7750 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 modules (IOMs), also referred to as cards, Media Dependent Adapters (MDAs), 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 7750 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 7750 SR documentation set is composed of the following books:

- 7750 SR OS Basic System Configuration Guide

  This guide describes basic system configurations and operations.
- 7750 SR OS System Management Guide

  This guide describes system security and access configurations as well as event logging and accounting logs.
- 7750 SR OS Interface Configuration Guide

  This guide describes card, Media Dependent Adapter (MDA), and port provisioning.
- 7750 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.
- 7750 SR OS Routing Protocols Guide

  This guide provides an overview of routing concepts and provides configuration examples for RIP, OSPF, IS-IS, BGP, and route policies.
- 7750 SR OS MPLS Guide

  This guide describes how to configure Multiprotocol Label Switching (MPLS) and Label Distribution Protocol (LDP).
- 7750 SR OS Services Guide

  This guide describes how to configure service parameters such as service distribution points (SDPs), customer information, and user services.
- 7750 SR OS OAM and Diagnostic Guide
- This guide describes how to configure features such as service mirroring and Operations, Administration and Management (OAM) tools.
- 7750 SR OS Triple Play Guide

  This guide describes Triple Play services and support provided by the 7750 SR7450 ESS7710 SR and presents examples to configure and implement various protocols and services.
- 7750 SR OS Quality of Service Guide

  This guide describes how to configure Quality of Service (QoS) policy management.
- OS Multi-Service ISA Guide

  This guide describes services provided by integrated service adapters such as Application Assurance, IPSec, ad insertion (ADI) and Network Address Translation (NAT).

Technical Support

If you purchased a service agreement for your 7750 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, MDAs and ports.

Alcatel-Lucent 7750 SR-Series Router Configuration Process

Table 1 lists the tasks necessary to provision input/output control modules (IOMs), also referred to as cards, Media Carrier Modules (MCMs), Media Dependent Adapters (MDAs), 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 19
	MCMs	MCMs on page 19
	MDAs	MDAs on page 20
	Versatile Service Module	Versatile Service Module (VSM) on page 23
	Ports	Ports on page 34
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support on page 621

7750 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 input/output modules (IOMs) and media dependent adapters (MDAs), 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 7750 SR-Series 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 19
- MDAs on page 20
- Ports on page 34

Chassis Slots and Cards

To pre-provision a chassis slot, the line card type must be specified as well as the MDA 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 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.

SR7/SR12 systems accept Input/Output Modules (IOM) cards. These IOM cards have two slots which accept MDA modules. The SR-c12 and SR-c4 systems do not accept IOMs. SR-c12 and SR-c4 systems accept MDAs using an MDA Carrier Modules. SR-c12 and SR-c4 systems also accept Compact Media Modules (CMAs) directly without the need for MCMs. Refer to the appropriate system installation guide for more information.

MCMs

An MCM (MDA Carrier Module) slot must be configured before an MDA (Media Dependant Adapter) can be provisioned. If you provision an MDA type before an MCM slot is configured, it is assumed you are provisioning a Compact Media Adapter (subscriber/SAP/spoke SDP). CMAs do not require MCM pre-configuration. Up to six MCMs may be provisioned on a 7750 SR-c12. Even numbered slots are invalid for MCM installation (MCMs physically span 2 slots; “mcm 1” spans slots 1 and 2)

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

MDAs

A chassis slot and card type must be specified and provisioned before an MDA can be preprovisioned. An MDA is provisioned when a type designated from the allowed MDA types is inserted. A preprovisioned MDA slot can remain empty without conflicting with populated slots.

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.

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 7750 SR-c12. 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:7750-3>config>card# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-xp           iom-xp           up    up                  12
1/1    mcm-xp           mcm-xp           up    up
1/3                     mcm-xp           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-xp           cfm-xp           up    up                      Active
B      cfm-xp                            up    down                    Standby
===============================================================================
A:7750-3>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.

CMAs

CMAs (Compact Media Adapter) are configured and provisioned in the same manner as MDAs (Media Dependent Adapter). 7750 SR-c12 and SR-c4 systems accept CMAs. Up to eight CMAs may be provisioned on a 7750 SR-c12, and up to 4 CMAs may be provisioned on an 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:7750-3# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned       Equipped         Admin Operational    Num   Num Comments
ID     Type              Type             State State          Ports MDA
-------------------------------------------------------------------------------
1      iom-xp            iom-xp            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-xp            cfm-xp            up    up                        Active
B      cfm-xp                              up    provisioned               Standby
===============================================================================
A:7750-3#
```

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.

Versatile Service Module (VSM)

The Versatile Service Module (VSM) is a module that allows operators to internally connect a VPLS or VLL service into an IES or IPVPN service. Each module is capable of 10 Gbps throughput.

This module is provisioned as a Cross Connect Adaptor (CCA). Unlike external port connections which utilize two TX-RX paths, a CCA interconnects the egress forwarding path on the IOM directly to the ingress forwarding path. This eliminates the need for the physical port MAC, PHY, cable and other MDA-specific components producing a less costly and more reliable adaptor. The complete 10G+ forwarding path is available allowing single conversations up to 10G.

Bandwidth is utilized in a more efficient manner than with externally cabled ports. Typically, the offered load presented to each side of the cross connect port pair is asymmetric in nature. When physical ports are used to cross connect services, each service is egress bandwidth limited to the link speed of the TX-RX path it is using. If one TX-RX path is under utilized, egress services on the other path cannot make use of the available bandwidth.

Since the CCA is forwarding all services over the same path, all the available bandwidth may be used. An example of this would be a two services connected over a CCA. Service A is a VPLS. Service B is an IES. There are two directions of traffic between the pair, A to B and B to A. Traffic in both directions travels across the CCA in the same path. The total bandwidth the CCA can forward is 10 Gbps. Therefore, A to B could consume 7 Gbps, and B to A could consume 3 Gbps. Any combination of services and traffic directions adding up to 10 Gbps can be supported on a single CCA.

The forwarding plane the CCA interconnects maintains the complete egress and ingress features of the services it is interconnecting. This includes the ability to remap QoS, enforce policing and shaping and provide ingress and egress accounting for each service.

In addition CCAs may be placed into Cross Connect Aggregation Groups (CCAGs). A CCAG provides a mechanism to aggregate multiple CCAs into a single forwarding group.

The CCAG uses conversation hashing to dynamically distribute cross connect traffic to the active CCAs in the aggregation group. In the event that an active CCA fails or is removed from the group, the conversation hashing function will redistribute the traffic over the remaining active CCAs within the group. The conversation hashing mechanism performed for a CCAG is identical to the hashing functions performed for Ethernet LAGs (Link Aggregation Groups).

The VSM module is not supported on 7750 SR-c12/c4 platforms.

Oversubscribed Ethernet MDAs

The 7750 SR supports oversubscribed Ethernet MDAs. These have more bandwidth towards the user than the 10 Gbps capacity between the MDA and IOM.

A traffic management function is implemented on the MDA to control the data entering the IOM. 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 IOM 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 IOM).
- 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 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.

Channelized MDA/CMA Support

Channelized DS-1/E-1 CMA

Each 8-port channelized DS-1/E-1 CMA supports channelization down to DS-0. Each 8-port channelized DS-1/E-1 CMA supports 64 channel groups.

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 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. 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 Any Service Any Port (ASAP) CHOC-3/STM-1

Each port for the channelized ASAP 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 MDAs can be used on the channelized ASAP OC-3/STM-1 MDA.

Each channelized OC-3/STM-1 supports up to 512 channels with DS-0 timeslots with per channel encapsulation configuration (for example, Frame Relay, PPP, cHDLC, ATM). 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. The MDA is based on a programmable data path architecture that enables enhanced L1 and L2 data path functionality, for example ATM TM features, MDA-based channel/port queuing, or multilink applications like Inverse ATM Multiplexing (IMA).

Channelized OC-12/STM-4 ASAP MDAs

The 1-port and 4-port channelized OC-12/STM-4 variant of the ASAP MDAs have 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 Circuit Emulation Services (CES) CMA and MDA

The channelized OC-3/STM-1/OC-12/STM-4 CES MDAs (c1-choc3-ces-sfp / m1-choc3-ces-sfp, m4-choc3-ces-sfp, m1-choc12-ces-sfp) provide an industry leading consolidation for DS-1, E-1 and n*64kbps for CES. The CES MDAs are supported on IOM-2 and IOM-3XP in the 7750 SR.

The channelized OC-3/STM-1/OC-12/STM-4 CES CMA/MDAs support CES. Circuit emulation services are interoperable with the existing 7705 SAR and 7250 SAS circuit emulation services. They are also interoperable with the 1850 TSS-5 circuit emulation services.

Two modes of circuit emulation are supported, unstructured and structured. Unstructured mode is supported for DS-1 and E-1 channels as per RFC4553 (SAToP). Structured mode is supported for n*64 kbps circuits as per RFC 5086, *Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)*. In addition, DS-1, E-1 and n*64 kbps circuits are also supported as per MEF8, *Circuit Emulation Services over Ethernet (CESoETH)* (Oct 2004). TDM circuits are optionally encapsulated in MPLS or Ethernet as per the applicable standards.

All channels on the CES CMA/MDA are supported as circuits to be emulated across the packet network. This includes DS-1, E-1 and n*64 kbps channels. Structure agnostic mode is supported for DS-1 and E-1 channels. Structure aware mode is supported for n*64 kbps channel groups in DS-1 and E-1 carriers. N*64 kbps circuit emulation supports basic and Channel

Associated Signaling (CAS) options. CAS configuration must be identical for all channel groups on a given DS-1 or E-1.

Circuits encapsulated in MPLS will use circuit pipes (Cpipes) to connect to the far end circuit. Cpipes support either SAP-spoke SDP or SAP-SAP connections.

Circuits encapsulated in Ethernet can be selected as a SAP in Epipes. Circuits encapsulated in Ethernet can be either SAP-spoke SDP or SAP-SAP connections for all valid epipe SAPs. An EC-ID and far-end destination MAC address must be configured for each circuit.

Each OC-3/STM-1 port can be independently configured to be loop-timed or node-timed. Each OC-3/STM-1 port can be configured to be a timing source for the node. Each DS-1 or E-1 channel can be independently configured to be loop-timed, node-timed or adaptive. One adaptive timed circuit is supported per CMA/MDA. The CES circuit configured for adaptive timing can be configured to be a timing source for the node. This is required to distribute network timing to network elements which only have packet connectivity to network.

On the 7750 SR-c12 CES CMA, a BITS port is also provided. The BITS port can be configured as one reference sources (ref1, ref2) in the system timing subsystem.

Network Interconnections

With the introduction of Alcatel-Lucent's 7750 SR-Series, the SR-Series product family can fill the needs of smaller service providers as well as the more remote point of presence (PoPs) locations for larger service providers. To support the use of lower speed links as network links in the likelihood that lower speed circuits are used as network or backbone links, the 7750 SR-Series supports a DS-1/E-1/DS-3/E-3 port (ASAP MDAs) or channel and an MLPPP bundle (ASAP MDAs) as network ports to transport and forwarding of all service types. This feature allows service providers to use lower speed circuits to interconnect small PoPs and CoS that do not require large amounts of network/backbone bandwidth.

Digital Diagnostics Monitoring

Some Alcatel-Lucent SFPs, XFPs, and the MSA DWDM transponder 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.

The 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	MSA DWDM
Temperature	Celsius	C	Supported	Supported	Supported
Supply Voltage	Volts	µV	Supported	Supported	Not supported
TX Bias Current	mA	µA	Supported	Supported	Supported
TX Output Power	dBm (converted from mW)	mW	Supported	Supported	Supported
RX Received Optical Power4	dBm (converted from dBm) (Avg Rx Power or OMA)	mW	Supported	Supported	Supported
AUX1	parameter dependent (embedded in transceiver)	-	Not supported	Supported	Not supported
AUX2	parameter dependent (embedded in transceiver)	-	Not supported	Supported	Not 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?	MSA DWDM
Temperature - High Alarm - Low Alarm - High Warning - Low Warning	C	Yes	Yes	Yes	Yes
Supply Voltage - High Alarm - Low Alarm - High Warning - Low Warning	µV	Yes	Yes	Yes	No
TX Bias Current - High Alarm - Low Alarm - High Warning - Low Warning	µA	Yes	Yes	Yes	Yes
TX Output Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes	Yes
RX Optical Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes	Yes
AUX1 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes	No
AUX2 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes	No

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.

Note that in the Transceiver Digital Diagnostic Monitoring section of the **show port** *port-id* **detail** command output:

- If the present measured value is higher than the either or both High Alarm, High Warn thresholds; an exclamation mark “!” displays along with the threshold value.
- If the present measured value is lower than the either or both Low Alarm, Low Warn thresholds; an exclamation mark “!” displays along with the threshold value.

