ISDN Operation and Maintenance Principles and Functions version 11/95
ITU-T Recommendation I.432.1 - BISDN user-network interface - Physical layer specification: General characteristics
GR-1248-CORE - Generic Requirements for Operations of ATM Network Elements (NEs). Issue 3
GR-1113-CORE - Bellcore, Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements, Issue 1
AF-ILMI-0065.000 Integrated Local Management Interface (ILMI) Version 4.0
AF-TM-0150.00 Addendum to Traffic Management v4.1 optional minimum desired cell rate indication for UBR

PSEUDO-WIRE

RFC 3985 Pseudo Wire Emulation Edge-to-Edge (PWE3)
RFC 4385 Pseudo Wire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN
RFC 3916 Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3)
RFC 4717 Encapsulation Methods for Transport ATM over MPLS Networks (draft-ietf-pwe3-atm-encap-10.txt)
RFC 4816 PWE3 ATM Transparent Cell Transport Service (draft-ietf-pwe3-cell-transport-04.txt)
RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks (draft-ietf-pwe3-ethernet-encap-11.txt)
RFC 4619 Encapsulation Methods for Transport of Frame Relay over MPLS Networks (draft-ietf-pwe3-frame-relay-07.txt)
RFC 4446 IANA Allocations for PWE3
RFC 4447 Pseudowire Setup and Maintenance Using LDP (draft-ietf-pwe3-control-protocol-17.txt)
RFC 5085, Pseudowire Virtual Circuit Connectivity Verification (VCCV):

draft-ietf-l2vpn-vpws-iw-oam-02.txt
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draft-ietf-pwe3-ms-pw-arch-02.txt
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draft-muley-pwe3-redundancy-02.txt
MFA Forum 9.0.0 The Use of Virtual trunks for ATM/MPLS Control Plane Interworking
MFA Forum 12.0.0 Multiservice Interworking - Ethernet over MPLS
MFA forum 13.0.0 - Fault Management for Multiservice Interworking v1.0
MFA Forum 16.0.0 - Multiservice Interworking - IP over MPLS

ANCP/L2CP

draft-ietf-ancp-framework-01.txt
draft-ietf-ancp-protocol-00.txt

CIRCUIT EMULATION

RFC 4553 Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP)
RFC 5086 Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)
MEF-8 Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks, October 2004
draft-ietf-pwe3-tdm-control-protocol-extensi-02.txt

SONET/SDH

GR-253-CORE SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000
ITU-G.841 Telecommunication Standardization Section of ITU, Types and Characteristics of
SDH Networks Protection Architecture, issued in October 1998 and as augmented by Corrigendum1 issued in July 2002
GR-253-CORE - SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000

RADIUS

RFC 2865 Remote Authentication Dial In User Service
RFC 2866 RADIUS Accounting

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draft-ietf-secsh-architecture.txtSSH Protocol Architecture
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draft-ietf-secsh-transport.txt SSH Transport Layer Protocol
draft-ietf-secsh-connection.txt SSH Connection Protocol
draft-ietf-secsh- newmodes.txt SSH Transport Layer Encryption Modes

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NETWORK MANAGEMENT

ITU-T X.721: Information technology- OSI-Structure of Management Information
ITU-T X.734: Information technology- OSI-Systems Management: Event Report Management Function
M.3100/3120 Equipment and Connection Models
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RFC 1157 SNMPv1
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IANA-IFType-MIB
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Proprietary MIBs

TIMETRA-APS-MIB.mib
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