```
B:SR7-101# show port 2/1/6 detail
......
===============================================================================
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
===============================================================================
                   Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)       +33.0+98.0   +88.0      -43.0-45.0
Supply Voltage (V)       3.31 4.12    3.60       3.00 2.80
Tx Bias Current (mA)5.7 60.0    50.00.1  0.0
Tx Output Power (dBm)      -5.45 0.00   -2.00     -10.50    -12.50
Rx Optical Power (avg dBm)    -0.65-3.00!   -4.00!    -19.51    -20.51
===============================================================================
```

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 7750 SR routers support the following port types:

- Ethernet — Supported Ethernet port types include:
  - → Fast Ethernet (10/100BASE-T)
  - → Gigabit (1000BASE-T)
  - → 10Gigabit Ethernet (10GBASE-X) ports on an appropriate MDA.

  7750 SR ports must be configured as either access, hybrid 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. These ports participate in the service provider transport or infrastructure network. Dot1q is supported on network ports.
  - → Hybrid ports — Configured for access and network facing traffic. While the default mode of an Ethernet port remains network, the mode of a port cannot be changed between the access/network/hybrid values unless the port is shut down and the configured SAPs and/or interfaces are deleted. Hybrid ports allow a single port to operate in both access and network modes. MTU of port in hybrid mode is the same as in network mode except for the 10/100 MDA. The default encap for hybrid port mode is dot1q; it also supports QinQ encapsulation on the port level. Null hybrid port mode is not supported. Hybrid mode on the 7750 SR-1 is not supported.

    Once the port is changed to hybrid, the default MTU of the port is changed to match the value of 9212 bytes currently used in network mode (higher than an access port); this is to ensure that both SAP and network VLANs can be accommodated. The only exception is when the port is a 10/100 fast Ethernet. In those cases, the MTU in hybrid mode is set to 1522 bytes, which corresponds to the default access MTU with QinQ, which is larger than the network dot1q MTU or access dot1q MTU for this type of Ethernet port. The configuration of all parameters in access and network contexts will continue to be done within the port using the same CLI hierarchy as in existing implementation. The difference is that a port configured in mode hybrid allows both ingress and egress contexts to be configured concurrently.

An Ethernet port configured in hybrid mode can have two values of encapsulation type: dot1q and QinQ. The NULL value is not supported since a single SAP is allowed, and can be achieved by configuring the port in the access mode, or a single network IP interface is allowed, which can be achieved by configuring the port in network mode. Hybrid mode can be enabled on a LAG port when the port is part of a single chassis LAG configuration. When the port is part of a multi-chassis LAG configuration, it can only be configured to access mode since MC-LAG is not supported on a network port and consequently is not supported on a hybrid port. The same restriction applies to a port that is part of an MC-Ring configuration.

For a hybrid port, the amount of the allocated port buffers in each of ingress and egress is split equally between network and access contexts using the following **config>port>hybrid-buffer-allocation>ing-weight access** *access-weight [0..100]* **network** *network-weight* [0..100] and **config>port>hybrid-buffer-allocation>egr-weight access** *access-weight* [0..100] **network** *network-weight* [0..100] commands.

Adapting the terminology in buffer-pools, the port's access active bandwidth and network active bandwidth in each ingress and egress are derived as follows (egress formulas shown only):

– total-hybrid-port-egress-weights = access-weight + network-weight
– hybrid-port-access-egress-factor = access-weight / total-hybrid-port-egress-weights
– hybrid-port-network-egress-factor = network-weight / total-hybrid-port-egress-weights
– port-access-active-egress-bandwidth = port-active-egress-bandwidth x
– hybrid-port-access-egress-factor
– port-network-active-egress-bandwidth = port-active-egress-bandwidth x
– hybrid-port-network-egress-factor

When a named pool policy is applied to the hybrid port's MDA or to the hybrid port, the port's fair share of total buffers available to the MDA is split into three parts: default pools, named pools local to the port, and named pools on the ports MDA. This allocation can be altered by entering the corresponding values in the **port-allocation-weights** parameter.

- SONET-SDH and TDM — Supported SONET-SDH and TDM port types include:
  → n*DS-0 inside DS-1/E-1
  → DS-1/E-1DS-3/E-3
  → OC3/STM-1
  → OC12/STM-4
  → OC48/STM-16
  → OC192/STM-64 SONET/SDH

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

→ Frame Relay
→ PPP
→ cHDLC

- ATM

  Some MDAs support ATM encapsulation on SONET/SDH and TDM ports. The ATM cell format and 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. The ATM cell mapping can also be configured on per-interface basis for either Direct or PLCP on some MDAs (for example ASAP MDA).
- Several Alcatel-Lucent Media Dependent Adapters (MDAs) support channelization down to the DS-0 level. ATM, Frame Relay, PPP, and cHDLC are supported encapsulations on channelized ports.
- Link Aggregation (LAG) — LAG can be used to group up to 16 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 16 links can be supported in a single LAG, up to 200 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 DS-3/E-3 for example). Multilink bundles are supported over PPP channels (MLPPP) and ATM channels (IMA).
- APS — Automatic Protection Switching (APS) is a means to provide redundancy on SONET equipment to guard against linear unidirectional or bidirectional 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.
- 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.
- Cross connect adaptor (CCA) — A CCA on a VSM module interconnects the egress forwarding path on the IOM directly to the ingress forwarding path. This eliminates the

need for the physical port MAC, PHY, cable and other MDA-specific components producing a less costly and more reliable adapter.

- Optical Transport Network (OTN) — Including OTU2 and OTU2e. OTU2 encapsulates 10-Gigabit Ethernet WAN and adds FEC (Forward Error Correction). OTU2e encapsulates 10-Gigabit Ethernet LAN and adds FEC (Forward Error Correction).

Port Features

SONET/SDH Port Attributes

One OC-3 / STM-1 port is supported on the CMA. One OC-3 / STM-1 port is supported on the MDA. The ports can be configured for either SONET or SDH operation. SONET ports are configured for channelized OC-3 operation. SDH ports can be configured for channelized STM-1 operation.

The port’s transmit clock rate can be node or loop timed. The port’s receive clock rate can be used as a synchronization source for the system. The Section Trace (C1) byte can be configured by the user to ensure proper physical cabling. The port can activate and deactivate local line and internal loopbacks.

All SONET/SDH line alarms are configurable to be either enabled (default) or disabled. Link hold timers can be configured in 100ms increments to control link up and link down indications. The line signal degradation bit error rate (ber-sd) threshold and the line signal failure bit error rate (ber-sf) threshold can be configured.

The CMAs and MDAs support all standard SR OC-3/STM-1 SFP optics including multi-mode, intermediate reach, and long reach. Single fiber mode is not supported.

The CMA contains 3 LEDs for power, status and link state of port #1. The MDA contains LEDs for power, status and one for each link state. The power LED is blue if power is connected and off if no power is present. The status LED is green when operationally up, amber when operationally down, off when administratively shutdown and blinking green during initialization. The link state LED is green when the link is established; amber when the link is down; and unlit when the port is shutdown.

SONET/ SDH Path Attributes

Any CES path can only be configured to operate in access mode. Each path has a configurable text description. The SONET/SDH signal label byte (C2) is configurable. The SONET/SDH path trace string (J1) is configurable. Payload scrambling can not be enabled on CES paths. The valid SONET and SDH path configurations are shown in Table 5.

Table 5: Valid SONET and SDH Path Configurations

Framing	Path Configuration Options Per Physical Port	Max Number of Paths Per Physical Port
SDH	STM1>AUG1>VC4>TUG3>TUG2>VC12> E1 STM1>AUG1>VC3>TUG2>VC12>E1	63 E1 or 512 n*64kbps
SONET	OC3>STS1 SPE>DS3>E1	
SONET	OC3>STS1 SPE>VT GROUP>VT1.5 SPE>DS1	84 DS1 or 512 n*64kbps
SONET	OC3>STS1 SPE>DS3	3 DS3
SONET	OC3>STS1 SPE>DS3>DS1	84 DS1, 63 E1 or 512 n*64kbps
SDH	STM1>AUG1>VC4>TUG3>TUG2>TU11> VC11>DS1 STM1>AUG1>VC3>TUG2>VC11>DS1	84 DS1 or 512 n*64kbps
SDH	STM1>AUG1>VC3>DS3>DS1	84 DS1, 63 E1 or 512 n*64kbps
SDH	STM1>AUG1>VC4>TUG3>VC3>E3 STM1>AUG1>VC3>E3	3 E3
SDH	STM1>AUG1>VC3>DS3	3 DS3
SDH	STM1>AUG1>VC3>DS3>E1	3 DS3

All SONET/SDH path alarms are configurable to be either enabled (the default) or disabled. The MTU size is configurable per path in the range of 512 to 2092. The path uses a default MTU size set to equal the largest possible CES packet size.

Load balancing options are not applicable to channelized CES paths.

Multilink Frame Relay

MLFR is a bundling capability allowing users to spray FR frame fragments over multiple T1/E1 links. This allows a dynamic provisioning of additional bandwidth by adding incremental bandwidth between T1/E1 and DS3/E3. A MLFR bundle increases fault tolerance and improves QoS characteristics since one single large frame of low priority cannot block a higher priority frame.

A MLFR supports up to eight (8) member links and a maximum of 128 bundles with up to 336 T1 / 252 E1 members links can be configured per MDA. NxDS0 circuits or higher speed circuits are not supported.

The MLFR implementation supports FRF.16.1 bundle link integrity protocol to verify serviceability of a member link.

MLFR Bundle Data Plane

FRF.16.1 reuses the UNI/NNI fragmentation procedures defined in FRF.12. Frames on all FR SAP on the MLFR bundle have the UNI/NNI fragmentation header added regardless if they are fragmented or not. A separate sequence number state machine is used for each FR SAP configured on the bundle. The fragmentation threshold is configurable in the range 128-512 bytes.

In order to provide priority based scheduling of the FR SAP fragments over the bundle links, the user configures a FR scheduling class for each FR SAP configured on the bundle. As in MC-MLPPP, four scheduling classes are supported.

A separate fragmentation context is used by each FR SAP. FR SAPs of the same scheduling class share the same egress FR scheduling class queue with fragments of each SAP packets stored contiguously. The fragments from each scheduling class queue are then sprayed over the member links. Furthermore, the user may select the option to not fragment but spray the FR frames with the fragmentation header included over the member links.

Received fragments over the member links are re-assembled on a per SAP basis to re-create the original FR frame.

A user is not allowed to add an FR SAP with FRF.12 e2e fragmentation enabled to an MLFR bundle. Conversely, the user cannot enable FRF.12 e2e fragmentation on an FR SAP configured on an MLFR bundle. If an FR frame with the e2e fragmentation header is received on a bundle, it is forwarded if the FR SAP is part of an fpipe service. It will be discarded if the FR SAP is part of any other service.

Note that the operator must disable LMI before adding a link to an MLFR bundle. Also, the operator must shut down the bundle in order to change the value of the fragmentation threshold.

An FR SAP configured on an MLFR bundle can be part of a VLL, VPLS, IES, or VPRN service.

MLFR Bundle Link Integrity Protocol

FRF.16.1 defines a MLFR Bundle Link Integrity Protocol which verifies the serviceability of a member link. If a problem is found on the member link the link integrity protocol will identify the problem, flag the link as unusable, and adjust the Bundle's available bandwidth. For MLFR Bundles the link integrity protocol is always enabled.

For each member link of a bundle the link integrity protocol will do the following:

- Confirm frame processing capabilities of each member link.
- Verify membership of a link to a specific remote bundle.
- Report to the remote end of the member link the bundle to which the link belongs
- Detect loopbacks on the member link. This is always enabled on the 7750 SR. The near-end monitors the magic number Information Element (IE) sent by the far-end and if its value matches the one it transmitted in ten consecutive control messages, it sends a remove_link message to the far-end and brings the link down. The near-end will attempt to add the link until it succeeds.
- Estimate propagation delay on the member link. The differential delay is calculated as follows in the 7750 SR implementation. Every time the near-end sends an add_link or Hello message to the far-end, it includes the Timestamp Information Element (IE) with the local time the packet was sent. FRF16.1 standard requires that the remote equipment includes the timestamp IE and copies the received timestamp value unchanged if the sender included this IE. When the far-end node sends back the ACK for these messages, the near-end calculates the round trip time. The 7750 SR implementation maintains a history of the last "N" round-trip-times that were received. It takes the fastest of these samples for each member link to find out the member link with the fastest RTT. Then for each link it calculates the difference between the fastest links RTT, and the RTT for the current link. The user has the option to coordinate link removal between the local and remote equipment. Note, however, that in the 7750 implementation, the addition of a link will be hitless but the removing a link is not.

Specifically, the MLFR Bundle Link Integrity Protocol defines the following control messages:

- ADD_LINK
- ADD_LINK_ACK
- ADD_LINK_REJ
- HELLO
- HELLO_ACK
- REMOVE_LINK
- REMOVE_LINK_ACK

The control messages are encapsulated in a single-fragment frame where the C-bit, the B-bit, and the E-bit are all set. The details of the message format are given in FRF.16.1. Table 6 lists the user configured control parameters with values as specified in FRF.16.1.

Table 6: MLFR Bundle Link Integrity Configurable Parameters

Parameter	Default Value	Minimum Value	Maximum Value
Timer T_HELLO	10 seconds	1 second	180 seconds
Timer T_ACK	4 seconds	1 second	10
Count N_MAX_RETRY	2	1	5

T_HELLO Timer - this timer controls the rate at which hello messages are sent. Following a period of T_HELLO duration, a HELLO message is transmitted onto the Bundle Link.

Note that T_HELLO Timer is also used, during the Bundle Link adding process, as an additional delay before re-sending an ADD_LINK message to the peer Bundle Link when this peer Bundle Link does not answer as expected.

T_ACK Timer - this timer defines the maximum period to wait for a response to any message sent onto the Bundle Link before attempting to retransmit a message onto the Bundle Link.

N_RETRY - this counter specifies the number of times a retransmission onto a Bundle Link will be attempted before an error is declared and the appropriate action taken.

FRF.12 End-to-End Fragmentation

The user enables FRF.12 e2e fragmentation on a per FR SAP basis. A fragmentation header is added between the standard Q.922 header and the payload. This header consists of a 2-byte Network Layer Protocol ID (NLPID) of value 0xB1 to indicate e2e fragmentation payload and a 2-byte containing the Beginning bit (B-bit), the End-bit (E-bit), the Control bit (C-bit), and the Sequence Number field.

The following is the mode of operation for the fragmentation in the transmit direction of the FR SAP. Frames of all the FR SAP forwarding class queues are subject to fragmentation. The fragmentation header is, however, not included when the frame size is smaller than the user configured fragmentation size. The SAP transmits all fragments of a frame before sending the next full or fragmented frame. The fragmentation threshold is configurable in the range 128 — 512 bytes. In the receive direction, the SAP accepts a full frame interleaved with fragments of another frame to interoperate with other vendor implementations.

A FR SAP with FRF.12 e2e fragmentation enabled can be part of a VPLS service, an IES service, a VPRN service, an Ethernet VLL service, or an IP VLL service. This SAP cannot be part of a FR VLL service or an FRF.5 VLL service. However, fragmented frames received on such VLLs will be passed transparently as in current implementation.

SAP Fragment Interleaving Option

This option provides a different mode of operation for the fragmentation in the transmit direction of the FR SAP than in the default behavior of a FRF.12 end-to-end fragmentation. It allows for the interleaving of high-priority frames and fragments of low-priority frames.

When the interleave option is enabled, only frames of the FR SAP non expedited forwarding class queues are subject to fragmentation. The frames of the FR SAP expedited queues are interleaved, with no fragmentation header, among the fragmented frames. In effect, this provides a behavior like in MLPPP Link Fragment Interleaving (LFI). The receive direction of the FR SAP supports both modes of operation concurrently, for example, with and without fragment interleaving.

FRF.12 UNI/NNI Link Fragmentation

The user enables FRF.12 UNI/NNI link fragmentation on a per FR circuit basis. All FR SAPs configured on this circuit are subject to fragmentation. A fragmentation header is added on top of the standard Q.922 header. This header consists of 2 bytes containing the beginning bit (B-bit), the End-bit (E-bit), the Control bit (C-bit), and the sequence number field. The fragmentation header is included on frames of all SAPs regardless if the frame size is larger or not than the fragment size.

The FECN, BECN, and DE bits of all fragments of a given FR frame are set to the same value as the original frame. The FECN, BECN, and DE bits of a re-assembled frame are set to the logical OR of the corresponding bits on the constituent fragments.

The operator must delete all configured FR SAPs on a port before enabling or disabling FRF.12 UNI/NNI on that port. Also, the user must shut down the port in order to change the value of the fragmentation threshold.

A FR SAP on a FR circuit with FRF.12 UNI/NNI fragmentation enabled can be part of a VLL, VPLS, IES, or VPRN service.

QoS for a link with FRF.12 UNI/NNI fragmentation is the same as for a MLFR bundle. The FR class queue parameters and its scheduling parameters are configured by applying an egress QoS profile to an FRF.12 UNI/NNI port. The FR scheduling class ingress re-assembly timeout is not applicable to a FRF.12 UNI/NNI port.

MLFR/FRF.12 Support of APS, BFD, and Mirroring Features

The following APS support is provided:

- Single-chassis APS is supported on a SONET/SDH port with FRF.12 UNI/NNI fragmentation enabled on the port or on a constituent TDM circuit.
- Single-chassis APS is supported on a SONET/SDH port with FRF.12 e2e fragmentation enabled on one or more FR SAPs on the port or on a constituent TDM circuit.
- Single-chassis APS is not supported on a SONET/SDH port with MLFR bundles configured.
- Multi-chassis APS is not supported on a SONET/SDH port with FR encapsulation configured on the port or on a constituent TDM circuit.

The following BFD support is provided:

- BFD is supported on an IP interface configured over a FR SAP with e2e fragmentation enabled.

- BFD is supported on an IP interface configured over a FR SAP on a port or channel with UNI/NNI fragmentation enabled.
- BFD is not supported on an FR SAP configured on an MLFR bundle.

The following mirroring support is provided:

- Port mirroring and FR SAP mirroring on an MLFR bundle.
- IP mirroring for an FR SAP on an MLFR bundle.
- A mirror source can be an MLFR bundle or a FR SAP on an FR bundle.
- Mirror destinations must be FR SAPs and must not be part of an APS group or an MLFR bundle.

Multilink Point-to-Point Protocol (MLPPP)

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 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. A summary of the MP encapsulation is shown in Figure 1.

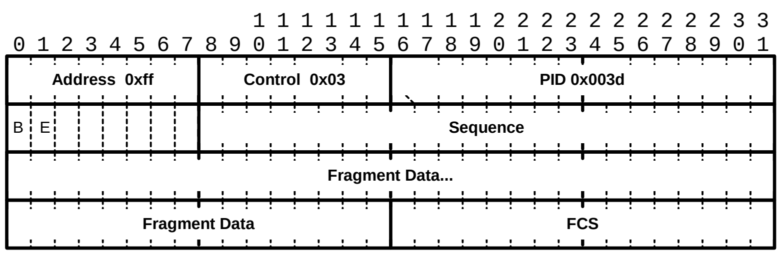

Figure 1: MLPPP 24-bit Fragment Format

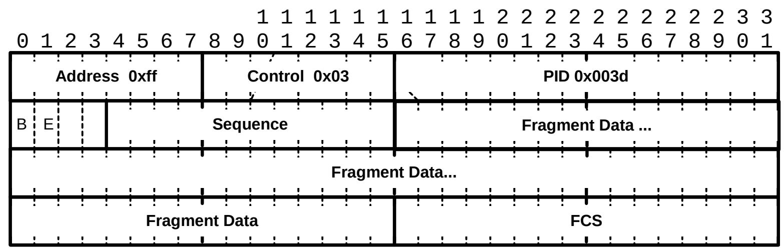

Figure 2: MLPPP 12-bit Fragment Format

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 can support and negotiate 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 Point-to-Point Protocol (PPP)*. 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., the 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 DS-1 or fractional DS-1 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.

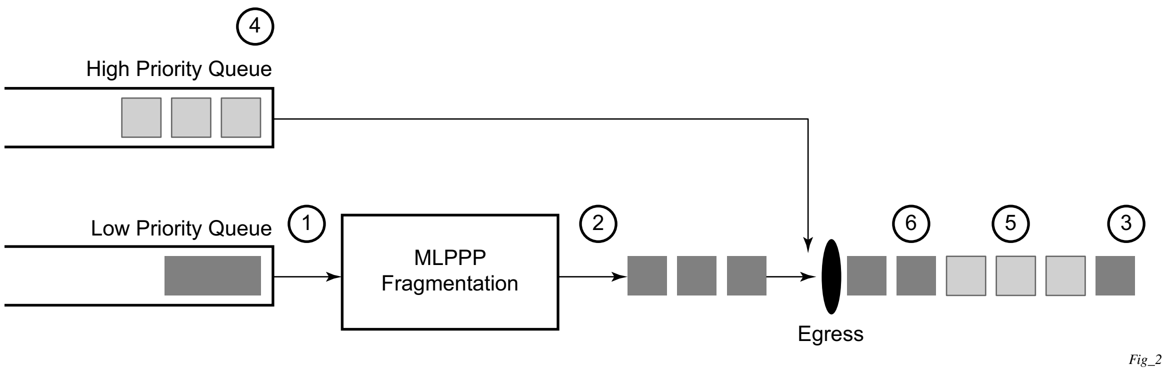

Figure 3: Frame Sequence of Events

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.
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.

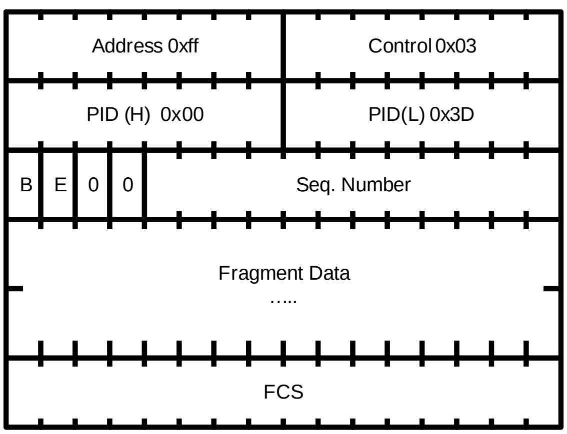

Figure 4: Original MLPPP Header Format

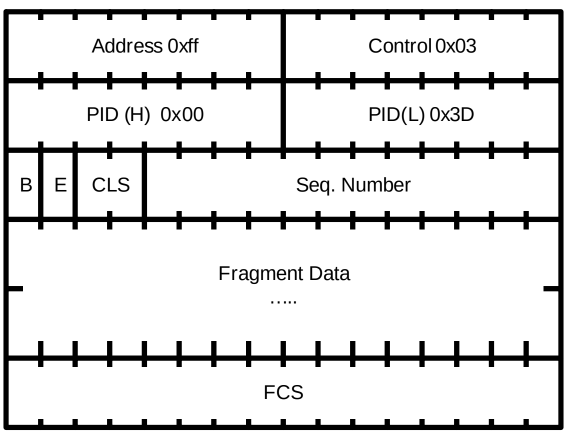

Figure 5: MC-MLPPP Short Sequence Header Format

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 7.

Table 7: 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 8 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 8: 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 9 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 9: 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

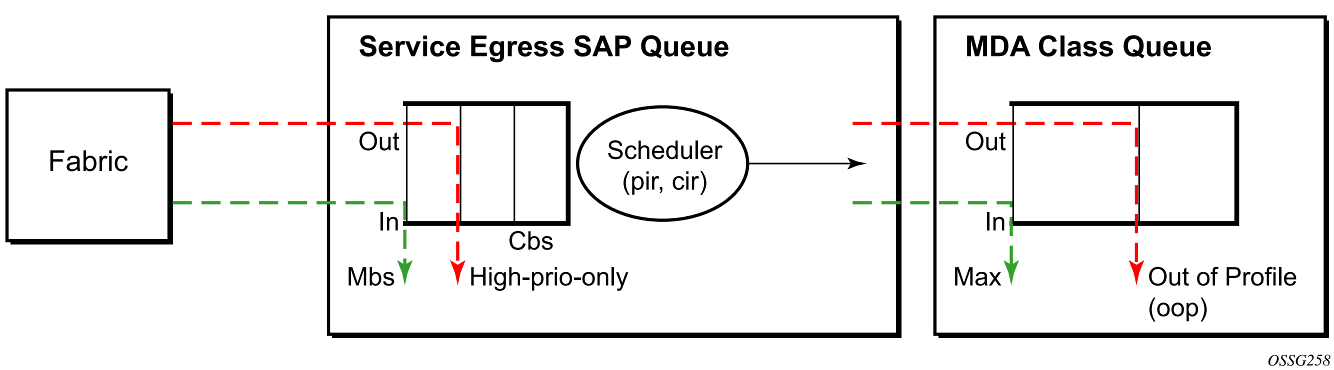

Figure 6: MLPPP Class Queue Thresholds for In-Profile and Out-of-Profile Packets

Table 10 and Figure 7 provide the details of the class queue scheduling parameters.

Table 10: MLPPP Class Queue Scheduling Parameters

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

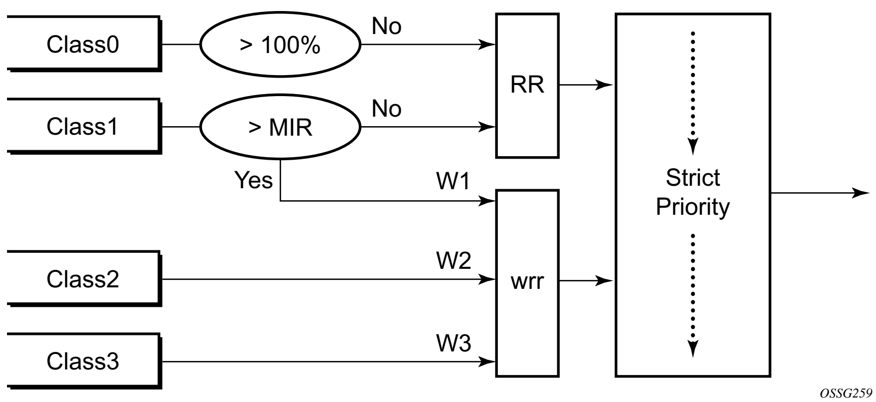

Figure 7: MLPPP Class Queue Scheduling Scheme

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 11.

Table 11: MLPPP Ingress QoS Profile: Reassembly Timers (msec)

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

Configuring MC-MLPPP QoS Parameters

A 4-class MLPPP bundle can be configured with user-defined MLPPP QoS attributes. This feature cannot be used with MC-MLPPP bundles with fewer than 4 classes or with non-multiclass bundles.

The following describe the parameters and the configuration processes and rules

1. The user creates an ingress QoS profile in the **mlppp-profile-ingress** context, to configure a preferred value of the ingress per-class re-assembly timer. Ingress QoS profile 1 is reserved for the pre-defined profile with parameter values displayed in Table 11. The user is allowed to edit this profile and change parameter values. When a user creates a profile with a profile-id greater than 1, or performs the no option command on the parameter, the parameter's default value will always be the 1 in Table 11 for ingress QoS Profile #1 regardless of the parameter value the edited Profile 1 has at that point
2. The user creates an egress QoS profile in the **mlppp-profile-egress** context to configure preferred values for the per-class queue and queue scheduling parameters. The user can also configure system forwarding class mapping to the MLPPP classes. Egress QoS profiles 1, 2, and 3, are reserved for the pre-defined profiles with parameter values shown in Table 8, Table 9, or Table 10. Users can edit these profiles and change parameter values. When a user creates a profile with a profile-id higher than 3, or when the user specifies the no option command on the parameter, the default value will be the one shown in Table 8, Table 9, or Table 10 for the egress QoS Profile 1. This is regardless of the parameter value the edited profiles have at that point in time.
3. A maximum of 128 ingress and 128 egress QoS profiles can be created on the system.
4. The values of the ingress per-class re-assembly timer are configured in the ingress QoS profile.
5. The mapping of the system forwarding classes to the MLPPP Classes are configured in the egress QoS profile. There is a many-to-one relationship between the system FC and an MLPPP class. See Table 8 for the mapping when one of the three pre-defined 4-class egress QoS profiles is selected.
6. The maximum size for each MLPPP class queue in units of msec at the available bundle rate is configured in the egress QoS profile. This is referred to as max in Figure 6 and as max-queue-size in CLI. The out-of-profile threshold for an MLPPP class queue, referred to as oop in Figure 6, is not directly configurable and is set to 50% of the maximum queue size rounded up to the nearest higher integer value.
7. The MLPPP class queue scheduling parameters is configured in the egress QoS profile. The minimum information rate, referred to as **MIR** in Figure 7 and **mir** in CLI, applies to Class 1 queue only. The MIR parameter value is entered as a percentage of the available bundle rate. The WRR weight, referred to as W1, W2, and W3 in Figure 7 and weight in CLI, applies to class 1, class 2, and class 3 queues. Note that W1 in Figure 7 is not configurable and is internally set to a value of 1 such that Class 1 queue shares 1% of the available bundle rate when the sum of W1, W2, and W3 equals 100. W2 and W3 weights are integer values and are user configurable such that Class 2 queue shares (W2/(W1 +

W2 + W3)) and Class 3 queue shares (W3/(W1 + W2 + W3)) of the available bundle rate.

8. The user applies the ingress and egress QoS profiles to a 4-class MLPPP bundle for the configured QoS parameter values to take effect on the bundle.
9. The following operations require the bundles associated with a QoS profile to be shutdown to take effect.
   → A change of the numbered ingress or egress QoS profile associated with a bundle.
   → A change of the bundle associated ingress or egress QoS profile from default profile to a numbered profile and vice-versa.
10. The following operations can be performed without shutting down the associated bundles:
   → Changes to any parameters in the ingress and egress QoS profiles.

The CLI commands for the creation of ingress and egress QoS profiles and configuration of the individual QoS parameters are described in the 7750 SR OS Quality of Service Guide.

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 60) address-request and address-response messages with peer network devices.

The basic frame structure of a cHDLC frame is shown in Table 12. 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 12: 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 13: 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 unidirectional or bidirectional 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.

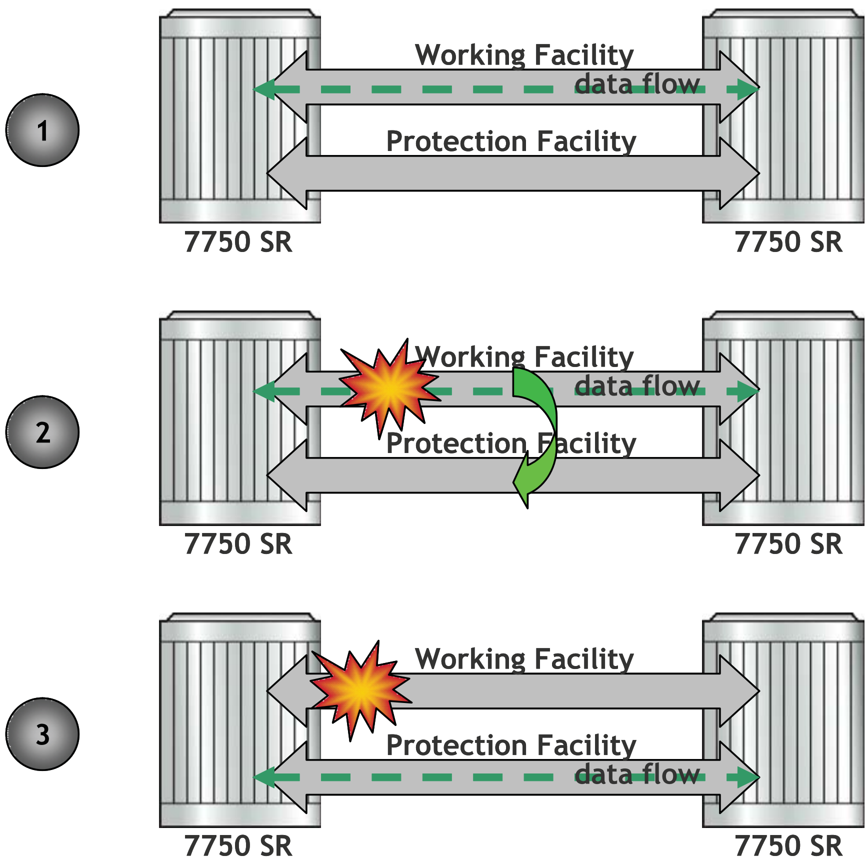

Figure 8: APS Protection (Single Chassis APS) and Switchover

Note that “facility” in the SR-OS context refers to the physical line (including intermediate transport/switching equipment) and directly attached line terminating hardware (e.g. SFP module, MDA and IOM). “Circuit” is also a term used for a link/facility (e.g. working-circuit).

A 1+1 APS group contains two circuits.

APS is configured on a port by port basis. If all ports on an MDA or IOM need to be protected then each port on the MDA or IOM must be individually added into an APS group.

Working and protection circuits can be connected to a variety of types of network elements (e.g. ADMs, DACSes, ATM Switches, Routers) and serve as an access or network port providing one or more services or network interfaces to the router. APS-protected SONET/SDH ports may be further channelized, and may contain bundled channels (e.g. MLPPP or IMA Bundle Protection Groups). The ports may be one of a variety of encapsulation types as supported by the MDA including PPP, ATM, FR and more. For a definitive description of the MDAs, port types, switching modes, bundles and encapsulations supported with APS please see APS Applicability, Restrictions and Interactions on page 80.

This section discusses the different APS architectures and their implementations.

Single Chassis and Multi-Chassis APS

APS can operate in a Single Chassis configuration (SC-APS) or in a Multi-Chassis configuration (MC-APS).

An SC-APS group can span multiple ports, MDAs or IOMs within a single node whereas as MC-APS can span two separate nodes.

Table 14: SC-APS versus MC-APS Protection

	Single Chassis APS	Multi-Chassis APS
Short form name	SC-APS	MC-APS
Link failure protection (including intermediate transmission equipment failure)	Yes	Yes
Optical/electrical module (e.g. SPF, XPF) failure protection	Yes	Yes
MDA failure protection	Yes	Yes
IOM failure protection	Yes	Yes
Node failure protection	No	Yes

The support of SC-APS and MC-APS depends on switching modes, MDAs, port types and ecaps. For a definitive description of the MDAs, port types, switching modes, bundles and encapsulations supported with APS please see APS Applicability, Restrictions and Interactions on page 80.

APS on a Single Node (SC-APS)

In Single Chassis APS both circuits of an aps group are terminated on the same node.

The working and protect lines of a single chassis APS group can be:

- Two ports on the same MDA.
- Two ports on different MDAs but on the same IOM.
- Two ports on different MDAs on two different IOMs (installed in different slots).

If the working and protection circuits are on the same MDA, protection is limited to the physical port and the media connecting the two devices. If the working and protection circuits are on different IOMs then protection extends to MDA or IOM failure. The following figure shows a configuration that provides protection against circuit, port, MDA or IOM failure on the 7750 SR connected to an Add-Drop-Multiplexer (ADM).

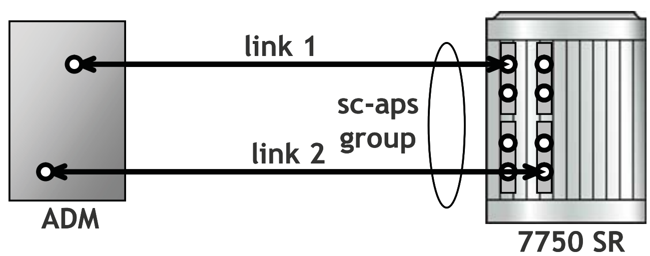

Figure 9: SC-APS Group with MDA and IOM Protection

APS Across Two Nodes (MC-APS)

Multi-Chassis APS functionality extends the protection offered by SC-APS to include protection against nodal (7750 SR) failure by configuring the working circuit of an APS group on one 7750 SR node while configuring the protect circuit of the same APS group on a different 7750 SR node.

These two nodes connect to each other with an IP link that is used to establish an MC-APS signalling path between the two 7750 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 7750 SR. Service or network-specific configuration data is not signalled nor 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.

The following figure illustrates a Multi-Chassis APS group being used to protect against link, port, MDA, IOM or node failure.

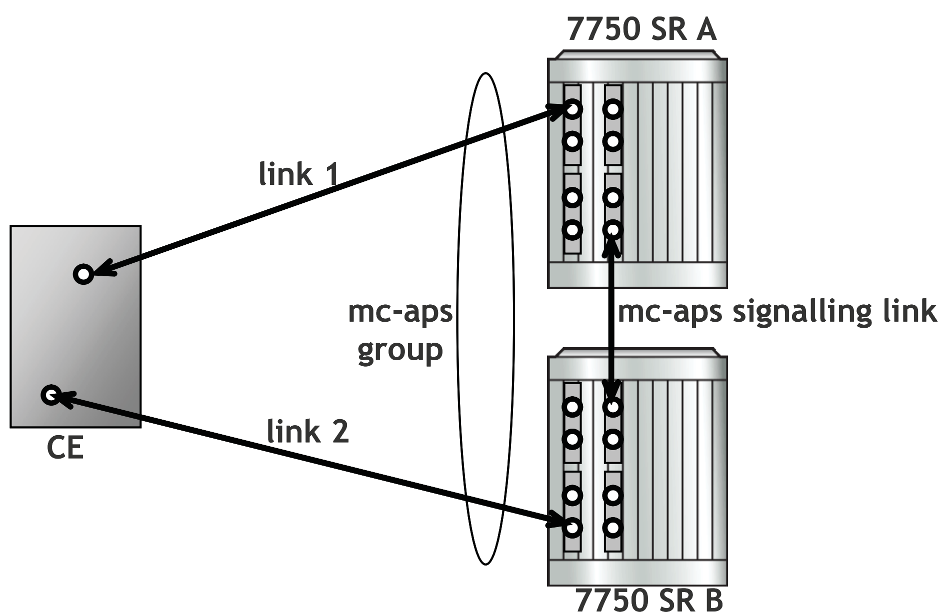

Figure 10: MC-APS Group Protects Against Node Failure

APS Switching Modes

APS behavior and operation differs based on the switching mode configured for the APS group. Several switching modes are supported in SR-OS.

The switching mode affects how the two directions of a link behave during failure scenarios and how APS tx operates.

Unidirectional / Bidirectional configuration must be the same at both sides of the APS group. The APS protocol (K byte messages) exchange switching mode information to ensure that both nodes can detect a configuration mismatch.

- If one end of an APS group is configured in a Unidirectional mode (Uni 1+1 Sig APS or Uni 1+1 Sig+Data APS) then the other end must also be configured in a Unidirectional mode (Uni 1+1 Sig+Data APS).
- If one end of an APS group is configured in a Bidirectional mode then the other end must also be configured in Bidirectional mode.

Table 15: APS Switching Modes

	Bidirectional 1+1 Signalling APS	Unidirectional 1+1 Signalling APS	Unidirectional 1+1 Signalling and Datapath APS
Short form name	Bidir 1+1 Sig APS	Uni 1+1 Sig APS	Uni 1+1 Sig+Data APS
CLI keyword	bi-directional	uni-directional	uni-1plus1
Interworks with a standards compliant APS implementation	Yes	Yes	Yes
Full 1+1 APS standards-based signalling	Yes	Yes	Yes
Data is transmitted simultaneously on both links/circuits (1+1 Data)	No	No	Yes

The support of switching modes depends on SC-APS / MC-APS, MDAs, port types and ecaps. For a definitive description of the MDAs, port types, switching modes, bundles and encapsulations supported with APS please see APS Applicability, Restrictions and Interactions on page 80.

Bidirectional 1+1 Signalling APS

In Bidir 1+1 Sig APS switching mode the data path supports 1:1 data path architecture (data is sent only on the active link); 1+1 signalling, however, is used for full interoperability with signalling-compliant 1+1 architectures.

In the ingress direction (Rx), the decision to accept data from either the working or protection circuit is based on both locally detected failures/degradation and on what circuit the far-end is listening on (as indicated in the K bytes). If the far-end indicates that it has switched its active receiver, then the local SR-OS node will also switch its receiver (and Tx) to match the far-end. If the local Rx changes from one circuit to another it notifies the far end using the K bytes.

In the egress direction (Tx), the data is only transmitted on the active circuit. If the active Rx changes, then Tx will also change to the same circuit.

Bidirectional 1+1 Signalling APS ensures that both directions of active data flow (including both Rx) are using the same link/circuit (e.g. using the two directions of the same fiber pair) as required by the APS standards. If one end of the aps group changes the active receiver, it will signal the far end using the K bytes. The far end will then also change its receiver to listen on the same circuit.

Because the router transmits on active circuits only and keeps active TX and RX on the same port, both local and remote switches are required to restore the service.

The APS channel (bytes K1 and K2 in the SONET header – K bytes) is used to exchange requests and acknowledgments for protection switch actions. In Bidirectional 1+1 Signalling APS switching mode, the router sends correct status on the K bytes and requires the far-end to also correctly update/send the K-bytes to ensure that data is transmitted on the circuit on which the far-end has selected as its active receiver.

Line alarms are processed and generated independently on each physical circuit.

In Bidirectional 1+1 Signalling APS mode, the highest priority local request is compared to the remote request (received from the far end node using an APS command in the K bytes), 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 16 on page 71 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.).

Unidirectional 1+1 Signalling APS

In Uni 1+1 Sig APS switching mode the data path supports 1:1 data path architecture (data is sent only on the active link); 1+1 signalling, however, is used for full interoperability with signalling-compliant 1+1 architectures.

In the ingress direction (Rx), the decision to accept data from either the working or protection circuit is based on both locally detected failures/degradation and on what circuit the far-end is listening on (as indicated in the K bytes). Although it is not required in the APS standards, the SR-OS implementation of Unidirectional 1+1 Signalling APS uses standards based signaling to keep both the Rx and Tx on the same circuit / port. If the far-end indicates that it has switched its active receiver, then the local SR-OS node will also switch its receiver (and Tx) to match the far-end. If the local Rx changes from one circuit to another it notifies the far end using the K bytes.

In the egress direction (Tx), the data is only transmitted on the active circuit. f the active Rx changes, then Tx will also change to the same circuit.

Because the router transmits on active circuits only and keeps active TX and RX on the same port, both local and remote switches are required to restore the service. For a single failure a data outage is limited to a maximum of 100 milliseconds.

The APS channel (bytes K1 and K2 in the SONET header – K bytes) is used to exchange requests and acknowledgments for protection switch actions. In Unidirectional 1+1 Signalling APS switching mode, the router sends correct status on the K bytes and requires the far-end to also correctly update/send the K-bytes to ensure that data is transmitted on the circuit on which the far-end has selected as its active receiver.

Line alarms are processed and generated independently on each physical circuit.

In Unidirectional 1+1 Signalling APS switching mode:

- K-bytes are generated/transmitted based on local request/condition only (as required by the APS signalling).
- Local request priority is compliant to 1+1 U-APS specification.
- RX and TX are always forced on to the same (active) circuit (bi-directional). This has the following caveats:
  - → If an APS switch is performed due to a local condition, then the TX direction will be moved as well to the newly selected RX circuit (old inactive). The router will send LAIS on the old active TX circuit to force the remote end to APS switch to the newly active circuit. Note that some local request may not cause an APS switch when a remote condition prevents both RX and TX direction to be on the same circuit (for example an SD detected locally on a working circuit will not cause a switch if the protection circuit is locked out by the remote end).

→ If the remote end indicates an APS switch and the router can RX and TX on the circuit newly selected by the remote end, then the router will move its TX direction and will perform an APS switch of its RX direction (unless the router already TX and RX on the newly selected circuit).

→ If the remote end indicates an APS switch and the router cannot RX and TX on the circuit newly selected by the remote end (for example due to a higher priority local request, like a force request or manual request, etc.), then L-AIS are sent on the circuit newly selected by the remote end to force it back to the previously active circuit.

→ The sent L-AIS in the above cases can be either momentary or persistent. The persistent L-AIS is sent under the following conditions:
  - On the protection circuit when the protection circuit is inactive and cannot be selected due to local SF or Lockout Request.
  - On the working circuit as long as the working circuit remains inactive due to a local condition. The persistent L-AIS is sent to prevent revertive switching at the other end.

In all other cases a momentary L-AIS is sent. SR-OS provides debugging information that informs operators about the APS-induced L-AIS.

Unidirectional 1+1 Signalling and Datapath APS

Uni 1+1 Sig+Data APSsupports unidirectional switching operations, 1+1 signaling and 1+1 data path.

In the ingress direction (Rx) switching is done based on local requests only as per the APS specifications. K-bytes are used to signal the far end the APS actions taken.

In the egress direction (Tx), the data is transmitted on both active and protecting circuits.

Each end of the aps group may be actively listening on a different circuit.

The APS channel (bytes K1 and K2 in the SONET header) is used to exchange APS protocol messages.

In Uni 1+1 Sig+Data APS a received L-RDI signal on the active circuit does not cause that circuit (port) to be placed out of service. The APS group can continue to use that circuit as the active receiver. This behavior is not configurable.

Uni 1+1 Sig+Data APS also supports configurable:

- Debounce timers for signal failure and degradation conditions
- Suppression of L-RDI alarm generation

APS Channel and SONET Header K Bytes

The APS channel (bytes K1 and K2 in the SONET header) is used to exchange APS protocol messages for all APS modes.

K1 Byte

The switch priority of a request is assigned as indicated by bits 1 through 4 of the K1 byte (as described in the rfc3498 APS-MIB).

Table 16: 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. Channel values of 0 and 1 are supported.

Table 17 displays bits 5-8 of a K1 byte and K2 Bits 1-4 and the channel number code assignments.

Table 17: 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 18.

Table 18: K2 Byte Functions

Bits 1-8	Function	
1 — 4	Channel number. The 7750 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)

Differences in SONET/SDH Standards for K Bytes

SONET and SDH standards are slightly different with respect to the behavior of K1 and K2 Bytes.

Table 19 depicts the differences between the two standards.

Table 19: 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.

Failures Indicated by K Bytes

The following sections describe failures indicated by K bytes.

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 7750 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. 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.

Revertive Switching

The APS implementation also provides the revertive and non-revertive modes with non-revertive switching as the default option. 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. 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.

Bidirectional 1+1 Switchover Operation Example

Table 20 outlines the steps that a bi-directional protection switching process will go through during a typical automatic switchover.

Table 20: 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

Protection of Upper Layer Protocols and Services

APS prevents upper layer protocols and services from being affected by the failure of the active circuit.

The following example with figures and description illustrate how services are protected during a single-chassis APS swithover.

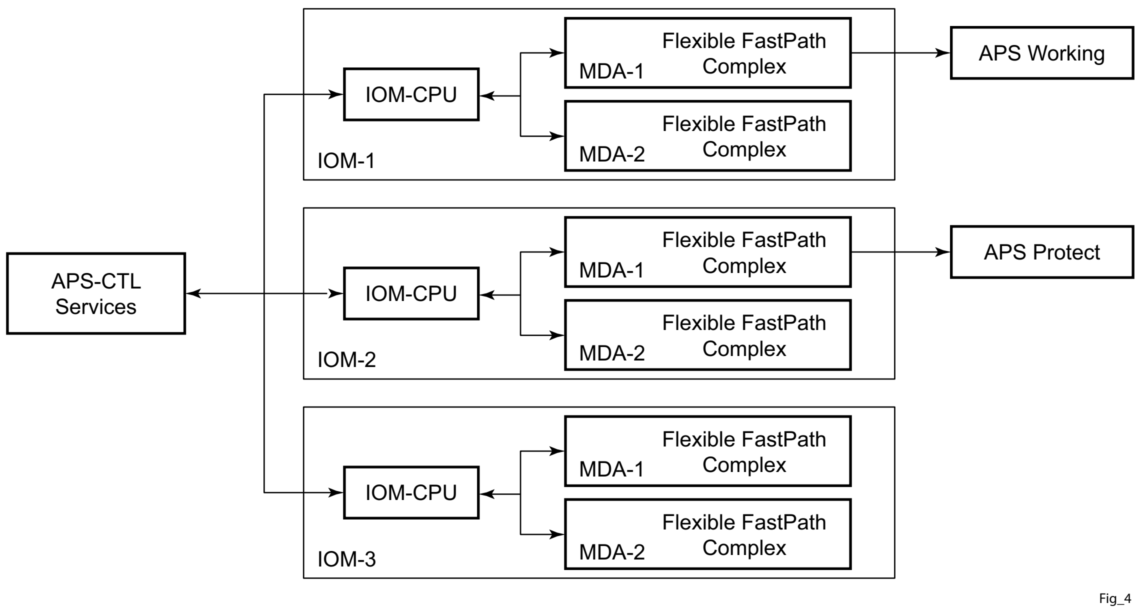

Figure 11: APS Working and Protection Circuit Example

Figure 11 is an example in which the APS working circuit is connected to IOM-1 / MDA-1 and the protection circuit is connected to IOM-2 / MDA-1. In this example, assume that the working circuit is currently used to transmit and receive data.

Switchover 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 circuit on IOM-1 / MDA-1.

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

Although the control CFM/CPM on the SF/CPM blade initiates the changeover between the working to protect circuit, 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 circuits.

Switchover Process for Received Data

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

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 circuit fails or degrades to the degree that requires a switchover to the protect circuit. When the switchover occurs all services including all their QoS and filter policies are activated on the protection circuit.

APS User-Initiated Requests

The following sections describe 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 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 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 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 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.

APS and SNMP

SNMP Management of APS uses the APS-MIB (from rfc3498) and the TIMETRA-APS-MIB.

The following table shows the mapping between APS switching modes and MIB objects.

Table 21: Switching Mode to MIB Mapping

switching-mode	TIMETRA-APS-MIB tApsProtectionType	APS-MIB apsConfigDirection
Bidir 1+1 Sig APS (bi-directional)	onePlusOneSignalling (1)	bidirectional (2)
Uni 1+1 Sig APS (uni-directional)	onePlusOneSignalling (1)	unidirectional (1)
Uni 1+1 Sig+Data APS (uni-1plus1)	onePlusOne (2)	unidirectional (1)

APS Applicability, Restrictions and Interactions

Note: The Release Notes document for the relevant SR-OS release should be consulted for details about APS Restrictions.

Table 22: Supported APS Mode Combinations

	Bidirectional 1+1 Signalling APS	Unidirectional 1+1 Signalling APS	Unidirectional 1+1 Signalling and Datapath APS
Single Chassis APS (SC-APS)	Supported	Supported	Supported (for 7750 SR-c4/12 platforms only)
Multi-Chassis APS (MC-APS)	Supported	Not supported	Not supported

APS and Bundles

Bundles (such as IMA and MLPPP) can be protected with APS through the use of Bundle Protection Groups (bpgrp). 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.

IMA APS protection is supported only when the router is connected to another piece of equipment (possibly via an ADM) running a single IMA instance at the far end. By design, the IMA APS implementation is expected to keep the IMA protocol up as long as the far end device can tolerate some frame loss. Similarly, the PPP protocol state machine for PPP channels and MLPPP bundles remains UP when a switchover occurs between the working and protect circuits.

When APS protects IMA groups, IMA control cells, but not user traffic, are sent on the inactive circuit (as well as the active) to keep the IMA protocol up during an APS switch.

For details on MLFR/FRF.12 support with APS see the section called “MLFR/FRF.12 Support of APS, BFD, and Mirroring Features”.

APS Switchover Impact on Statistics

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 behaviour as described above.

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.

Supported APS MDA/Port Combinations

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 23: MDA/Port Type Pairing for APS

MDA Type	**Unchannelized SONET/SDH (POS)** For example: m16-oc12/3-sfp	**ATM** For example: m4-atmoc12/3-sfp	**Circuit Emulation (CES)** For example: m4-choc3-ces-sfp	**Channelized Any Service Any Port (ASAP)** For example: m1-choc12-as-sfp
Unchannelized SONET/SDH (POS) For example: m16-oc12/3-sfp	Supported			
ATM For example: m4-atmoc12/3-sfp		Supported		
Circuit Emulation (CES) For example: m4-choc3-ces-sfp			Supported	
Channelized Any Service Any Port (ASAP) For example: m1-choc12-as-sfp				Supported

For example, an APS group can be comprised of a pair of ports where each port is on one of the two following MDAs:

- m16-atmoc3-sfp
- m4-atmoc12/3-sfp (port in oc3 mode)

For example, an APS group can not be comprised of a pair of ports where one port is on an m16-oc12/3-sfp and the other port is on an m1-choc12-as-sfp.

APS Switchover During CFM/CPM Switchover

An APS switchover immediately before, during or immediately after a CFM/CPM switchover may cause a longer outage than normal.

Removing or Failure of a Protect MDA

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

Mirroring Support

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

Sample APS Applications

The following sections provide sample APS application examples.

Sample APS Application: MLPPP with SC-APS and MC-APS on Channelized Interfaces

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).

Figure 12 displays an example of MLPPP termination on APS protected channelized OC-n/STM-n links. This example illustrates the following:

- SC-APS (the APS circuits terminate on the same node Aggregation Router A)
- APS protecting MLPPP bundles (bundles are between the BTS and Aggregation Router A, but APS operates on the Sonet links between the DACS and the Aggregation Router)
- APS on channelized access interfaces (OC-3/OC-12 links)

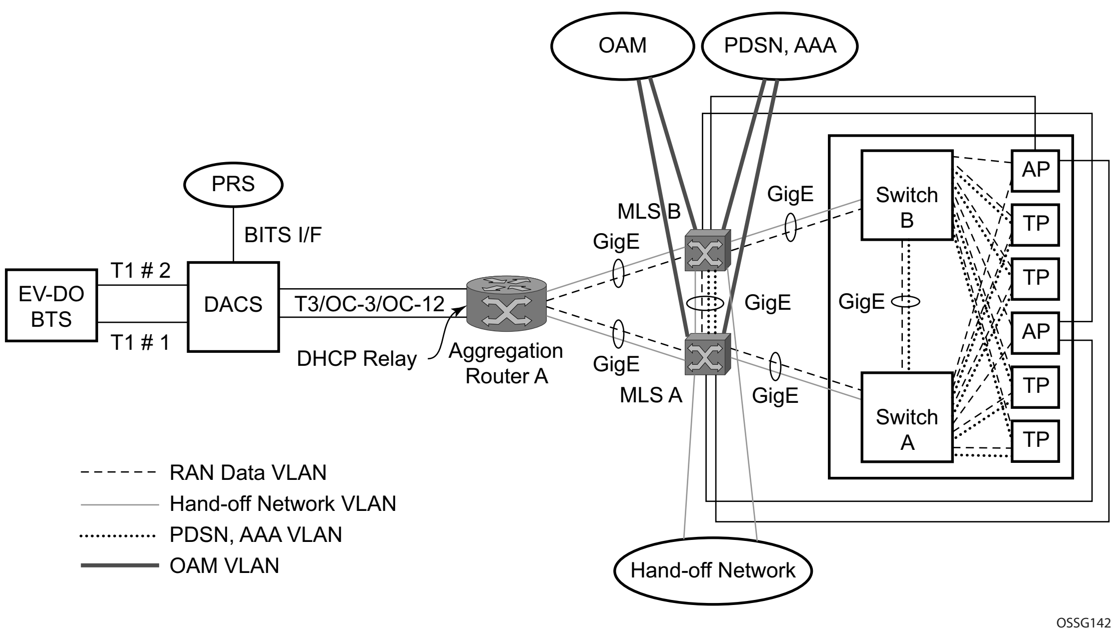

Figure 12: SC-APS MLPPP on Channelized Access Interfaces Example

Figure 13 depicts an APS group between a digital access cross-connect system (DACS) and a pair of Aggregation Routers. At one end of the APS group both circuits (OC-3/STM-1 and/or OC-12/STM-4 links) are terminated on the DACS and at the other end each circuit is terminated on a different Aggregation Routers to provide protection against router failure. The MLPPP bundle operates between the BTS and the Aggregation Routers. At any one time only one of the two Aggregation Routers is actually terminating the MLPPP bundle (whichever Aggregation Router is processing the active APS circuit).

This example illustrates the following:

- MC-APS (the APS circuits terminate on different Aggregation Routers)
- APS protecting MLPPP bundles (bundles are between the BTS and the Aggregation Routers but APS operates on the Sonet links between the DACS and the Aggregation Routers)
- APS on channelized access interfaces (OC-3/OC-12 links)

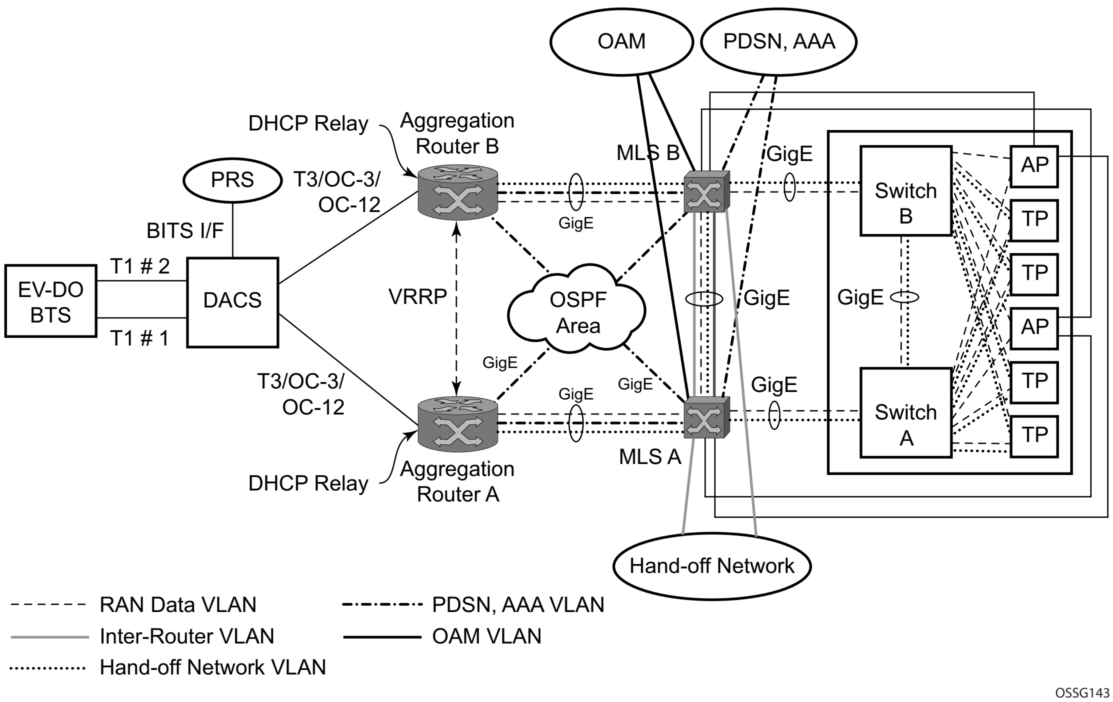

Figure 13: MC-APS MLPPP on Channelized Access Intefaces Example

Sample APS Application: MC-APS for ATM SAP with ATM VPLS Service

In Figure 14, service router A is connected to the ATM switch or 7670 through an OCx ATM 1 link. This link is configured as the working circuit. Service router B is connected to the same ATM switch or 7670 through an OCx ATM 2 link. This link is configured as the protection circuit.

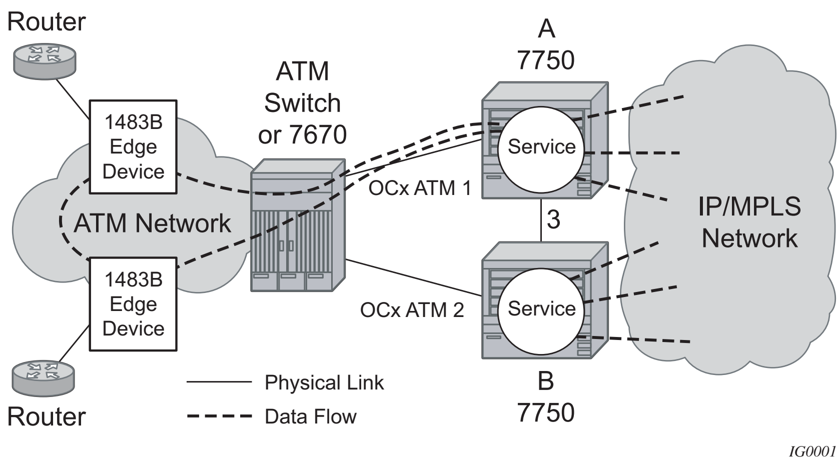

Figure 14: Multi-Chassis APS Application

Communication between service routers A and B is established through link 3. This link is for signalling. To guarantee optimum fail-over time between service routers A and B, link 3 must be a direct physical link between routers A and B.

Sample APS Application: MC-APS with VLL Redundancy

Support of MC-APS to ATM VLLs and Ethernet VLL with ATM SAPs allows 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 15.

MC-APS groups are configured as follows:

- MC-APS group between the MSAN on the left and Aggregation Nodes A & B
- MC-APS group between the MSAN on the right and Aggregation Nodes C & D

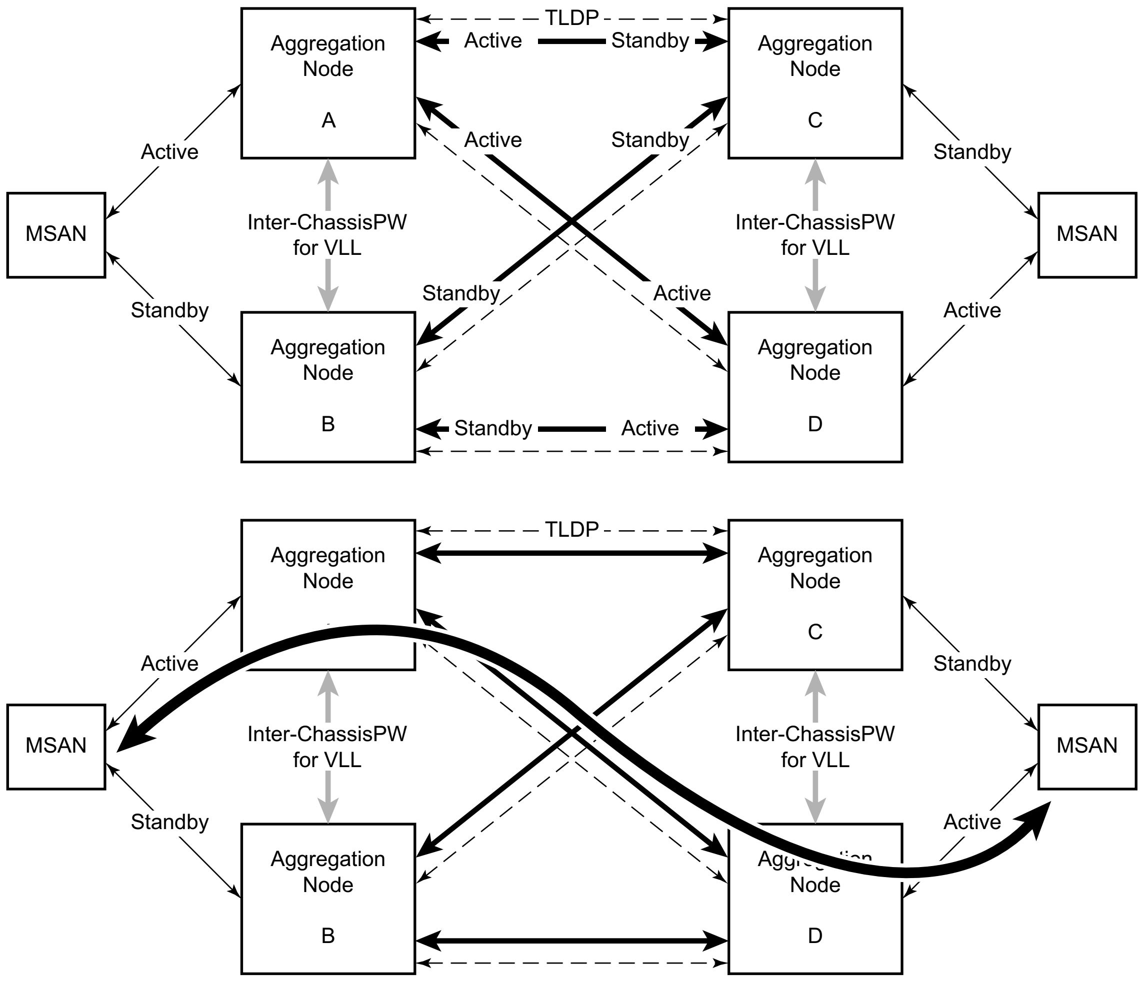

Figure 15: Access and Node and Network Resilience

An example of a customer application in the mobile market is displayed in Figure 16.

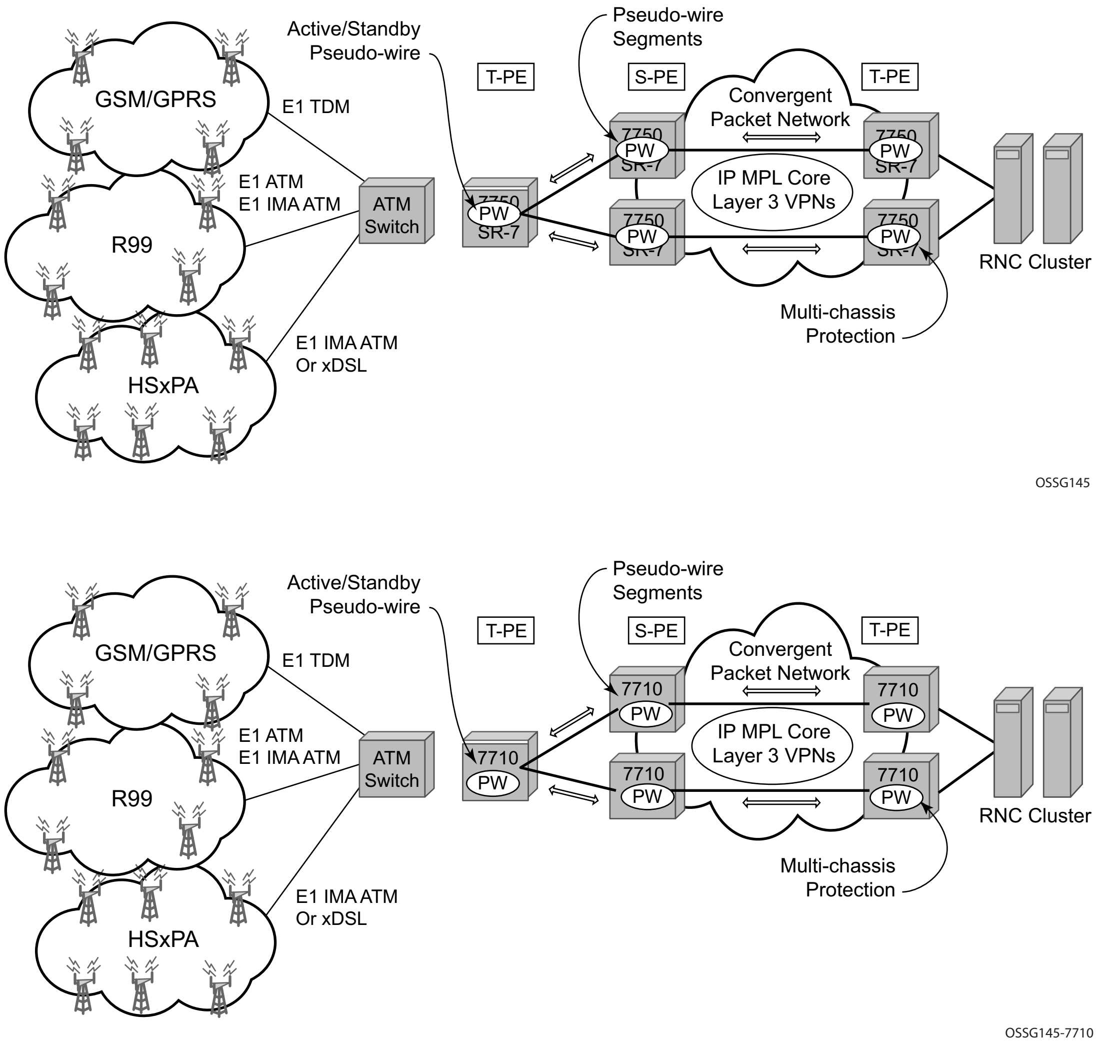

Figure 16: MC-APS with ATM VLL Redundancy

In the application show in Figure 16, 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.

Sample APS Application: RAN Aggregation with Microwave Radio Transport

Figure 17 displays a RAN aggregation network deployment example. In this example Uni-dir 1+1 Sig+Data APS is being used.

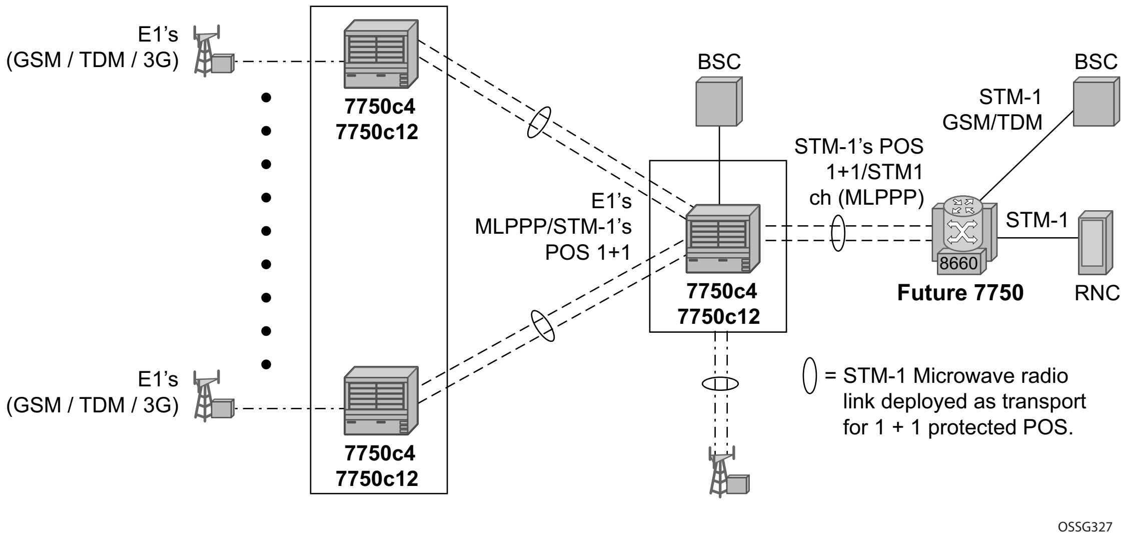

Figure 17: Mobile RAN with Microwave Transport Example

As depicted in Figure 17, some APS-protected interfaces may require microwave radio transport. The following picture depicts APS-protected links between two routers that use Microwave transport. The radio equipment acts as a SONET section/ SDH regenerator section equipment, yet it implements Unidirectional APS-like processing to provide equipment protection on the local/ remote radio sites respectively.

The active RX line signal (switched independently from TX) is being transmitted over the radio link to the far end radio where the signal gets transmitted on both active and inactive circuits.

The radio reacts on APS triggered failures as detected by the segment termination function: LOS, LOF, manual APS commands, and optionally BER SF/SD. Since the radio does not terminate the SONET/SDH line layer, any line signaling (including Kbytes signaling for APS, line alarms like RDI/AIS) are not terminated by the radio and arrive at a far-end router.

Note that the far-end router can either send line alarms based on its active link status or based on physical circuit status (in which case for example, an L-RDI with a valid data will be received on the 77x0).

To facilitate a deployment such as shown in this example, some of following features of the 7750 SR-c12 routers are employed:

- Uni-dir 1+1 Sig+Data APS switching mode.
- Configurable L-RDI suppression.
- Active RX circuits are selected based on local conditions only. The SONET K Bytes are not needed to coordinate switch actions, but they are still used since they flow through and reach the far-end router.
- Ports are not failed on L-RDI, as L-RDI may be received on both ports momentarily, as a result of a local radio APS switch or, permanently as a result of a remote router APS switch (with remote radio selecting traffic from the TX line on the same port as failed RX line on the router).
- For some radio equipment, a radio can cause an APS switch resulting in the far end radio detecting radio alarm and generating L-AIS toward its locally attached router on both circuits. In some cases, that router also detects BER SD/BER SF conditions on both circuits as well. Therefore, to localize failure recovery, the 7750c12 can optionally debounce those alarms so a remote router does not invoke an APS switch on a local failure condition.

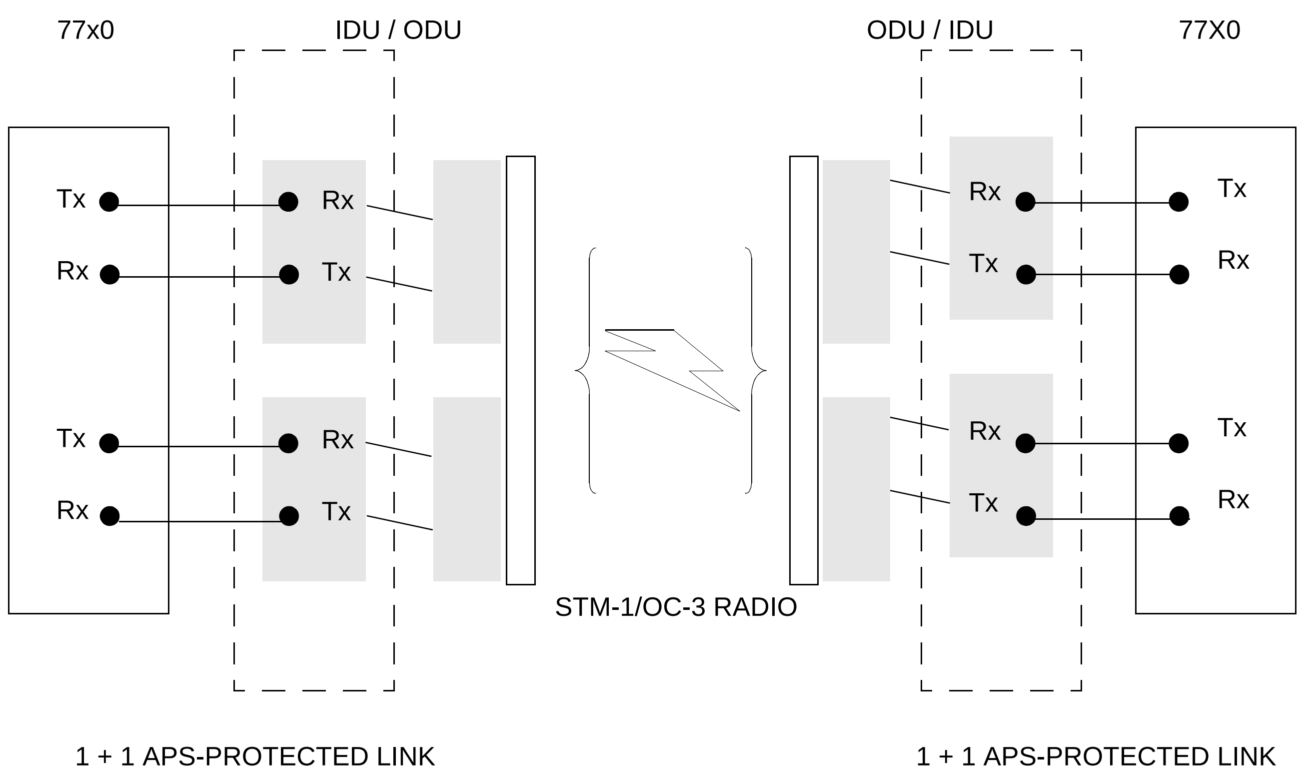

Figure 18: 1+1 APS Protected Microwave SDH Transport

Inverse Multiplexing Over ATM (IMA)

IMA is a cell based protocol where an ATM cell stream is inverse-multiplexed and de-multiplexed in a cyclical fashion among ATM-supporting channels to form a higher bandwidth logical link where the logical link concept is referred as an IMA group. By grouping channels into an IMA group, customers gain bandwidth management capability at in-between rates (for example, between E-1/DS-1 and E-3/DS-3 respectively) through addition/removal of channels to/from the IMA group.

In the ingress direction, traffic coming over multiple ATM channels configured as part of a single IMA group, is converted into a single ATM stream and passed for further processing to the ATM Layer where service-related functions, for example L2 TM, or feeding into a pseudowire are applied. In the egress direction, a single ATM stream (after service functions are applied) is distributed over all paths that are part of an IMA group after ATM layer processing takes place.

An IMA group interface compensates for differential delay and allows only for a minimal cell delay variation. The interface deals with links that are added, deleted or that fail. The higher layers see only an IMA group and not individual links, therefore service configuration and management is done using IMA groups, and not individual links that are part of it.

The IMA protocol uses an IMA frame as the unit of control. An IMA frame consists of a series of consecutive (128) cells. In addition to ATM cells received from the ATM layer, the IMA frame contains IMA OAM cells. Two types of cells are defined: IMA Control Protocol (ICP) cells and IMA filler cells. ICP cells carry information used by IMA protocol at both ends of an IMA group (for example IMA frame sequence number, link stuff indication, status and control indication, IMA ID, TX and RX test patters, version of the IMA protocol, etc.). A single ICP cell is inserted at the ICP cell offset position (the offset may be different on each link of the group) of each frame. Filler cells are used by the transmitting side to fill up each IMA frame in case there are not enough ATM stream cells from the ATM layer, so a continuous stream of cells is presented to the physical layer. Those cells are then discarded by the receiving end. IMA frames are transmitted simultaneously on all paths of an IMA group and when they are received out of sync at the other end of the IMA group link, the receiver compensates for differential link delays among all paths.

Inverse Multiplexing over ATM (IMA) Features

Hardware Applicability

IMA is supported on channelized ASAP MDAs.

Software Capabilities

Alcatel-Lucent's implementation supports IMA functionality as specified in ATM Forum's Inverse Multiplexing for ATM (IMA) Specification Version 1.1 (af-phy-0086.001, March 1999). The following details major functions

- TX Frame length — Only IMA specification default of 128 cells is supported.
- IMA version — Both versions 1.0 and 1.1 of IMA are supported. There is no support for automatically falling to version 1.0 if the far end advertises 1.0 support, and the local end is configured as 1.1. Due to potential protocol interoperability issues between IMA 1.0 implementations, it is recommended that IMA version 1.1 is used whenever possible.
- Alpha, beta, and gamma values supported are defaults required by the IMA specification (values of 2, 2, and 1 respectively).
- Clock mode — Only IMA specification default of common clock mode is supported (CTC).
- Timing reference link — The transmit timing reference link is chosen first among the active links in an IMA group. If none found, then it is chosen among the usable links or finally, among the unusable links.
- Cell Offset Configuration — The cell offsets for IMA links are not user configurable but internally assigned according to the recommended distribution described in the IMA spec.
- TX IMA ID — An internally assigned number equal to the IMA bundle number.
- Minimum Links — A configurable value is supported to control minimum member links required to be up for an IMA group to stay operationally up.
- Maximum Group Bandwidth — A configurable value is supported to specify maximum bandwidth available to services over an IMA group. The maximum may exceed the number of minimum/configured/active links allowing for overbooking of ATM shaped traffic.
- Symmetry mode — Only IMA specification default of symmetric operation and configuration is supported.
- Re-alignment — Errors that require a re-alignment of the link (e.g., missing or extra cells, corrupted frame sequence numbers), are dealt with by automatically resetting the IMA link upon detection of an error.

- Activation/Deactivation Link Delay Timers — Separate, configurable timers are supported defining the amount of delay between detection of LIF, LODS and RFI-IMA change and raising/clearing of a respective alarm to higher layers and reporting RXIFailed to the far end. This protocol dampening mechanism protects those higher layers from bouncing links.
- Differential delay — A configurable value of differential delay that will be tolerated among the members of the IMA group is supported. If a link exceeds the configured delay value, then LODS defect is declared and protocol management actions are initiated as required by the IMA protocol and as governed by Link Activation and Deactivation procedures. The differential delay of a link is calculated based on the difference between the frame sequence number received on the link and the frame sequence number received on the fastest link (a link on which the IMA frame was received first).
- Graceful link deletion — The option is supported for remotely originated requests only. To prevent data loss on services configured over an IMA group, it is recommended to initiate graceful deletion from the far end before a member link is deleted or a physical link is shutdown.
- IMA test pattern — Alcatel-Lucent's implementation supports test pattern procedures specified in the IMA specification. Test pattern procedures allow debugging of IMA group problems without affecting user data. Test pattern configurations are not preserved upon a router reboot.
- Statistics — Alcatel-Lucent's IMA implementation supports all standard-defined IMA group and IMA link status and statistics through proprietary TIMETRA-PORT-MIB. Display and monitoring of traffic related interface/SAP statistics is also available for IMA groups and services over IMA groups on par with physical ATM interfaces and services.
- Scaling — Up to 8 member links per IMA group, up to 128 groups per MDA and all DS-1/E-1 links configurable per MDA in all IMA groups per MDA are supported.

Ethernet Local Management Interface (E-LMI)

The Ethernet Local Management Interface (E-LMI) protocol is defined in Metro Ethernet Forum (MEF) technical specification MEF16. This specification largely based on Frame Relay - LMI defines the protocol and procedures that convey the information for auto-configuration of a CE device and provides the means for EVC status notification. MEF16 does not include link management functions like Frame Relay LMI does. In the Ethernet context that role is already accomplished with Clause 57 Ethernet OAM (formerly 802.3ah).

The SR OS currently implements the User Network Interface-Network (UNI-N) functions for status notification supported on Ethernet access ports with dot1q encapsulation type. Notification related to status change of the EVC and CE-VLAN ID to EVC mapping information is provided as a one to one between SAP and EVC.

The E-LMI frame encapsulation is based on IEEE 802.3 untagged MAC frame format using an ether-type of 0x88EE. The destination MAC address of the packet 01-80-C2-00-00-07 will be dropped by any 802.1d compliant bridge that does not support or have the E-LMI protocol enabled. This means the protocol cannot be tunneled.

Status information is sent from the UNI-N to the UNI-C, either because a status enquiry was received from the UNI-C or unsolicited. The Active and Not Active EVC status are supported. The Partially Active state is left for further study.

The bandwidth profile sub-information element associated with the EVC Status IE does not use information from the SAP QoS policy. A value of 0 is used in this release as MEF 16 indicates the bandwidth profile sub-IE is mandatory in the EVC Status IE. The EVC identifier is set to the description of the SAP and the UNI identifier is set to the description configured on the port. Further, the implementation associates each SAP with an EVC. Currently, support exists for CE-VLAN ID/EVC bundling mode.

As stated in the OAM Mapping section in the OAM and Diagnostics Guide, E-LMI the UNI-N can participates in the OAM fault propagation functions. This is a unidirectional update from the UNI-N to the UNI-C and interacting with service manager of VLL, VPLS, VPRN and IES services.

Link Layer Discovery Protocol (LLDP)

The IEEE 802.1ab Link Layer Discovery Protocol (LLDP) standard defines protocol and management elements that are suitable for advertising information to stations attached to the same IEEE 802 LAN (emulation) for the purpose of populating physical or logical topology and device discovery management information databases. The protocol facilitates the identification of stations connected by IEEE 802 LANs/MANs, their points of interconnection, and access points for management protocols.

Note that LAN emulation and logical topology wording is applicable to customer bridge scenarios (enterprise/carrier of carrier) connected to a provider network offering a transparent LAN emulation service to their customers. It helps the customer bridges detect misconnection by an intermediate provider by offering a view of the customer topology where the provider service is represented as a LAN interconnecting these customer bridges.

The IEEE 802.1ab standard defines a protocol that:

- Advertises connectivity and management information about the local station to adjacent stations on the same IEEE 802 LAN.
- Receives network management information from adjacent stations on the same IEEE 802 LAN.
- Operates with all IEEE 802 access protocols and network media.
- Establishes a network management information schema and object definitions that are suitable for storing connection information about adjacent stations.
- Provides compatibility with a number of MIBs as depicted in Figure 19.

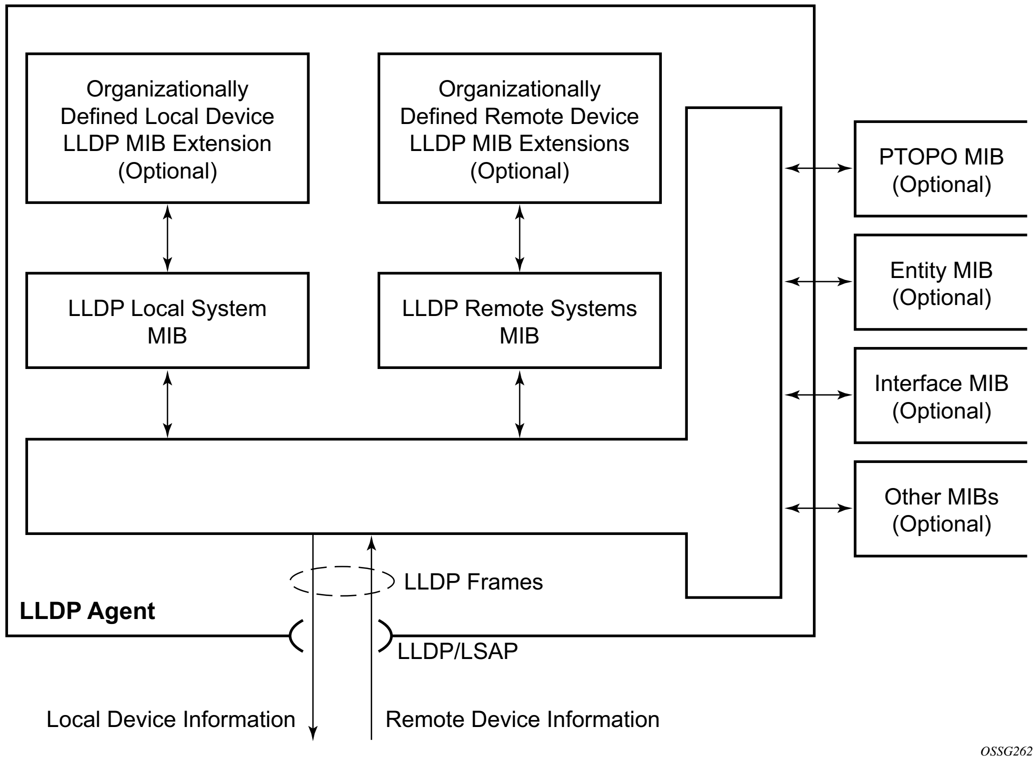

Figure 19: LLDP Internal Architecture for a Network Node

Network operators must be able to discover the topology information in order to detect and address network problems and inconsistencies in the configuration. Moreover, standard-based tools can address the complex network scenarios where multiple devices from different vendors are interconnected using Ethernet interfaces.

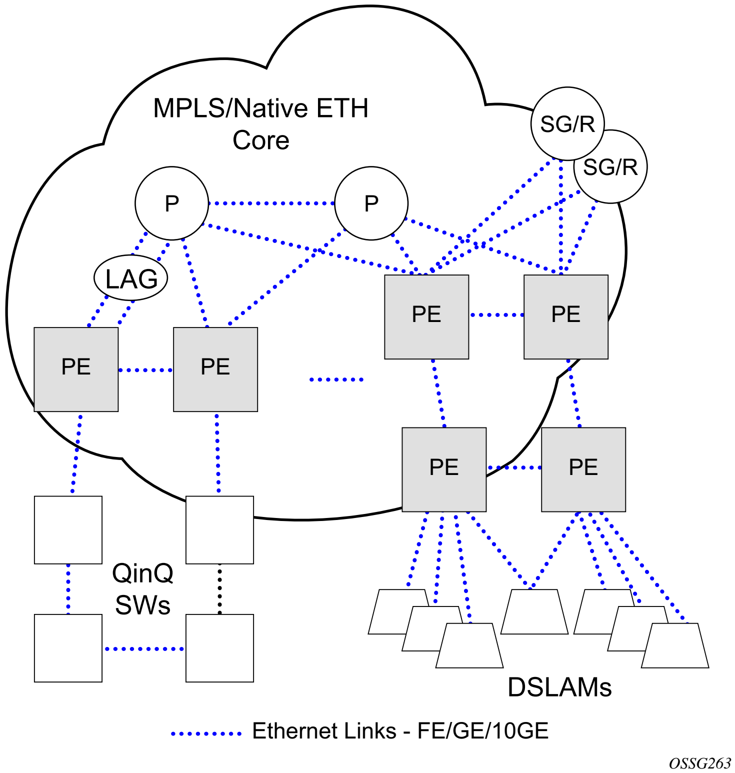

Figure 20: Generic Customer Use Case For LLDP

The example displayed in Figure 20 depicts a MPLS network that uses Ethernet interfaces in the core or as an access/handoff interfaces to connect to different kind of Ethernet enabled devices such as service gateway/routers, QinQ switches, DSLAMs or customer equipment.

IEEE 802.1ab LLDP running on each Ethernet interfaces in between all the above network elements may be used to discover the topology information.

LLDP Protocol Features

LLDP is an unidirectional protocol that uses the MAC layer to transmit specific information related to the capabilities and status of the local device. Separately from the transmit direction, the LLDP agent can also receive the same kind of information for a remote device which is stored in the related MIB(s).

LLDP itself does not contain a mechanism for soliciting specific information from other LLDP agents, nor does it provide a specific means of confirming the receipt of information. LLDP allows the transmitter and the receiver to be separately enabled, making it possible to configure an implementation so the local LLDP agent can either transmit only or receive only, or can transmit and receive LLDP information.

The information fields in each LLDP frame are contained in a LLDP Data Unit (LLDPDU) as a sequence of variable length information elements, that each include type, length, and value fields (known as TLVs), where:

- Type identifies what kind of information is being sent.
- Length indicates the length of the information string in octets.
- Value is the actual information that needs to be sent (for example, a binary bit map or an alphanumeric string that can contain one or more fields).

Each LLDPDU contains four mandatory TLVs and can contain optional TLVs as selected by network management:

- Chassis ID TLV
- Port ID TLV
- Time To Live TLV
- Zero or more optional TLVs, as allowed by the maximum size of the LLDPDU
- End Of LLDPDU TLV

The chassis ID and the port ID values are concatenated to form a logical identifier that is used by the recipient to identify the sending LLDP agent/port. Both the chassis ID and port ID values can be defined in a number of convenient forms. Once selected however, the chassis ID/port ID value combination remains the same as long as the particular port remains operable.

A non-zero value in the TTL field of the Time To Live TLV tells the receiving LLDP agent how long all information pertaining to this LLDPDU’s identifier will be valid so that all the associated information can later be automatically discarded by the receiving LLDP agent if the sender fails to update it in a timely manner. A zero value indicates that any information pertaining to this LLDPDU’s identifier is to be discarded immediately.

Note that a TTL value of zero can be used, for example, to signal that the sending port has initiated a port shutdown procedure. The End Of LLDPDU TLV marks the end of the LLDPDU.

LAG

Based on the IEEE 802.3ax standard (formerly 802.3ad), 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 16 on iom3-xp/ IMM with chassis-mode D (or) from 1 to 8 on all other IOMs). 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 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 802.3ax is not implemented. LAGs can be configured on network andaccess ports.

LAG Features

Hardware capabilities:

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

Software capabilities:

- The Alcatel-Lucent solution conforms to the IEEE LAG implementation 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 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 or 0-15), depending on chassis-mode and IOM type), 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 fourand 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 slots, 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 200 LAGs, 16 ports in each, can be configured on a 7750 SR. The 7750 SR-1 supports a maximum of 64 LAGs.
- 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.
- The **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. For 10GBE ports, the xgig setting must be set to the same value.

Figure 21 displays traffic routed between ALA-1 and ALA-2 as a LAG consisting of four ports.

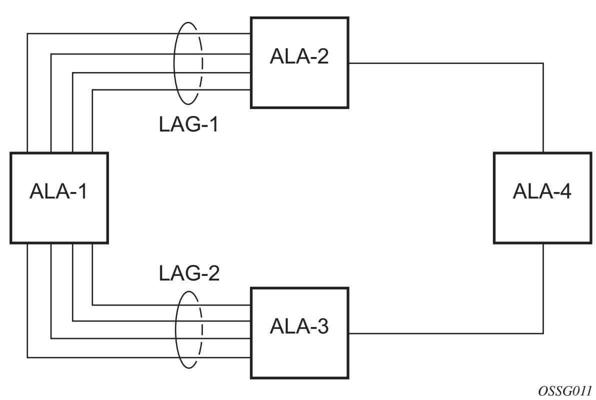

Figure 21: LAG Configuration

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 the methods is applied; equal cost multi-path (ECMP) or Link Aggregation (LAG). A 7750 SR can deploy both at the same time, meaning, using ECMP of two or more Link Aggregation Groups (LAG) and/or single links. The supports up to 16 equal cost routes in ECMP and up to 16 ports per LAG.

Different types of hashing algorithms can be employed depending whether better loadspreading or consistent per service forwarding is required. The Alcatel-Lucent implementation supports per flow hashing used to achieve uniform loadspreading and per service hashing designed to provide consistent per service forwarding. The following sub-sections describe these two hashing algorithms.

Per Flow Hashing

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 a 7750 SR router uses the IP SA/DA or optionally TCP/UDP port information.
- By default, MPLS packet hashing at an LSR is based on the whole label stack, 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. This method is referred to as “Label-Only Hash” option and is enabled in CLI by entering the **lbl-only** keyword.
- A couple of options to further hash on the header of an IP packet in the payload of the MPLS packet are also provided.
- The first method is referred to as the "Label-IP Hash" option and is enabled in CLI by entering the lbl-ip keyword. In the first hash round for ECMP, the algorithm will parse down the label stack and once it hits the bottom it checks the next nibble. If the nibble

value is 4 then it will assume it is an IPv4 packet. If the nibble value is 6 it will assume it is an IPv6 packet. The result of the hash of the label stack, along with the incoming port and system IP address, is fed into another hash along with source and destination address fields in the IP packet header. Otherwise, it will just use the label stack hash calculated in the first round like in the default “Label-Only Hash” option. If there are more than 6 labels in the stack the algorithm will also use the result of the label stack hash only. The net result will be used to select which LDP FEC next-hop to send the packet to using a modulo operation of the net result with the number of next-hops. This same net result will feed to a second round of hashing to select a LAG link on the egress port where the LSP has its NHLFE programmed when applicable.

- The second method is referred to as “IP-only Hash” and is enabled in CLI by entering the **ip-only** keyword. It operates the same way as the "Label-IP Hash" method except that the hash is performed exclusively on the source and destination address fields in the IP packet header.
- VPLS multicast, broadcast and unknown unicast traffic transmitted on SAPs is not sprayed on a per-frame basis, but instead the service ID is used to pick ECMP and LAG paths statically.
  - → VPLS multicast, broadcast and unknown unicast traffic transmitted on SDPs is and 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.

Per Flow Hashing Changes

There have been some changes to the existing per flow behavior described above to better spread certain types of traffic across various paths.

The hashing procedure that used to be applied for all VPLS BUM traffic (broadcast, unknown unicast and multicast) would result in PBB BUM trafficbeing sent out on a BVPLS SAP to follow only one link if MMRP was not used.

Now, only for chassis mode D, traffic flooded out an egress BVPLS SAP is loadspread using the algorithm described above for the VPLS known unicast.

When H-POL is configured on an Epipe SAP, traffic spraying is the same as for VPLS known unicast instead of just using the related service id.

Per Service Consistent Hashing

The hashing feature described in this section applies to traffic going over LAG, Ethernet tunnels (eth-tunnel) in loadsharing mode, or CCAG loadbalancing for VSM redundancy. The feature does not apply to ECMP.

Per-service-hashing was introduced to ensure consistent forwarding of packets belonging to one service. The feature can be enabled only in chassis mode D using the [**no**] **per-service-hashing** configuration option under **config>service>epipe** and **config>service>vpls**, valid for Epipe, VPLS, PBB Epipe, IVPLS and BVPLS.

The following algorithm describes the hash-key used for hashing when the new option is enabled:

- If the packet is PBB encapsulated (contains an I-TAG ethertype) at the ingress side, use the ISID value from the I-TAG
- If the packet is not PBB encapsulated at the ingress side
  - → For regular (non-PBB) VPLS and EPIPE services, use the related service ID
  - → If the packet is originated from an ingress IVPLS or PBB Epipe SAP
    - – If there is an ISID configured use the related ISID value
    - – If there is no ISID yet configured use the related service ID
  - → For BVPLS transit traffic use the related flood list id
    - – Transit traffic is the traffic going between BVPLS endpoints
    - – An example of non-PBB transit traffic in BVPLS is the OAM traffic
- The above rules apply regardless of traffic type
  - → Unicast, BUM flooded without MMRP or with MMRP, IGMP snooped

Operators may sometimes require the capability to query the system for the link in a LAG or Ethernet tunnel that is currently assigned to a given service-id or ISID. This ability is provided using the **tools>dump>map-to-phy-port** {**ccag** *ccag-id* | **lag** *lag-id* | **eth-tunnel** *tunnel-index*} {**isid** *isid* [**end-isid** *isid*] | **service** *servid-id* | *svc-name* [**end-service** *service-id* | *syc-name*]} [**summary**] command.

A sample usage is as follows:

```
A:Dut-B# tools dump map-to-phy-port lag 11 service 1

ServiceId  ServiceName   ServiceType     Hashing                  Physical Link
---------- ------------- --------------  -----------------------  -------------
1                        i-vpls          per-service(if enabled)  3/2/8

A:Dut-B# tools dump map-to-phy-port lag 11 isid 1

ISID     Hashing                  Physical Link
-------- -----------------------  -------------
1        per-service(if enabled)  3/2/8

A:Dut-B# tools dump map-to-phy-port lag 11 isid 1 end-isid 4
ISID     Hashing                  Physical Link
-------- -----------------------  -------------
1        per-service(if enabled)  3/2/8
2        per-service(if enabled)  3/2/7
3        per-service(if enabled)  1/2/2
4        per-service(if enabled)  1/2/3
```

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 IOMCFM 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).

1. Divide the SLA among the IOMs, based on their share of the LAG group. For example, a 100 Mb PIR with 2 links on IOM A and 3 links on IOM B, IOM A would get 40 Mb PIR and IOM B would get a 60 MB PIR. The advantage of this method is that the overall SLA can be enforced. The disadvantage is a single flow cannot exceed the IOM's share of the SLA. This is the default method.
2. All ports get the full SLA. With the example above, each port would get a PIR of 100 Mb. The advantage of this method is a single flow can consume the entire SLA. The disadvantage is that the overall SLA can be exceeded if the flows span multiple ports.

The following features are supported as an extension of **lsr-load-balancing lbl-ip**.

- Supported on the IOM-3 and as well as the IOM-2 (mode C) and IOM-1 (mode B)
- Supported for IPv4 and as well as for IPv6 (IPv6 works only on IOM-3 chassis mode D)
- **lsr-load-balancing lbl-ip** can be enabled in the **config>router>interface** context.

LSR Hashing

The LSR hash routine operates on the label stack only. However, there is also the ability to hash on the IP header if a packet is IP. An LSR will consider a packet to be IP if the first nibble following the bottom of the label stack is either 4 (IPv4) or 6 (IPv6). This allows the user to include an IP header in the hashing routine at an LSR for the purpose of spraying labeled IP packets over multiple equal cost paths in ECMP in an LDP LSP and/or over multiple links of a LAG group in all types of LSPs.

The user enables the LSR hashing on label stack and/or IP header by entering the following system-wide command: **config>system>lsr-load-balancing lbl-ip | ip-only**.

By default, the 7x50 LSR falls back to the hashing on label stack only as in existing implementation behavior. This option is referred to as lbl-only and the user can revert to this behavior by entering one of the two commands:

config>system>lsr-load-balancing lbl-only

config>system>no lsr-load-balancing

The user can also selectively enable or disable the inclusion of label stack and IP header in the LSR hash routine on a specific network interface by entering the following command:

config>router>interface>lsr-load-balancing lbl-ip | ip-only

This provides some control to the user such that this feature is disabled if labeled packets received on a specific interface include non IP packets that can be confused by the hash routine for IP packets. These could be VLL and VPLS packets without a PW control word.

When you exclude label stack and IP header from the hash routine on an interface, the 7x50 LSR falls back to the hashing on label stack only as in existing implementation behavior.

LSR Default Hash Routine— Label-Only Hash Option

The following is the behavior of ECMP and LAG hashing at an LSR in the existing implementation. These are performed in two rounds.

First the ECMP hash. It consists of an initial hash based on the source port/system IP address. Each label in the stack is then hashed separately with the result of the previous hash, up to a maximum of five labels. The net result will be used to select which LDP FEC next-hop to send the packet to using a modulo operation of the net result with the number of next-hops. If there is a single next-hop for the LDP FEC, or if the packet is received on an RSVP LSP ILM, then a single next-hop exists.

This same net result will feed to a second round of hashing if there is LAG on the egress port where the selected LDP or RSVP LSP has its NHLFE programmed.

LSR Label-IP Hash Option Enabled

In the first hash round for ECMP, the algorithm will parse down the label stack and once it hits the bottom it checks the next nibble. If the nibble value is 4 then it will assume it is an IPv4 packet. If the nibble value is 6 then it will assume it is an IPv6 packet. In both cases, the result of the label hash is fed into another hash along with source and destination address fields in the IP packet's header. Otherwise, it will just use the label stack hash already calculated for the ECMP path selection.

If there are more than five labels in the stack, then the algorithm will also use the result of the label hash for the ECMP path selection.

The second round of hashing for LAG re-uses the net result of the first round of hashing. This means IPv6 packets will continue to be hashed on label stack only.

LSR IP-Only Hash Option Enabled

This option behaves like the label-IP hash option except that when the algorithm reached the bottom of the label stack in the ECMP round and finds an IP packet, it throws the outcome of the label hash and only uses the source and destination address fields in the IP packet's header.

Interaction with Layer 4 Load-Balancing Feature

The 7x50 supports the inclusion of the L4 header in the hash routing for a VLL/VPLS SAP and for an IES/VPRN interface. The user enables this at the system level using the following command:

configure>system>l4-load-balancing

When this option is enabled, and the LSR hashing is set to lbl-ip or ip-only, the 7x50 LSR hash routine will also include the Layer 4 header in addition to the IP header in the LSR hash routine. The user can include or exclude Layer 4 header on a specific network interface by applying the following command:

config>router>interface>lsr-load-balancing [**include-ip** [**l4-hdr**] | **exclude-ip**]

This is supported on all existing and future CFM/CPM. It is supported with IPv4 payload on IOM-3/IMM in SR-7/SR-12 with all chassis modes. It is not supported on the SR1 platform. Support of IPv6 on IOM-3/IMM and support of IOM-1 and IOM-2. It is supported with IPv4 payload on IOM-3 in ESS-6, ESS-7, and ESS-12 with all chassis modes. It is not supported on the ESS-1 platform. Support of IPv6 on IOM-3 and support of IOM-1 for IPv4 payload only. This feature is also supported on 7750 SR-c12 for IPv4/IPv6 payload. This feature is supported on all MDA ports which can be configured in network port mode.

Per-fp-ing-queuing

Per-fp-ing-queuing optimization for LAG ports provides the ability to reduce the number of hardware queues assigned on each LAG SAP on ingress when the flag at LAG level is set for per-fp-ing-queuing.

When the feature is enabled in the **config>lag>access** context, the queue allocation for SAPs on a LAG will be optimized and only one queuing set per ingress forwarding path (FP) is allocated instead of one per port.

The following rules will apply for configuring the per-fp-ing-queuing at LAG level:

- To enable per-fp-ing-queuing, the LAG must be in access mode
- The LAG mode cannot be set to network mode when the feature is enabled
- Per-fp-ing-queuing can only be set if no port members exists in the LAG
- Per-fp-ing-queuing cannot be set if LAG's port-type is hsmda-ports.

Port Link Damping

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

The 7750 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.

Under normal operation, all non-failing links in a given LAG will become active and traffic is load balanced across all active links. In some circumstances, however, this is not desirable. Instead, it desired that only some of the links are active (for example, all links on the same IOM) and the other links be kept in stand-by condition.

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

LAG Subgroups on Access for DSLAM Aggregation

Figure 21 shows interconnection between DSLAM and aggregation node by a LAG. In this configuration, LAG is used not only to provide higher bandwidth but also to protect against hardware failure. LAG members are typically distributed across different IOMs to eliminate single point of failure.

At the same time, QoS SLA enforcement is required. Enforcing QoS policies across links attached to different IOMs is not possible and therefore it is desirable that traffic always flows through a single IOM. This can be achieved by selecting only links of a single IOM as active LAG members and keeping all other LAG members in stand-by condition.

In case of a link failure, Figure 22 and Figure 23, the switch over mechanism must take into account the above QoS restriction. This means that all lag-members connected to the same IOM as failing link will become stand-by and lag-members connected to other IOM will become active.

This way, QoS enforcement constraints are respected, while the maximum of available links is utilized.

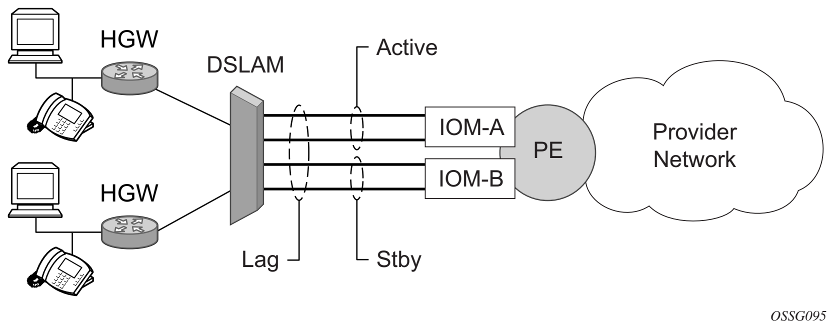

Figure 22: LAG on Access Interconnection

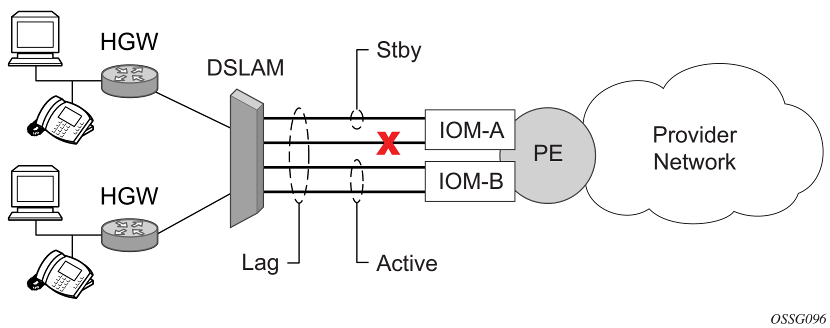

Figure 23: LAG on Access Failure Switchover

LACP is used to make selection of active links predictable and compatible with any vendor equipment. Refer to the IEEE STD 802.3-2002, Section 3, Clause 43.6.1 standard which describes how LACP allows stand-by and active signalling.

The 7750 SR OS implementation of LACP supports the following:

- A given LAG member can be assigned to sub-groups. The selection algorithm then assures that only members of a single sub-group are selected as active links.
- The selection algorithm is effective only if LACP is enabled on a given LAG. At the same time, it is assumed that connected system has also LACP enabled (active or passive mode).
- The algorithm will select active links based on following criteria:

- → Depending on selection-criteria setting either the sub-group with the highest number of eligible links or the sub-group with the highest aggregate weight of all eligible members is selected first.
- → If multiple groups satisfy the selection criteria, the sub-group being currently active remains active. Initially, the sub-group containing the highest priority eligible link is selected.
- → Only links pertaining to a single sub-group are active at any time.
- → An eligible member refers to a LAG member link which can potentially become active. This means it is operationally up, and if the slave-to-partner flag is set, the remote system did not disable its use (by signalling stand-by).

- The selection algorithm works in a reverting mode. This means that every time the configuration or status of any link in a LAG changes, the selection algorithm is re-run. In case of a tie between two groups (one of them being currently active) the active group remains active (no reverting).

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 is 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.

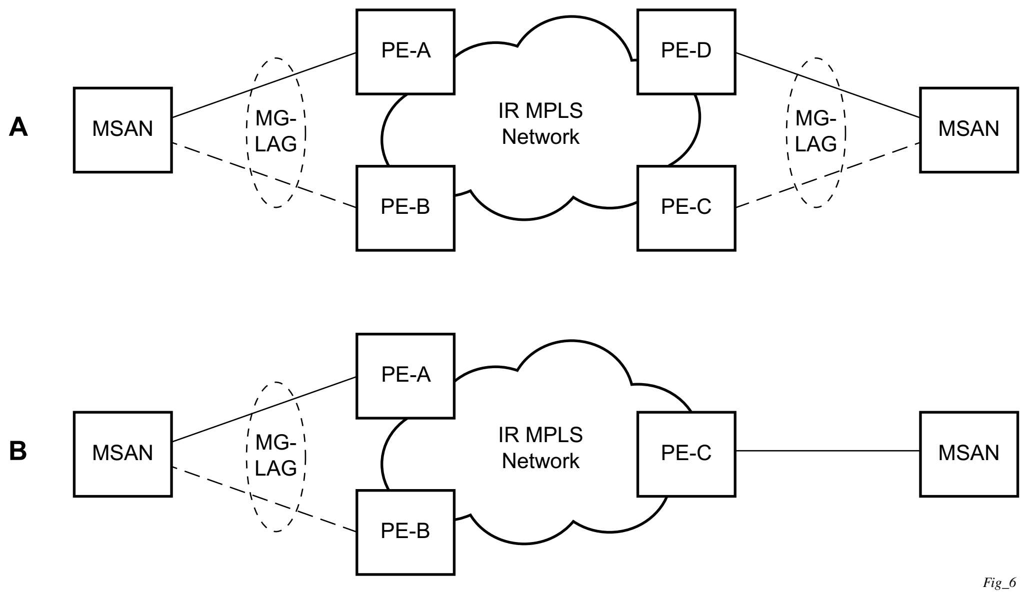

Figure 24: MC-LAG Dual Homing to Remote PE Pairs

Figure 24 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

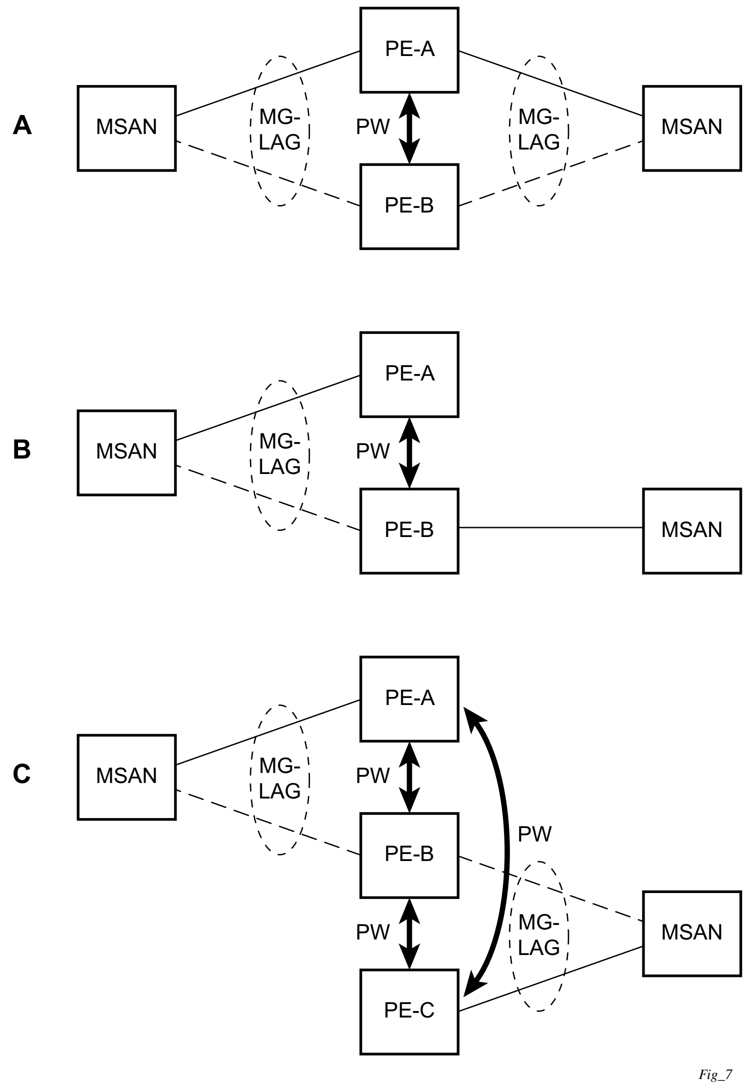

Figure 25: MC-LAG Dual Homing to Local PE-Pairs

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 802.3ax (formerly 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 7750 SR OS Triple Play Guide for information about SRRP.

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

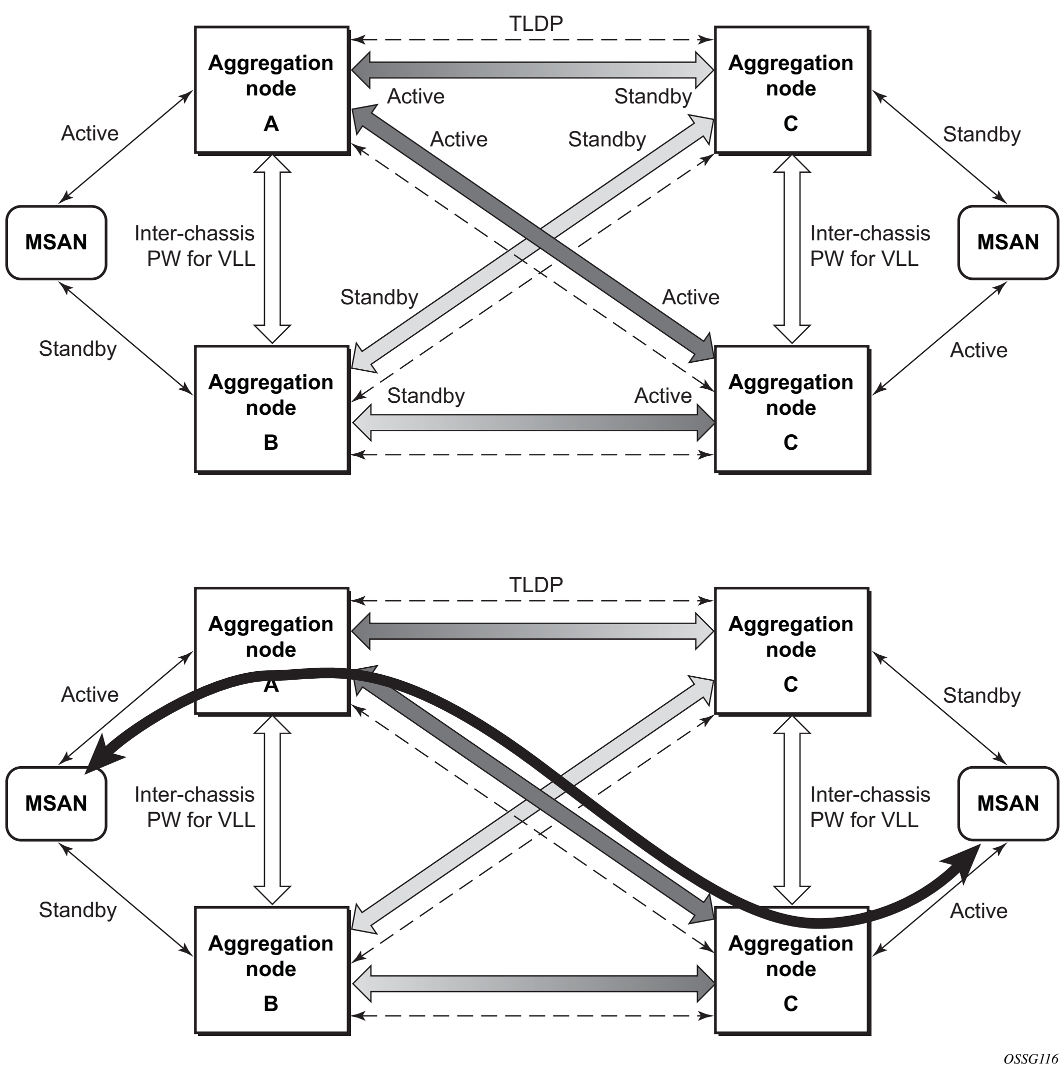

Figure 26: P2P Redundant Connection Through a Layer 2 VPN Network

Figure 26 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 26 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

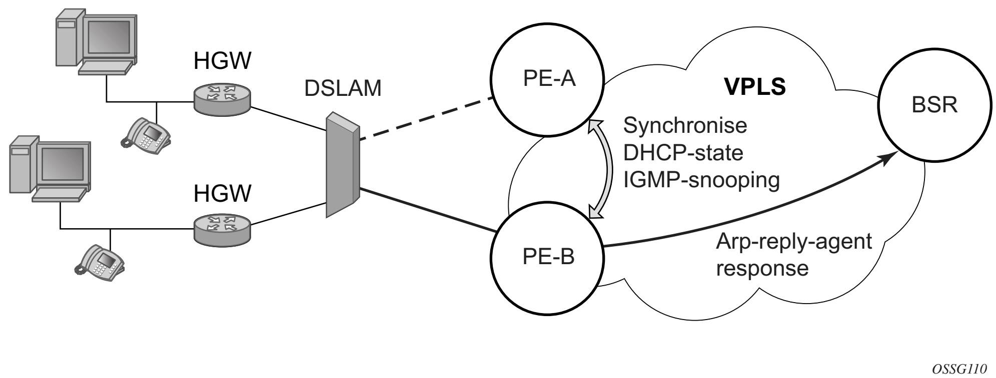

Figure 27: DSLAM Dual-Homing Using MC-LAG

Figure 27 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 7750 SR 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 7750 SR 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

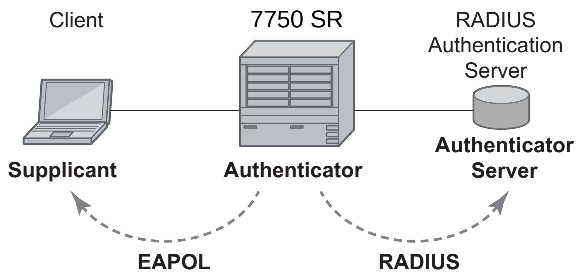

Figure 28: 802.1x Architecture

The IEEE 802.1x standard defines three participants in an authentication conversation (see Figure 28).

- 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.

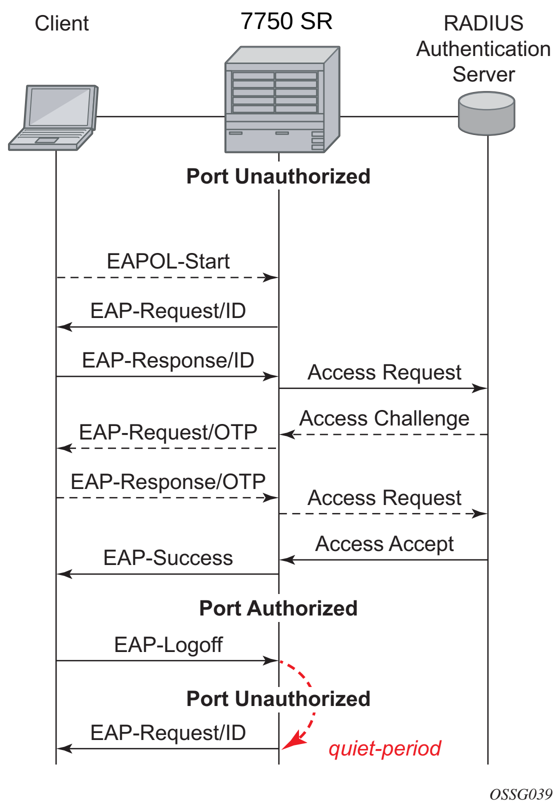

Figure 29: 802.1x Authentication Scenario

The messages involved in the authentication procedure are illustrated in Figure 29. The router 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 router 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 Access Accept message to the router. 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 30 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 router 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.

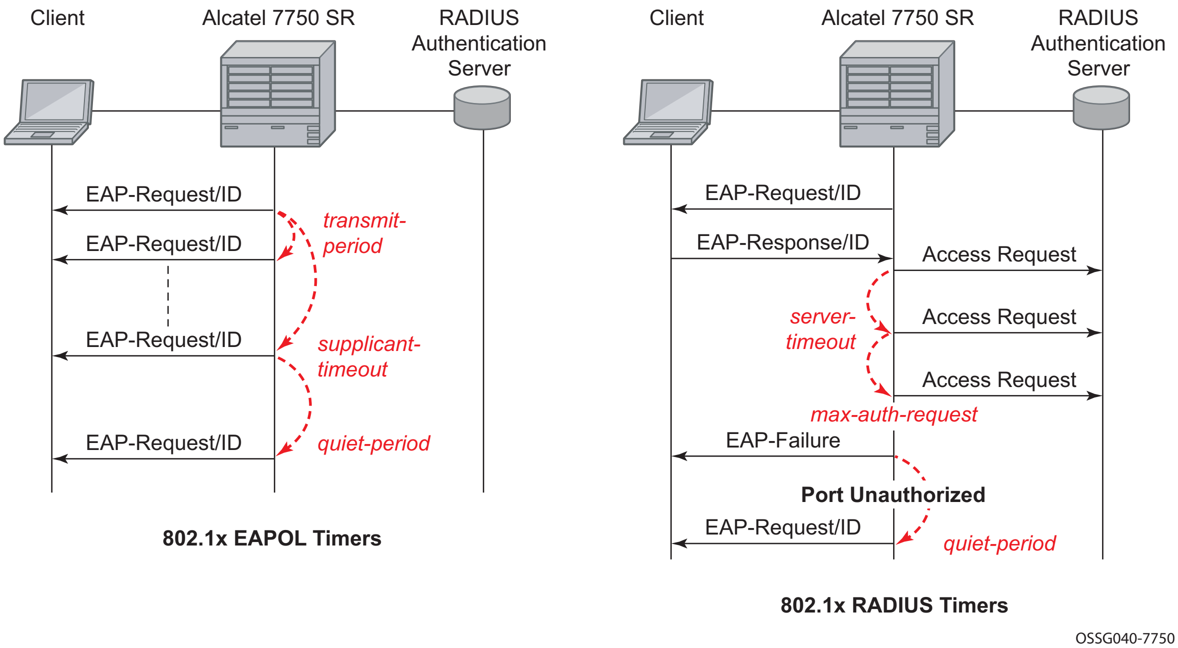

Figure 30: 802.1x EAPOL Timers (left) and RADIUS Timers (right)

The router 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 an authorized state during the re-authentication procedure.

802.1x Configuration and Limitations

Configuration of 802.1x network access control on the router 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 (such as a VPLS service) depending on the 802.1x authentication information.

G.8031 Protected Ethernet Tunnels

Alcatel-Lucent PBB implementation offers the capability to use core Ethernet tunnels compliant with ITU-T G.8031 specification to achieve 50 ms resiliency for failures in a native Ethernet backbone. For further information regarding Ethernet tunnels, see G.8031 Protected Ethernet Tunnels on page 130 in the Services Guide.

G.8032 Protected Ethernet Rings

Ethernet ring protection switching offers ITU-T G.8032 specification compliance to achieve resiliency for Ethernet Layer 2 networks. Similar to G.8031 linear protection (also called Automatic Protection Switching (APS)), G.8032 (Eth-ring) is also built on Ethernet OAM and often referred to as Ring Automatic Protection Switching (R-APS).

For further information regarding Ethernet rings, see G.8032 Protected Ethernet Rings section in the Services Guide.

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 (such as STP or 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 7750 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. Hence, such ports must be configured as null encapsulated SAPs.

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 **no 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 7750 SR 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 24 displays the default MTU values which are dependent upon the (sub-) port type, mode, and encapsulation.

Table 24: 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 31.

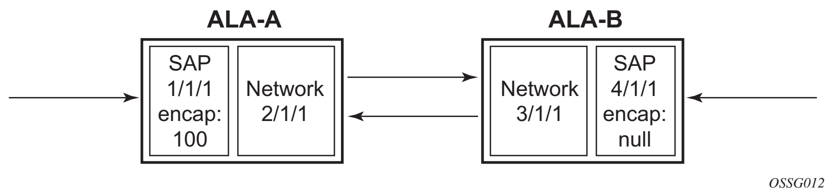

Figure 31: MTU Configuration Example

Table 25: MTU Configuration Example Values

	ALA-A		ALA-B	
	Access (SAP)	**Network**	**Network**	**Access (SAP)**
Port (slot/MDA/port)	1/1/1	2/1/1	3/1/1	4/1/1
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 24 for MTU default values). Each SDP MTU must be set to at least 1514 as well. If ALA-A's network port (2/1/1) is configured as an Ethernet port with a GRE SDP encapsulation type, then the MTU value of network ports 2/1/1 and 3/1/1 must *each* be at least 1556 bytes (1514 MTU + 28 GRE/Martini + 14 Ethernet). Finally, the MTU of ALA-B's SAP (access port 4/1/1) must be at least 1514, as it uses null encapsulation.

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

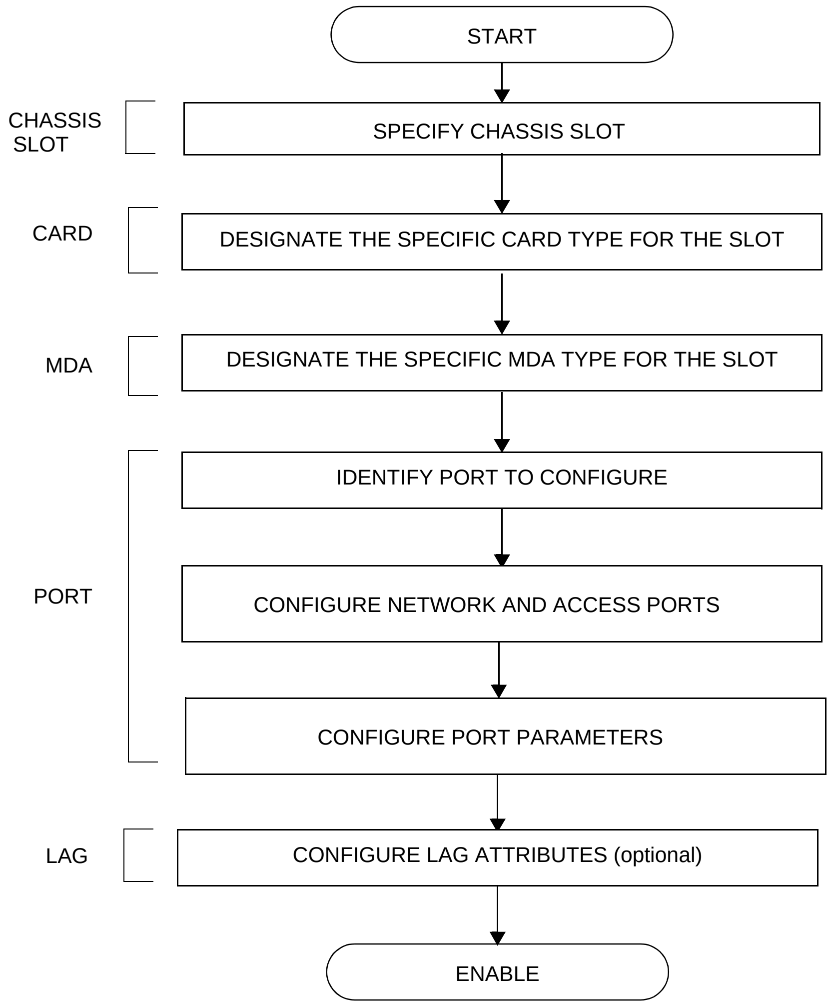

Figure 32: Slot, Card, MDA, and Port Configuration and Implementation Flow

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.
- 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

7750 SR-Series routers have at least two ports, either located on SF/CPM modules on the CCM or integrated into the chassis (on the 7750 SR-1 and 7750 SR-c4 models), a console port and an auxiliary port, to connect terminals to the router.

Configure parameters from a system console connected to a 7750 SR console port, using Telnet to access a 7750 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:

- Pre-provision 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.
Some recommendations to configure a port 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 161.
- SONET/SDH
  - → SONET/SDH can be used only when configuring an OC-3, OC-12, OC-48, and OC-192 SONET paths on an appropriate MDA.

    To configure a SONET path, refer to Configuring SONET/SDH Port Parameters on page 164.

    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 161.
- Channelized
  - → Channelized ports can only be configured on channel-capable MDAs or CMAs such as the channelized DS-3, channelized OC-3-SFP, channelized OC-12-SFP, or channelized Any Service Any Port MDAs or CMAs.

Maximizing Bandwidth Use

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 (16 per LAG) 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 206. To configure channelized port for TDM, refer to section Configuring Channelized Ports on page 167. To configure channelized port for Sonet/SDH high speed channels (ASAP MDAs only), refer to Configuring SONET/SDH Port Parameters on page 164.

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 for 7750 SR-c4 and SR-c12 only (not required for CMA)
- Specify MCM type 7750 SR-c4 and SR-c12 only (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
#------------------------------------------
# Card Configuration
#------------------------------------------
     card 1
        card-type iom-20g
        mda 1
            mda-type m60-10/100eth-tx
        exit
        mda 2
            mda-type m60-10/100eth-tx
        exit
    exit
    card 2
        card-type iom-20g
        mda 1
            mda-type m10-1gb-sfp
        exit
        mda 2
            mda-type m10-1gb-sfp
        exit
    exit
    card 3
        card-type iom-20g
        mda 1
            mda-type m12-ds3
        exit
        mda 2
            mda-type m12-ds3
        exit
    exit
    card 8
        card-type iom-20g
        mda 1
            mda-type m8-oc12/3-sfp
        exit
        mda 2
            mda-type m16-oc12/3-sfp
```

```
        exit
    exit
#--------------------------------------------------
echo "Card Configuration"
#--------------------------------------------------
    card 1
        card-type iom-xp
        mcm 1
            mcm-type mcm-xp
        exit
        mcm 3
            mcm-type mcm-xp
        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#
#--------------------------------------------------
echo "Card Configuration "
#--------------------------------------------------
card 1
card-type iom-c4-xp
mcm 1
mcm-type mcm-v1
exit
mcm 3
mcm-type mcm-xp
exit
mda 1
mda-type m60-10/100eth-tx
exit
mda 3
mda-type m4-atmoc12/3-sfp
exit
exit
#--------------------------------------------------
ALA-A> config#
```

Common Configuration Tasks

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

- Configuring Cards and MDAs on page 149
  - → Configuring MDA/CMA Access and Network Pool Parameters on page 153
- Configuring Ports on page 155
  - → Configuring Port Pool Parameters on page 155
  - → Configuring APS Parameters on page 159
  - → Configuring Ethernet Port Parameters on page 161
  - → Configuring SONET/SDH Port Parameters on page 164
  - → Configuring Channelized Ports on page 167
  - → Configuring Frame Relay Parameters on page 202
  - → Configuring Multilink PPP Bundles on page 206
- Configuring LAG Parameters on page 217
- Configuring G.8031 Protected Ethernet Tunnels on page 218
- Service Management Tasks on page 220

Configuring Cards and MDAs

Card configurations include a chassis slot designation. A slot can be preconfigured with the type of cards and MDAs that are allowed to be provisioned. To configure the Versatile Service Module, refer to the Versatile Service Module section of the 7750 SR OS Services Guide.

The following example displays a card and MDA configuration:

```
A:ALA-B>config>card# info
----------------------------------------------
      card-type iom-20g
        mda 1
            mda-type m10-1gb-sfp
        exit
        mda 2
            mda-type m10-1gb-sfp
        exit
----------------------------------------------
A:ALA-B>config>card#
```

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-xp
        mcm 1
                mcm-type mcm-xp
            exit
            mcm 3
                mcm-type mcm-xp
            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-xp
          mda 5
            mda-type c8-10/100eth-tx
          exit
          mda 6
            mda-type c8-10/100eth-tx
          exit
    exit
#------------------------------------------
```

Configuring Forwarding Plane Parameters

The following output provides a forwarding plane configuration. The **fp** command is not allowed on iom-1 or iom-2 types. An error message appears when the command is executed on an incorrect IOM type:

```
MINOR: CLI This command is not supported for iom2-20g.
```

```
*A:Dut-C# configure card 10
*A:Dut-C>config>card# info
----------------------------------------------
        card-type iom3-xp
        fp 1
            ingress
                mcast-path-management
                    bandwidth-policy "BWP"
                    no shutdown
                exit
            exit
        exit
        mda 1
            mda-type m1-10gb
            ingress
                mcast-path-management
                    bandwidth-policy "BWP"
                    no shutdown
                exit
            exit
        exit
        mda 2
            mda-type m2-10gb-xfp
            ingress
                mcast-path-management
                    bandwidth-policy "BWP"
                    no shutdown
                exit
            exit
        exit
----------------------------------------------
*A:Dut-C>config>card# 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 MDA Policies for Named Pools Mode

Network ingress queues can use either MDA ingress named pools or ingress default pools but not port named pools. In the case with an IOM with multiple MDAs sharing the same buffer space (iom3-xp, iom-10g), network ingress queues will use only the MDA 1 named pools. Even if named pools are configured for MDA 2, they will not be used by network ingress queues. Network ingress queues configured to use MDA2 named pools will be considered pool orphaned. To check for orphan queues, use the command “show mda <mda> qos ingress orphaned-queues”.

SAP shared queues use by default the SAP shared pool; a system reserved buffer pool. Shared queues can be configured to use MDA named pools. Shared queues cannot be configured to use port pools since they are not port specific queues. In case a shared queue is configured to use a port named pool, the queue will be considered orphan and will get buffers from access ingress default pool.

For complete QoS configuration details reference the Named Pools section of the QoS Guide. Interface Named Pools configuration details are located in the Interface CLI portion of this guide.

Configuring Ports

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

- Configuring Port Pool Parameters on page 155
- Changing Hybrid-Buffer-Allocation on page 158
- Configuring APS Parameters on page 159
- Configuring Ethernet Port Parameters on page 161
- Configuring SONET/SDH Port Parameters on page 164
- Configuring Channelized Ports on page 167
- Configuring DWDM Port Parameters on page 190
- Configuring ATM Interface Parameters on page 197
- Configuring OTU Port Parameters on page 195

Configuring Port Pool Parameters

The buffer space is portioned out on a per port basis whether one or multiple MDAs share the same buffer space. Each port gets an amount of buffering which is its fair-share based on the port's bandwidth compared to the overall active bandwidth.

IOM with each MDA has a dedicated buffer space: iom-20g; iom2-20g

IOM with multiple MDAs share a buffer space: iom-10g; iom3-xp

This mechanism takes the buffer space available and divides it into a portion for each port based on the ports active bandwidth relative to the amount of active bandwidth for all ports associated with the buffer space. The number of ports sharing the same buffer space depends on the type of IOM the pools are being created on and the type of MDAs populated on the IOM. An active port is considered to be any port that has an active queue associated. Once a queue is created for the port, the system will allocate the appropriate amount of buffer space to the port. This process is independently performed for both ingress and egress.

Normally, the amount of active bandwidth is considered as opposed to total potential bandwidth for the port when determining the ports fair share. If a port is channelized and not all bandwidth is allocated, only the bandwidth represented by the configured channels with queues configured is counted towards the bandwidth represented by the port. Also, if a port may operate at variable speeds (as in some Ethernet ports), only the current speed is considered. Based on the above, the number of buffers managed by a port may change due to queue creation and deletion, channel creation and deletion and port speed variance on the local port or other ports sharing the same buffer space.

After the active bandwidth is calculated for the port, the result may be modified through the use of the ‘ing-percentage-of-rate’ and ‘egr-percent-of-rate’ commands. The default value of each is 100% which allows the system to use all of the ports active bandwidth when deciding the relative amount of buffer space to allocate to the port. When the value is explicitly modified, the active bandwidth on the port is changed according to the specified percentage. If a value of 50% is given, the ports active bandwidth will be multiplied by .5, if a value of 150% is given, the active bandwidth will be multiplied by 1.5. This capability is independent of named pool mode. The ports rate percentage parameters may be modified at any time.

Examples:

1. To modify (in this example, to double) the size of buffer allocated on ingress for a port:

CLI Syntax: `B:SR7-10# configure port 1/2/1 modify-buffer-allocation-rate ing-percentage-of-rate 200`

2. To modify (in this example, to double) the size of buffer allocated on ingress for a port:

CLI Syntax: `B:SR7-10# configure port 1/2/1 modify-buffer-allocation-rate egr-percentage-of-rate 200`

Named Buffer Pools feature provides a way to customize the port ingress and/or egress buffer allocation. The port buffer allocation size and Forwarding class (FC) queue association to the buffer pool may be changed. By mapping each FC to different pools, it is possible to achieve separation of available buffers per forwarding class.

Previous to this feature only the default buffer allocation mode was available, with the following characteristics:

- Each port manages a buffer according to its active bandwidth (ports with equal active bandwidth get the same buffer size)
- An access port has 2 default pools created: access-ingress and access-egress
- A network port has 2 default pools created: ingress-MDA (common pool for all ingress network ports) and network-egress
- All queues defined for a port get buffers from the same buffer pool.

Named Buffer Pools feature offers the following new capabilities:

- Ability to modify the port bandwidth considered for buffer allocation without changing the active port bandwidth. (modify-buffer-allocation-rate) (ports with equal active bandwidth can be configured to get different buffer size)
- Configure a named pool policy which includes the customized buffer pools
- Forwarding class queues are associated with the named pools
- Pools can be default, MDA common pools, port specific pools.

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#
```

Changing Hybrid-Buffer-Allocation

The following example displays a hybrid-buffer-allocation value change (from default) for ingress. In this example, the network-egress buffer pool is two times the size of the access-egress.

```
A:SR>config>port>hybrid-buffer-allocation# info
----------------------------------------------
egr-weight access 20 network 40
```

Configuring APS Parameters

NOTE: It is recommended to group working lines and protect lines on separate IOMs.

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 sample configuration for an ATM SC-APS group that contains an aPipe SAP:

```
A:ALA-274>config# port (1/1/1)
----------------------------------------------
    sonet-sdh
        speed oc3
    exit
    no-shutdown
----------------------------------------------
A:ALA-274>config>port# aps-1
----------------------------------------------
    aps
        working-circuit 1/1/1
            protect-circuit 1/1/2
    exit
    sonet-sdh
        path
```

```
            atm
            exit
            no-shutdown
        exit
    exit
    no-shutdown
    exit
----------------------------------------------
A:ALA-274>config>service# apipe 100
----------------------------------------------
    sap aps-1:0/100 create
    exit
    spoke-sdp 1:100 create
    exit
    no-shutdown
----------------------------------------------
```

The following displays an example of the configuration for the working circuit/node of a MC-APS group:

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

The following displays an example of the configuration for the protect circuit/node of a MC-APS group:

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

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:

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

- OC-3
- OC-3 ASAP
- OC-12/3
- OC-48
- OC-192
- OC-12 ASAP
- Channelized OC3
- Channelized OC12
- ATM OC-12/3
- ATM OC-12
- Channelized ASAP OC3
- 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>port# 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#
```

Configuring Channelized Ports

- Configuring a Channelized DS3 Port on page 173
- Configuring a Channelized OC-12-SFP Port on page 176
- Configuring a Channelized Any Service Any Port (ASAP) OC3-SFP Port on page 180
- Configuring a Channelized DS1 Card on page 214
- Configuring Cisco HDLC on a Channelized Port on page 183

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. Table 26 lists channelization options available on the 7750 SR channelized MDAs and gives port ID syntax for each.

Table 26: Channelization Options Available on the 7750 SR Channelized MDAs

Framing	Channelization/Mapping Option	Channelized MDAs Supporting Services on the Port/Channel
599,040 kbits/s (clear channel OC12/STM-4)		
SDH	STM4>AUG4>VC4-C4	None
SONET	OC12>STS12>STS12c SPE	None
139,264 kbits/s ñ 149,760 Kbits/s (clear channel STS-3/STM-1 or STS-3/STM-1 channel within STS12-STM4		
SDH	STM4>AUG4>AUG1>VC4	m4-choc3-as
SONET	OC12>STS12>STS3c SPE	m4-choc3-as
44,763 kbits/s (DS3 or sub-DS3 port or a channel)		
SDH	STM4>AUG4>AUG1>VC4>TUG3>VC3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SONET	OC12>STS12>STS1 SPE	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as

Table 26: Channelization Options Available on the 7750 SR Channelized MDAs (Continued)

Framing	Channelization/Mapping Option	Channelized MDAs Supporting Services on the Port/Channel
SDH	STM4>AUG4>AUG1>VC4>TUG3>VC3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SONET	OC12>STS12>STS1 SPE	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
Up to 2,048 kbits/s (n*DS0 within E1 up to E1)		
SDH	STM4>AUG4>AUG1>VC4>TUG3>TUG2>VC12	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC3>TUG2>VC12	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC4>TUG3>VC3>DS3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC3>DS3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SONET	OC12>STS12>STS1 SPE>VT GROUP>VT2 SPE	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SONET	OC12>STS12>STS1 SPE>DS3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
Up to 1,544 kbits/s (n*DS0 within DS1 up to DS1)		

Table 26: Channelization Options Available on the 7750 SR Channelized MDAs (Continued)

Framing	Channelization/Mapping Option	Channelized MDAs Supporting Services on the Port/Channel
SDH	STM4>AUG4>AUG1>VC4>TUG3>TUG2>TU11 >VC11	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC4>TUG3>TUG2>TU12 >VC11	None
SDH	STM4>AUG4>AUG1>VC3>TUG2>VC11	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC4>TUG3>TUG2>VC12	m1-choc12 m4-choc3 m12-chds3
SDH	STM4>AUG4>AUG1>VC3>TUG2>VC12	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC4>TUG3>VC3>DS3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SDH	STM4>AUG4>AUG1>VC3>DS3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SONET	OC12>STS12>STS1 SPE>VT GROUP>VT1.5 SPE	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as
SONET	OC12>STS12>STS1 SPE>VT GROUP>VT2 SPE	m1-choc12 m4-choc3 m12-chds3
SONET	OC12>STS12>STS1 SPE>DS3	m1-choc12 m4-choc3 m12-chds3 m4-choc3-as

Note: The E1 encapsulation in the ASAP MDA and in the channelized MDAs is compliant to G.704 and G.703. The G.703 feature allows a user to configure an unstructured E1 channel on deep channel MDAs and ASAP MDAs. In G.704, time slot 0 is used to carry timing information by a service provider and thus, only 31 slots are 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.

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 27):

Table 27: Channelized Port Syntax Examples

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

Verify the MDA Type

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

The MDAs displayed in the *MDA Provisioned* column in the following output are a 12-port channelized DS3 MDA (m12-ds3) on card 1, MDA slot 1, and a 1-port channelized OC12-SFP MDA (m1-choc12-sfp) on card 1, MDA slot 2.

```
A:ALA-A# show mda 1
===============================================================================
MDA 1/1
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m12-ds3               m12-ds3               up        provisioned
===============================================================================
ALA-A# show mda 2
===============================================================================
MDA 1/2
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     2     m1-choc12-sfp         m1-choc12-sfp         up        provisioned
===============================================================================
A:ALA-A#
```

Configuring a Channelized DS3 Port

Figure 33 depicts the logic of the DS3 port configuration.

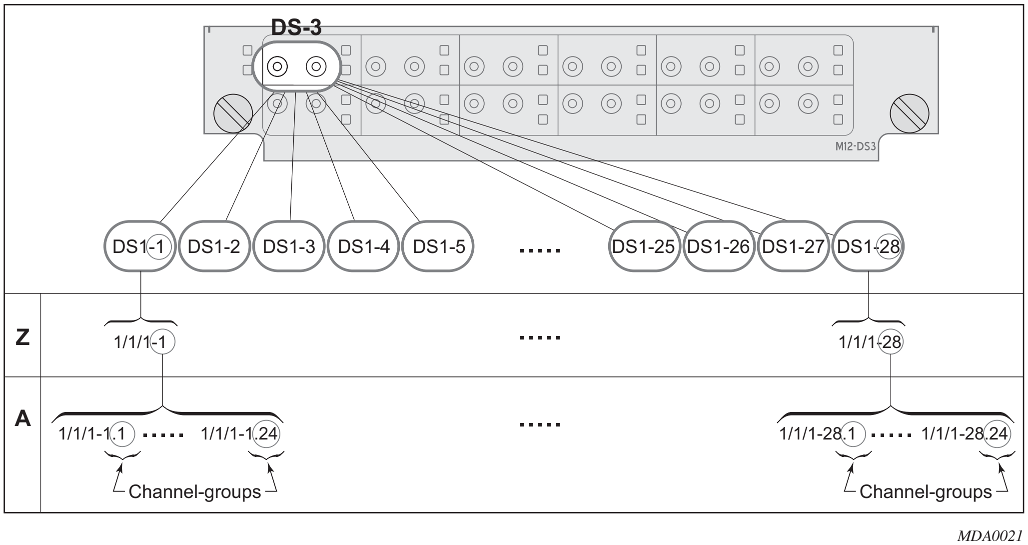

Figure 33: Channelized DS3 Port Structure

The following describes steps to configure a channelized port on a 12-port DS3 MDA:

```
A:ALA-A>config# port 7/1/1
A:ALA-A>config>port# tdm
```

In order to set the channelized mode on a port, the DS3 parameter must be in a shut down state. Clear channel uses out-of-band signaling, not in-band signaling, so the channel's entire bit rate is available. Channelized ports use in-band signalling and must be explicitly enabled.

```
A:ALA-A>config>port>tdm# ds3
A:ALA-A>config>port>tdm>ds3# shutdown
A:ALA-A>config>port>tdm>ds3# channelized ds1
A:ALA-A>config>port>tdm>ds3# no shutdown
A:ALA-A>config>port>tdm>ds3# exit
```

In the DS1 context, configure DS0 channel groups parameters. 24 timeslots can be configured per channel group.

```
A:ALA-A>config>port>tdm# ds1 1
A:ALA-A>config>port>tdm>ds1# no shutdown
A:ALA-A>config>port>tdm>ds1# channel-group 1
A:ALA-A>config>port>tdm>ds1>channel-group# timeslots 1
A:ALA-A>config>port>tdm>ds1>channel-group# encap-type frame-relay
A:ALA-A>config>port>tdm>ds1>channel-group# no shutdown
A:ALA-A>config>port>tdm>ds1>channel-group# exit
A:ALA-A>config>port>tdm>ds1# channel-group 2
```

```
A:ALA-A>config>port>tdm>ds1>channel-group# timeslots 2-10
A:ALA-A>config>port>tdm>ds1>channel-group# no shutdown
A:ALA-A>config>port>tdm>ds1>channel-group# exit
A:ALA-A>config>port>tdm>ds1# exit
A:ALA-A>config>port>tdm# ds1 2
A:ALA-A>config>port>tdm>ds1# channel-group 1
A:ALA-A>config>port>tdm>ds1>channel-group# timeslots 1
A:ALA-A>config>port>tdm>ds1>channel-group# exit
A:ALA-A>config>port>tdm>ds1# no shutdown
A:ALA-A>config>port>tdm>ds1# channel-group 2
A:ALA-A>config>port>tdm>ds1>channel-group# timeslots 2
A:ALA-A>config>port>tdm>ds1>channel-group# exit
A:ALA-A>config>port>tdm>ds1# no shutdown
```

The following output displays the channelized mode configuration:

```
A:ALA-A>config>port># info
----------------------------------------------
        tdm
            ds3 ds3
                channelized ds1
                no shutdown
            exit
            ds1 ds1-1
                channel-group 1
                    encap-type frame-relay
                    timeslots 1
                    frame-relay
                    exit
                    no shutdown
                exit
                channel-group 2
                    shutdown
                    timeslots 2-10
                exit
                no shutdown
            exit
            ds1 ds1-2
                channel-group 1
                    shutdown
                    timeslots 1
                exit
                channel-group 2
                    timeslots 2
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

Services can be applied to the configured channelized ports. The following example shows the CLI usage to configure a customer IES service with interface SAPs on the channelized ports. Refer to the 7750 SR OS Services Guide for information to configure services.

```
A:ALA-A>config>service# ies 103 customer 1 create
A:ALA-A>config>service>ies$ interface test1 create
A:ALA-A>config>service>ies>if$ address 102.21.1.1/24
A:ALA-A>config>service>ies>if# sap 7/1/1.1.2 create
A:ALA-A>config>service>ies>if>sap$ exit
A:ALA-A>config>service>ies>if# no shutdown
A:ALA-A>config>service>ies>if# exit
A:ALA-A>config>service>ies# interface test2 create
A:ALA-A>config>service>ies>if$ address 102.22.1.1/24
A:ALA-A>config>service>ies>if$ sap 7/1/1.2.1 create
A:ALA-A>config>service>ies>if>sap$ exit
A:ALA-A>config>service>ies>if# no shutdown
A:ALA-A>config>service>ies>if# exit
A:ALA-A>config>service>ies>if#
```

The following output displays the channelized ports (7/1/1.1.1 and 7/1/1.1.2) applied to SAPs on the IES service configuration.

```
A:ALA-A>config>service>ies# info
----------------------------------------------
...
        ies 103 customer 1 vpn 103 create
            interface "test2" create
                address 102.22.1.1/24
                sap 7/1/1.2.1 create
                exit
            exit
            interface "test1" create
                address 102.21.1.1/24
                sap 7/1/1.1.2 create
                exit
            exit
            no shutdown
        exit
...
----------------------------------------------
A:ALA-A>config>service>ies#
```

Configuring a Channelized OC-12-SFP Port

Figure 34 depicts the logic of the channelized OC-12 port configuration.

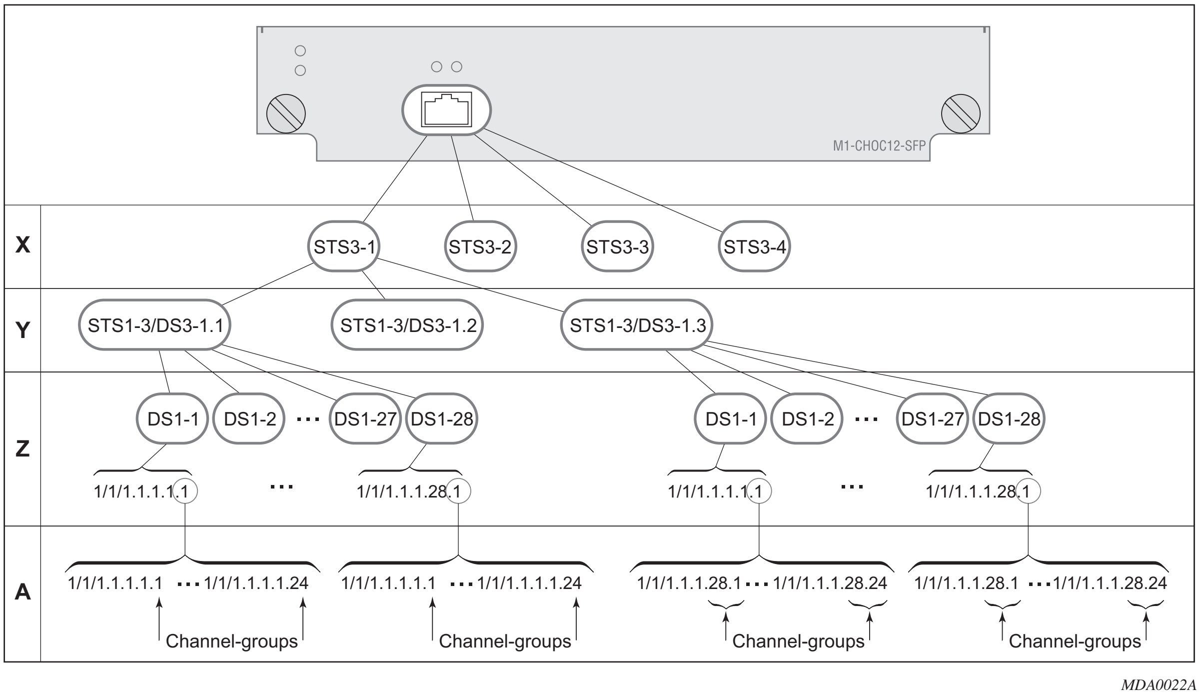

Figure 34: Channelized OC-12 Port Structure

The following describes an example to configure a channelized port on a 1-port channelized OC-12-SFP MDA:

```
ALA-A>config# port 5/2/1
```

At this level you must choose the tributary. When provisioning DS3 nodes on a channelized OC-12 MDA, you must provision the parent STS1-1 SONET path first.

```
A:ALA-A>config>port# sonet-sdh
A:ALA-A>config>port>sonet-sdh# path sts1-1.1
A:ALA-A>config>port>sonet-sdh>path# no shutdown
A:ALA-A>config>port>sonet-sdh>path# exit
```

The following displays the output:

```
A:ALA-A>config>port>sonet-sdh# info
----------------------------------------------
        sonet-sdh
            path sts1-1.1
                no shutdown
            exit
```

```
        exit
----------------------------------------------
A:ALA-A>config>port>sonet-sdh#
```

In order to set the channelized mode on a port, the DS3 parameter must be in a shut down state. Clear channel uses out-of-band signaling, not in-band signaling, so the channel's entire bit rate is available. Channelized ports use in-band signalling and must be explicitly enabled.

```
A:ALA-A>config>port# tdm
A:ALA-A>config>port>tdm# ds3 1.1
A:ALA-A>config>port>tdm>ds3# shutdown
A:ALA-A>config>port>tdm>ds3# channelized ds1
A:ALA-A>config>port>tdm>ds3# no shutdown
A:ALA-A>config>port>tdm>ds3# exit
```

The following displays the output:

```
A:ALA-A>config>port# info
----------------------------------------------
        sonet-sdh
            path sts12
                no shutdown
            exit
            path sts3-1
                no shutdown
            exit
            path sts1-1.1
                no shutdown
            exit
        exit
        tdm
            ds3 ds3-1.1
                channelized
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

In the TDM context, configure DS0 channel groups parameters. 24 timeslots can be configured per channel group.

```
A:ALA-A>config>port>tdm# ds1 1.1.1
A:ALA-A>config>port>tdm>ds1# no shutdown
A:ALA-A>config>port>tdm>ds1# channel-group 1
A:ALA-A>config>port>tdm>ds1>channel-group# timeslots 1
A:ALA-A>config>port>tdm>ds1>channel-group# no shutdown
A:ALA-A>config>port>tdm>ds1>channel-group# exit
A:ALA-A>config>port>tdm>ds1# no shutdown
A:ALA-A>config>port>tdm>ds1# channel-group 2
A:ALA-A>config>port>tdm>tds1>channel-group# timeslots 2
A:ALA-A>config>port>tdm>ds1>channel-group# no shutdown
A:ALA-A>config>port>tdm>ds1>channel-group# exit
A:ALA-A>config>port>tdm>ds1# exit


A:ALA-A>config>port>tdm# info
----------------------------------------------
        sonet-sdh
            path sts12
                no shutdown
            exit
            path sts3-1
                no shutdown
            exit
            path sts1-1.1
                no shutdown
            exit
        exit
        tdm
            ds3 ds3-1.1
                channelized
                no shutdown
            exit
            ds1 ds1-1.1.1
                channel-group 1        (see SAP 5/2/1.1.1.1.1 below)
                    timeslots 1
                    no shutdown
                exit
                channel-group 2        (see SAP 5/2/1.1.1.1.2 below)
                    timeslots 2
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port>tdm#
```

Services can be applied to the configured channelized ports. The following example shows the CLI usage to configure a customer IES service with interface SAPs on the channelized ports. Refer to the 7750 SR OS Services Guide for detailed information to configure services.

```
A:ALA-A>config>service# ies 104 customer 1 create
A:ALA-A>config>service>ies$ interface testA create
A:ALA-A>config>service>ies>if$ address 192.22.1.1/24
A:ALA-A>config>service>ies>if# sap 5/2/1.1.1.1.1 create
A:ALA-A>config>service>ies>if>sap$ exit
A:ALA-A>config>service>ies>if# no shutdown
A:ALA-A>config>service>ies>if# exit
A:ALA-A>config>service>ies# interface testB create
A:ALA-A>config>service>ies>if$ address 192.23.1.1/24
A:ALA-A>config>service>ies>if# sap 5/2/1.1.1.1.2 create
A:ALA-A>config>service>ies>if>sap$ exit
A:ALA-A>config>service>ies>if# no shutdown
A:ALA-A>config>service>ies>if# exit
A:ALA-A>config>service>ies# no shutdown
```

The following output displays the channelized ports 5/2/1.1.1.1.1 and 5/2/1.1.1.1.2) applied to SAPs on the IES service configuration.

```
A:ALA-A>config>service>ies# info
----------------------------------------------
            interface "testA" create
                address 192.22.1.1/24
                sap 5/2/1.1.1.1.1 create
                exit
            exit
            interface "testB" create
                address 192.23.1.1/24
                sap 5/2/1.1.1.1.2 create
                exit
            exit
            no shutdown
----------------------------------------------
A:ALA-A>config>service>ies#
```

Configuring a Channelized Any Service Any Port (ASAP) OC3-SFP Port

This section provides examples to configure PPP, FR, cHDLC, and ATM n*DS0 channels on a channelized port on channelized ASAP OC-3 SFP MDA in slot 1/1/1. The ASAP OC-12 SFP MDA also supports the SONET options.

```
ALA-A>config# port 1/1/1
```

At this level you must choose the tributary. When provisioning DS3 nodes on a channelized ASAP OC-3 MDA, you must provision the parent STS1-1 SONET path first.

```
A:ALA-A>config>port# sonet-sdh
A:ALA-A>config>port>sonet-sdh# framing sdh
A:ALA-A>config>port>sonet-sdh# path sts1-1
A:ALA-A>config>port>sonet-sdh>path# no shutdown
A:ALA-A>config>port>sonet-sdh>path# exit
A:ALA-A>config>port>sonet-sdh# info
----------------------------------------------
        sonet-sdh
               framing sdh
               path sts1-1
                    no shutdown
               exit
        exit
----------------------------------------------
A:ALA-A>config>port>sonet-sdh#
```

In order to set the channelized mode on a port, the DS3 parameter must be in a shut down state. Clear channel uses out-of-band signaling, not in-band signaling, so the channel's entire bit rate is available. Channelized ports use in-band signalling and must be explicitly enabled.

```
A:ALA-A>config>port# tdm
A:ALA-A>config>port>tdm# ds3 1
A:ALA-A>config>port>tdm>ds3# shutdown
A:ALA-A>config>port>tdm>ds3# channelized e1
A:ALA-A>config>port>tdm>ds3# no shutdown
A:ALA-A>config>port>tdm>ds3# exit
A:ALA-A>config>port# info
----------------------------------------------
        sonet-sdh
               path sts1-1
                    no shutdown
               exit
        exit
        tdm
           ds3 1
                channelized e1
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

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:

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

Services can now be applied to the configured channelized ports. Follow examples of other channelized ports in this document.

Configuring Cisco HDLC on a Channelized Port

Use the following CLI syntax to configure cHDLC:

CLI Syntax:
```
config# port port-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 Channelized STM1/OC3 Parameters

The following example displays basic syntax to configure channelized STM1/OC3 parameters:

CLI Syntax:
```
config# port port-id
 sonet-sdh
    framing {sonet|sdh}
    group sonet-sdh-index payload {tu3|vt2|vt15}
    path [sonet-sdh-index]
       payload {sts3|tug3|ds3|e3}
       trace-string [trace-string]
       no shutdown
```

Example:
```
config# port 5/2/1
config>port# sonet-sdh
config>port>sonet-sdh# framing sdh
config>port>sonet-sdh# path sts3
config>port>sonet-sdh>path# trace-string "HO-path"
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# group tug3-1 payload vt2
config>port>sonet-sdh# group tug3-3 payload vt2
config>port>sonet-sdh# path vt2-1.1.1
config>port>sonet-sdh>path# trace-string "LO-path 3.7.3"
config>port>sonet-sdh>path# no shutdown
config>port>sonet-sdh>path# exit
config>port>sonet-sdh# exit
config>port# tdm
config>port>tdm# e1 1.1.1
config>port>tdm>e1# channel-group 1
config>port>tdm>e1>channel-group# timeslots 2-32
config>port>tdm>e1>channel-group# no shutdown
config>port>tdm>e1>channel-group# exit
config>port>tdm>e1# exit
config>port>tdm# e1 3.7.3
config>port>tdm>e1# channel-group 2
config>port>tdm>e1>channel-group# timeslots 2-32
config>port>tdm>e1>channel-group# no shutdown
config>port>tdm>e1>channel-group# exit
```

The following displays the configuration output:

```
A:ALA-49>config>port# info
----------------------------------------------------------------------------------------
        sonet-sdh
            framing sdh
            path sts3
                trace-string "HO-path"
                no shutdown
            exit
            group tug3-1 payload vt2
            group tug3-3 payload vt2
            path vt2-1.1.1
                trace-string "LO-path 3.7.3"
                no shutdown
            exit
            path vt2-3.7.3
                no shutdown
            exit
        exit
        tdm
            e1 1.1.1
                channel-group 1
                    timeslots 2-32
                    no shutdown
                exit
                no shutdown
            exit
            e1 3.7.3
                channel-group 2
                    timeslots 2-32
                    no shutdown
                exit
                no shutdown
            exit
        exit
        no shutdown
----------------------------------------------
A:ALA-49>config>port#
```

Configuring Cpipe Port Parameters

Before a Cpipe service can be provisioned, the following entities must be configured.

- Configuring a DS1 Port on page 187
- Configuring a Channel Group on page 187

Configuring a DS1 Port

The following displays an example of a DS1 port configured for CES.

```
A:sim216#  show port 1/5/1.1.3.1
===============================================================================
TDM DS1 Interface
===============================================================================
Description        : DS1
Interface          : 1/5/1.1.3,1
Type               : ds1                      Framing              : esf
Admin Status       : up                       Oper Status          : up
Physical Link      : yes                      Clock Source         : loop-timed
Signal Mode        : none
Last State Change  : 10/31/2006 14:23:12      Channel IfIndex      : 580943939
Loopback           : none                     Invert Data          : false
Remote Loop respond: false                    In Remote Loop       : false
Load-balance-algo  : default                  Egr. Sched. Pol      : n/a
BERT Duration      : N/A                      BERT Pattern         : none
BERT Synched       : 00h00m00s                Err Insertion Rate   : 0
BERT Errors        : 0                        BERT Status          : idle
BERT Total Bits    : 0
Cfg Alarm          : ais los
Alarm Status       :
===============================================================================
A:sim216#
```

Configuring a Channel Group

The following displays an example of a DS1 channel group configured for CES.

```
A:sim216#  show port 1/5/1.1.3.1
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/5/1.1.3.1
TimeSlots          : 1-12
Speed              : 64                       CRC                  : 16
Admin Status       : up                       Oper Status          : up
Last State Change  : 10/31/2006 14:23:12      Chan-Grp IfIndex     : 580943940
Configured mode    : access                   Encap Type           : cem
Admin MTU          : 4112                     Oper MTU             : 4112
```

```
Physical Link      : Yes                      Bundle Number        : none
Idle Cycle Flags   : flags                    Load-balance-algo    : default
Egr. Sched. Pol    : n/a
===============================================================================
A:sim216#
```

Configuring ATM SAPs

ATM SAP in an IES Service

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 2/1/1:17/24 create
                exit
            exit
            interface "atm_2" create
                address 2.4.5.1/24
                sap 2/1/1:18/300 create
                exit
            exit
            no shutdown
----------------------------------------------
B:ALA-701>config>service>ies#
```

ATM SAP in an Epipe Service

The following displays an Epipe service SAP configuration:

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

Configuring DWDM Port Parameters

The following example displays a DWDM port configuration:

```
*A:ALA-A>config>port>dwdm># info
----------------------------------------------
           channel 44
           wavetracker
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
           exit
----------------------------------------------

*A:ALA-A>config>port>dwdm># info detail
----------------------------------------------
           channel 44
           wavetracker
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
               report-alarm enc-fail enc-degr pwr-fail pwr-degr pwr-high pwr-low
           exit
           rxdtv-adjust
----------------------------------------------
*A:ALA-A>config>port>dwdm># wavetracker

*A:ALA-A>config>port>dwdm>wavetracker># info
----------------------------------------------
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
----------------------------------------------


*A:ALA-A>config>port>dwdm>wavetracker># info detail
----------------------------------------------
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
               report-alarm enc-fail enc-degr pwr-fail pwr-degr pwr-high pwr-low
----------------------------------------------
```

Configuring WaveTracker Parameters

NOTE: The WaveTracker feature is not supported on the 7750 SR-1.

The following example displays the default configuration with WaveTracker disabled:

```
*A:ALA-A>config>port>dwdm># info
----------------------------------------------
           channel 44
----------------------------------------------


*A:ALA-A>config>port>dwdm># info detail
----------------------------------------------
           channel 44
           wavetracker
               no power-control
               no encode
               report-alarm enc-fail enc-degr pwr-fail pwr-degr pwr-high pwr-low
           exit
           rxdtv-adjust
----------------------------------------------
```

The following example displays a configuration with DWDM channel 44, WaveTracker power control transmit power at -7.5 dBm and WaveTracker encoded keys 205 and 749

```
*A:ALA-A>config>port>dwdm># info
----------------------------------------------
           channel 44
           wavetracker
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
           exit
----------------------------------------------

*A:ALA-A>config>port>dwdm># info detail
----------------------------------------------
           channel 44
           wavetracker
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
               report-alarm enc-fail enc-degr pwr-fail pwr-degr pwr-high pwr-low
           exit
           rxdtv-adjust
----------------------------------------------
*A:ALA-A>config>port>dwdm># wavetracker

*A:ALA-A>config>port>dwdm>wavetracker># info
```

```
---------------------------------------------
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
---------------------------------------------


*A:ALA-A>config>port>dwdm>wavetracker># info detail
---------------------------------------------
               power-control
                   target-power -7.50
               exit
               encode key1 205 key2 749
               report-alarm enc-fail enc-degr pwr-fail pwr-degr pwr-high pwr-low
---------------------------------------------
```

Following is an example of the `show port <portId> wavetracker` command for the non-default WaveTracker configuration above:

```
*A:ALA-A# show port 3/2/1 wavetracker

===============================================================================
Wavelength Tracker
===============================================================================
Power Control      : Enabled                WaveKey Status     : Enabled
Target Power       :  -7.50 dBm             WaveKey 1          : 205
Measured Power     :  -7.49 dBm             WaveKey 2          : 749

Cfg Alarms         : enc-fail enc-degr pwr-fail pwr-degr pwr-high pwr-low
Alarm Status       :

Maximum Power      :   0.47 dBm             Power Upper Margin :   7.96 dB
Minimum Power      : -21.23 dBm             Power Lower Margin :  13.74 dB
===============================================================================
```

Following are the Wavetracker keys allowed for each DWDM channel:

```
ITU      Key1  Key1  Key2  Key2
Channel  Min   Max   Min   Max
-------  ----  ----  ----  ----
61       1548  1548  2032  2032
59       1     15    545   559
58       18    32    562   576
57       35    49    579   593
56       52    66    596   610
54       69    83    613   627
53       86    100   630   644
52       103   117   647   661
51       120   134   664   678
49       137   151   681   698
48       154   168   698   712
47       171   185   715   729
46       188   202   732   746
44       205   219   749   763
43       222   236   766   780
42       239   253   783   797
41       256   270   800   814
```

39	273	287	817	831
38	290	304	834	848
37	307	321	851	865
36	324	338	868	882
34	341	355	885	899
33	358	372	902	916
32	375	389	919	933
31	392	406	936	950
29	409	423	953	967
28	426	440	970	984
27	443	457	987	1001
26	460	474	1004	1018
24	477	491	1021	1035
23	494	508	1038	1052
22	511	525	1055	1069
21	528	542	1072	1086
60	1089	1103	1573	1587
55	1106	1120	1590	1604
50	1123	1137	1607	1621
45	1140	1154	1624	1638
40	1157	1171	1641	1655
35	1174	1188	1658	1672
30	1191	1205	1675	1689
25	1208	1222	1692	1706
20	1225	1239	1709	1723
19	1242	1256	1726	1740
18	1259	1273	1743	1757
17	1276	1290	1760	1774
595	1293	1307	1777	1791
585	1310	1324	1794	1808
575	1327	1341	1811	1825
565	1344	1358	1828	1842
545	1361	1375	1845	1859
535	1378	1392	1862	1876
525	1395	1409	1879	1893
515	1412	1426	1896	1910
495	1429	1443	1913	1927
485	1446	1460	1930	1944
475	1463	1477	1947	1961
465	1480	1494	1964	1978
445	1497	1511	1981	1995
435	1514	1528	1998	2012
425	1531	1545	2015	2029
415	1548	1562	2032	2046
395	3585	3599	2049	2063
385	3602	3616	2066	2080
375	3619	3633	2083	2097
365	3636	3650	2100	2114
345	3653	3667	2117	2131
335	3670	3684	2134	2148
325	3687	3701	2151	2165
315	3704	3718	2168	2182
295	3721	3735	2185	2199
285	3738	3752	2202	2216
275	3755	3769	2219	2233
265	3772	3786	2236	2250
245	3789	3803	2253	2267
235	3806	3820	2270	2284
225	3823	3837	2287	2301

```
215       3840  3854  2304  2318
605       3857  3871  2321  2335
555       3874  3888  2338  2352
505       3891  3905  2355  2369
455       3908  3922  2372  2386
405       3434  3448  3946  3960
355       3451  3465  3963  3977
305       3468  3482  3980  3994
255       3485  3499  3997  4011
205       3502  3516  4014  4028
195       3519  3533  4031  4045
185       3536  3550  4048  4062
175       3553  3567  4065  4079
```

Configuring OTU Port Parameters

The following example displays an OTU port configuration:

```
*A:ALA-A>config>port>otu# info detail
----------------------------------------------
           otu2-lan-data-rate 11.049
           sf-sd-method fec
           sf-threshold 5
           sd-threshold 7
           fec enhanced
           no report-alarm otu-ais otu-ber-sd otu-tim otu-iae otu-biae fec-sd
           no report-alarm fec-fail fec-uncorr odu-ais odu-oci odu-lck odu-bdi
           no report-alarm odu-tim opu-tim opu-plm
           report-alarm loc los lof lom otu-ber-sf otu-bdi fec-sf
           sm-tti
               tx auto-generated
               expected auto-generated
               no mismatch-reaction
           exit
           pm-tti
               tx auto-generated
               expected auto-generated
               no mismatch-reaction
           exit
           psi-tti
               tx auto-generated
               expected auto-generated
               no mismatch-reaction
           exit
           psi-payload
               tx auto
               expected auto
               no mismatch-reaction
           exit
----------------------------------------------
```

The following example displays the `show port <portId> otu detail` for the default OTU configuration above:

```
*A:ALA-A# show port 3/2/1 otu detail

===============================================================================
OTU Interface
===============================================================================
OTU Status         : Enabled                    FEC Mode          : enhanced
Async Mapping      : Disabled                   Data Rate         : 11.049 Gb/s

Cfg Alarms         : loc los lof lom otu-ber-sf otu-bdi fec-sf
Alarm Status       :
SF/SD Method       : FEC                        SF Threshold      : 1E-5
                                                SD Threshold      : 1E-7

SM-TTI Tx (auto)   : ALA-A:3/2/1/C44
SM-TTI Ex (bytes)  : (Not Specified)
SM-TTI Rx          : ALA-A:5/2/1/C34
```

```
OTU-TIM reaction   : none

PM-TTI Tx (auto)   : ALA-A:3/2/1/C44
PM-TTI Ex (bytes)  : (Not Specified)
PM-TTI Rx          : ALA-A:5/2/1/C34
ODU-TIM reaction   : none

PSI-TTI Tx (auto)  : ALA-A:3/2/1/C44
PSI-TTI Ex (bytes) : (Not Specified)
PSI-TTI Rx         : ALA-A:5/2/1/C34
OPU-TIM reaction   : none

PSI-PT Tx (auto)   : 0x03 (syncCbr)
PSI-PT Ex (auto)   : 0x03 (syncCbr)
PSI-PT Rx          : 0x03 (syncCbr)
OPU-PLM reaction   : none
===============================================================================
OTU Statistics
===============================================================================
Elapsed Seconds                                                       10
-------------------------------------------------------------------------------
Near End Statistics                                            Count
-------------------------------------------------------------------------------
FEC Corrected 0s                                                       0
FEC Corrected 1s                                                       0
FEC Unrrectable Sub-rows                                               0
FEC ES                                                                 0
FEC SES                                                                0
FEC UAS                                                                0
Pre-FEC BER                                                    0.000E+00
Post-FEC BER                                                   0.000E+00
-------------------------------------------------------------------------------
SM BIP8                                                                0
SM ES                                                                  0
SM SES                                                                 0
SM UAS                                                                 0
SM-BIP8-BER                                                    0.000E+00
-------------------------------------------------------------------------------
PM BIP8                                                                0
PM ES                                                                  0
PM SES                                                                 0
PM UAS                                                                 0
PM-BIP8-BER                                                    0.000E+00
-------------------------------------------------------------------------------
NPJ                                                                    0
PPJ                                                                    0

-------------------------------------------------------------------------------
Far End Statistics                                             Count
-------------------------------------------------------------------------------
SM BEI                                                                 0
PM BEI                                                                 0
===============================================================================
```

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 7750 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, 7750 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 28 illustrates how SONET alarm status, path operational status, ATM interface and PLCP status and PLCP Alarm state interact:

Table 28: 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 Configurations

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

CLI Syntax:
```
config# port port-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 IMA bundles.

CLI Syntax:
```
config>port>multilink-bundle
 ima
    atm
       cell-format cell-format
       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 example displays a channelized interface 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 a 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 7750 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# pwc
```

Configuring Multilink PPP Bundles

Multilink bundles can have from 1 to 8 members (ports) specified. The bundles aggregate channelized ports which define available bandwidth to carry data over a DS1 channel. 56 multilink bundles can be configured per MDA. 256 MLPPP groups are supported per ASAP MDA. Each bundle represents a single connection between two routers.

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 16 ports can be included in a multilink bundle.
- Multilink bundles can only be aggregated on a single MDA.

```
A:ALA-A>config# port bundle-5/2.1
A:ALA-A>config>port# multilink-bundle
A:ALA-A>config>port>ml-bundle# member 5/2/1.ds0grp-1.1
A:ALA-A>config>port>ml-bundle# member 5/2/1.ds0grp-2.2
A:ALA-A>config>port>ml-bundle# member 5/2/1.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 bundle parameters:

CLI Syntax:
```
configure# port bundle-type-slot/mda.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
       version ima-version
    red-differential-delay red-diff-delay down
    member port-id
```

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 bundle characteristics enforced over the link. 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 bundle.
- IMA links can only be aggregated into a bundle within a single MDA.
- IMA group maximum bandwidth and minimum link settings allows, by default, for oversubscription of shaped services; however when that occurs scheduling of traffic over an IMA group ATM interface degrades to round-robin between shaped services, therefore 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 E1 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), 1-35 ms maps to 1 frame sequence number difference (70 ms delay), 36 - 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 7750 RX end of the channel. When a channel is deleted on the 7750 end first, a small data loss will take place on the 7750 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.
- The shutdown command for IMA groups sets the IMA group state to “Blocking”. This makes the group operationally down but will not bring down the individual IMA links. Services configured on the IMA group will go operationally down as well.

- The 7750 supports automatic IMA version changing when the far end IMA group version matches the configured version. The group will remain operationally down until one of the IMA groups changes version.
- 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 bundle with 3 group members residing on a channelized OC-3 ASAP MDA in slot 5/2/1:

```
A:ALA-A>config# port bundle-ima-5/2.1
A:ALA-A>config>port# multilink-bundle
A:ALA-A>config>port>ml-bundle# member 5/2/1.1.1.1
A:ALA-A>config>port>ml-bundle# member 5/2/1.1.2.1

A:ALA-A>config>port>ml-bundle# member 5/2/1.1.3.1
```

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.
- Fractional DS1 MLPPP links are supported. This is applicableto MLPPP bundles on ASAP MDAs.

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 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. Bundle protection groups apply to MLPPP as well, and are configured the same way. The following examples show the process to configure BPGrp on ASAP MDAs to provide an APS protection for an IMA/MLPPP bundle.

First, two ASAP MDAs must be configured.

Example:
```
config# card 3
config>card# mda 2
config>card>mda# mda-type m4-choc3-as-sfp
config>card>mda# no shutdown
config>card>mda# exit
config>card# exit
config# card 10
config>card# mda 2
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-1
config>port# aps
config>port>aps# working-circuit 3/2/1
config>port>aps# protect-circuit 10/2/1
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/MLPPP-type BPGrp 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 BPGrp ID (for example, an ATM VC 0/32 SAP would be: `sap bpg-ima-1:0/32`).

Configuration Notes and Guidelines:

- Any configuration on a BPGrp applies to both the working and protection bundle.
- Working and protection bundles can be shutdown individually.
- Services cannot be configured on a BPGrp until at least one member link has been configured.

- The published switchover times for bundle protection groups on the router are dependent on the far end being able to recover from cell loss within that time. To ensure this, the following recommendations are given:
  - → The BPGrp link activation timer should be configured to a value small enough to allow a quick recovery from any IMA failure occurring during the switchover. A recommended value is 1 second.
  - → The ADM that terminates APS should support standard APS switchover time requirements.
  - → The far end IMA/MLPPP links must be able to tolerate cell loss during APS switchover without bringing links down. This includes, for example, a combination of link activation/deactivation and appropriate configuration of TDM/SONET debounce timers.
  - → Because of the temporary cell loss during the APS switchover, the far end IMA/MLPPP will experience a misalignment between individual links within an IMA/MLPPP group. The far end IMA/MLPPP group must support fast-realignment of links without having to bring the links down. The router synchronizes the IMA/MLPPP streams the far end receives between switchovers in an effort to cause the least amount of misalignment.
  - → To increase the BPGrp robustness, it is recommended to provision more IMA/MLPPP links than is required and set the minimum links and max bandwidth parameters to the number of required links. This type of configuration is required on the far end as well.

Configuring a Channelized DS1 Card

7750 SR-c12 and 7750 SR-c4 support channelized DS-1 cards. The channelization is as follows:

- N*DS0 in DS1 port.{1..24}
- N*DS0 in E1 port.{1..32}

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 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#
```

Configuring G.8031 Protected Ethernet Tunnels

Ethernet tunnel configuration can include at most two paths. Other considerations include:

- A path contains one member port and one control-tag (backbone VLAN ID/BVID)
- If the operator wants to replace an existing member port or a control-tag, the whole path needs to be shutdown first. The alternate path will be activated as a result keeping the traffic interruption to a minimum. Then the whole path must be deleted and re-created. To replace an existing member port or control tag, the whole path needs to be shutdown first. The alternate path will be activated as a result keeping traffic interruption to a minimum. Then the whole path must be deleted, the alternate path precedence modified to primary before re-creating the new path.
- The Ethernet tunnel will inherit the configuration from the first member port. The following port-level configuration needs to be the same between member ports of an Ethernet tunnel:
  - → config>port>ethernet>access>{ingress|egress}>queue-group
  - → config>port>ethernet>egress-scheduler-policy
  - → config>port>access>egress>pool
  - → config>port>ethernet>dot1q-etype
  - → config>port>ethernet>qinq-etype
  - → config>port>ethernet>pbb-etype
  - → config>port>ethernet> mtu
- The operator can update these port parameters only if the port is the sole member of an Ethernet tunnel. This means that in the example below, the operator needs to remove port 1/1/4 and port 1/1/5 before being allowed to modify 1/1/1 for the above parameters.

CLI Syntax:

```
eth-tunnel 1
    path 1
       member 1/1/1
    path 2
       member 1/1/4
 eth-tunnel 2
    path 1
       member 1/1/1
   path 2
        member 1/1/5
```

The following example displays eth-tunnel configuration output:

```
port 1/1/1
   ethernet
      encap-type dot1q
port 2/2/2
```

```
      ethernet
         encap-type dot1q

   config eth-tunnel 1
      path 1
         member 1/1/1
         control-tag 100
         precedence primary
         eth-cfm
            mep 51 domain 1 association 1
            ccm-enable
            low-priority-defect allDef
            mac-address 00:AE:AE:AE:AE:AE
            control-mep
            no shutdown
      no shutdown
      path 2
         member 2/2/2
         control-tag 200
         eth-cfm
            mep
               mep 52 domain 1 association 2 direction down
               ccm-enable
               low-priority-defect allDef
               mac-address 00:BE:BE:BE:BE:BE
               control-mep
               no shutdown
         no shutdown
```

Service Management Tasks

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

- Modifying or Deleting an MDA, MCM, or CMA on page 220
- Modifying a Card Type on page 221
- Deleting a Card on page 222
- Deleting Port Parameters on page 222

Modifying or Deleting an MDA, MCM, 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 MDA, CMA, 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
            [no] hi-bw-mcast-src [alarm] [group group-id]
            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. For 7750 SR-c12/c4 systems, 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. For 7750 SR-c12/c4 systems, after removing MDA configurations, you may shutdown and remove the MCM from service 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 (for 7750 SR-c12/c4 only)
    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:

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

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

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

Soft IOM Reset

The soft IOM reset procedure is applicable during the ISSU process and for a manual soft reset procedure. The impact to the data plane forwarding during the reboot process is minimized. The command to perform a soft IOM reset is “**clear card** *card-number* **soft**”. During the process, related show commands such as “**show card**” and “**show mda**” will indicate a soft IOM reset is occurring.

Card, MDA, and Port Command Reference

Command Hierarchies

Card and MDA Configuration Commands

Hardware Commands

config
- — [**no**] **card** *slot-number*
  - — **capability** {**sr** | **ess**} [**now**]
  - — **card-type** *card-type*
  - — **no card-type**
  - — [**no**] **named-pool-mode**
  - — [**no**] **mcm** *mcm-slot*
    - — **mcm-type** *mcm-type*
    - — **no mcm-type**
    - — [**no**] **shutdown**
  - — [**no**] **mda** *mda-slot*
    - — **access**
      - — **egress**
        - — [**no**] **pool** [*name*]
          - — **resv-cbs** *percent-or-default*
          - — **no resv-cbs**
          - — **slope-policy** *name*
          - — **no slope-policy**
      - — **ingress**
        - — [**no**] **pool** [*name*]
          - — **resv-cbs** *percent-or-default*
          - — **no resv-cbs**
          - — **slope-policy** *name*
          - — **no slope-policy**
    - — **egress**
      - — **hsmda-pool-policy** *policy-name*
      - — **no hsmda-pool-policy**
    - — **hi-bw-mcast-src** [**alarm**] [**group** *group-id*]
    - — **no hi-bw-mcast-src**
    - — **ingress**
      - — **hsmda-pool-policy** *policy-name*
      - — **no hsmda-pool-policy**
      - — [**no**] **hsmda-scheduler-overrides**
        - — **group** *group-id* **rate** *rate*
        - — **no group** *group-id*
        - — **max-rate** *rate*
        - — **no max-rate**
        - — **scheduling-class** *class* **rate** *rate*
        - — **scheduling-class** *class* weight *weight-in-group*
        - — **no scheduling-class** *class*
      - — **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**
— **named-pool-mode**
— **egress**
— **named-pool-policy** *policy-name*
— **no named-pool-policy**
— **ingress**
— **named-pool-policy** *policy-name*
— **no named-pool-policy**
— **network**
— **egress**
— [**no**] **pool** [*name*]
— **resv-cbs** *percent-or-default*
— **no resv-cbs**
— **slope-policy** *name*
— **no slope-policy**
— **ingress**
— [**no**] **pool** [*name*]
— **resv-cbs** *percent-or-default*
— **no resv-cbs**
— **slope-policy** *name*
— **no slope-policy**
— **queue-policy** *name*
— **no queue-policy**
— [**no**] **shutdown**
— [**no**] **sync-e**
— [**no**] **shutdown**
— [**no**] **named-pool-mode** [**now**]

Forwarding Plane Commands

config
- **card**
  - **fp** [*fp-number*]
    - **egress**
      - **wred-queue-control**
        - **buffer-allocation min** *percentage* **max** *percentage*
        - **no buffer-allocation**
        - **resv-cbs min** *percentage* **max** *percentage*
        - **no resv-cbs**
        - [**no**] **shutdown**
        - **slope-policy** *slope-policy-name*
        - **no slope-policy**
    - **hi-bw-mcast-src** [**alarm**] [**group** *group-id*]
    - **no hi-bw-mcast-src**
    - **ingress**
      - **mcast-path-management**
        - **bandwidth-policy** *policy-name*
        - **no bandwidth-policy**
        - [**no**] **shutdown**
  - **mda**
    - **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**

tools
- **dump**
  - **mcast-path-mgr**
    - **cpm**

Port Configuration Commands

config
- — **port** {*port-id* | *bundle-id* | *bpgrp-id* | *aps-id*}
- — **no port** {*bundle-id* | *bpgrp-id* | *aps-id*}
  - — **access**
    - — **egress**
      - — [**no**] **pool** [*name*]
        - — **resv-cbs** *percent-or-default*
        - — **no resv-cbs**
        - — **slope-policy** *name*
        - — **no slope-policy**
    - — **ingress**
      - — [**no**] **pool** [*name*]
        - — **resv-cbs** *percent-or-default*
        - — **no resv-cbs**
        - — **slope-policy** *name*
        - — **no slope-policy**
  - — [**no**] **ddm-events**
  - — **description** *long-description-string*
  - — **no description**
  - — **dwdm**
    - — **channel** *channel*
    - — [**no**] **rxdtv-adjust**
    - — **wavetracker**
      - — **encode** *wave-key* **key2** *wave-key*
      - — **no encode**
      - — [**no**] **power-control**
        - — **target-power** d*Bm*
        - — [**no**] **report-alarm** [**encode-fail**] [**encode-degrade**] [**power-fail**] [**power-degrade**] [**power-high**] [**power-low**]
  - — **ethernet**
    - — **xgig** {**lan** | **wan**}
  - — **hybrid-buffer-allocation**
    - — **ing-weight access** *access-weight* **network** *network-weight*
    - — **no ing-weight**
    - — **egr-weight access** *access-weight* **network** *network-weight*
    - — **no egr-weight**
  - — **modify-buffer-allocation-rate**
    - — **ing-percentage-of-rate** *rate-percentage*
    - — **no ing-percentage-of-rate**
    - — **egr-percentage-of-rate** *rate-percentage*
    - — **no egr-percentage-of-rate**
  - — **named-pool-mode**
    - — **egress**
      - — **named-pool-policy** *policy-name*
      - — **no named-pool-policy**
    - — **ingress**
      - — **named-pool-policy** *policy-name*
      - — **no named-pool-policy**
  - — **network**
    - — **egress**
      - — [**no**] **pool** [*name*]
        - — **resv-cbs** *percent-or-default*

— **no resv-cbs**
— **slope-policy** *name*
— **no slope-policy**
— [**no**] **otu**
— [**no**] **async-mapping**
— **fec** {**enhanced** | **g709**}
— [**no**] **fec**
— **otu2-lan-data-rate** {**11.049** | **11.0957**}
— **pm-tti**
— **expected auto-generated**
— **expected bytes** *byte* [*byte*...(up to 64 max)]
— **expected string** *identifier*
— **expected use-rx**
— **mismatch-reaction** {**squelch-rx**}
— **no mismatch-reaction**
— **tx auto-generated**
— **tx bytes** *bytes* [*bytes*...(up to 64 max)]
— **tx string** *identifier*
— **no tx**
— **psi-payload**
— **expected bytes** *byte*
— **expected auto**
— **mismatch-reaction** {**squelch-rx**}
— **no mismatch-reaction**
— **tx** *byte*
— **tx auto**
— [**no**] **psi-tti**
— **expected auto-generated**
— **expected bytes** *byte* [*byte*...(up to 64 max)]
— **expected string** *identifier*
— **expected use-rx**
— **mismatch-reaction** {**squelch-rx**}
— **no mismatch-reaction**
— **tx auto-generated**
— **tx bytes** *bytes* [*bytes*...(up to 64 max)]
— **tx string** *identifier*
— **no tx**
— [**no**] **report-alarms** [**loc**] [**los**] [**lof**] [lom] [**otu-ais**] [**otu-ber-sf**] [**otu-ber-sd**] [**otu-bdi**] [**otu-tim**] [**otu-iae**] [**otu-biae**] [**fec-sf**] [**fec-sd**] [**fec-fail**] [**fec-uncorr**] [**odu-ais**] [**odu-oci**] [**odu-lck**] [**odu-bdi**] [**odu-tim**] [**opu-tim**] [**opu-plm**]
— **sf-sd-method** {**bip8** | **fec**}
— **sf-threshold** *threshold*
— **sd-threshold** *threshold*
— **sm-tti**
— **expected auto-generated**
— **expected bytes** *byte* [*byte*...(up to 64 max)]
— **expected string** *identifier*
— **expected use-rx**
— **mismatch-reaction** {**squelch-rx**}
— **no mismatch-reaction**
— **tx** {**auto-generated** | **string** *identifier* | **bytes** *byte1* [*byte2*...(up to 64 bytes)]}
— **no tx**
— [**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**
— **hold-time-aps** [**lsignal-failure** *sf-time*][**lsignal-degrade** *sd-time*]
— **no hold-time-aps**
— **neighbor** ***ip-address***
— **no neighbor**
— **protect-circuit** *port-id*
— **no protect-circuit**
— **rdi-alarms** [**suppress** | **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**
— **access**
— **egress**
— **queue-group** *queue-group-name* [**create**]
— **no queue-group** *queue-group-name*
— **accounting-policy** *acct-policy-id*
— **no accounting-policy**
— **agg-rate-limit** *kilobits-per-second* [**queue-frame-based-accounting**]
— **no agg-rate-limit**
— [**no**] **collect-stats**
— **description** *description-string*
— **no description**
— **queue-overrides**
— **queue** *queue-id* [**create**]
— **no queue** *queue-id*
— **adaptation-rule** [**pir** {**max** | **min** | **closest**}] [**cir** {**max** | **min** | **closest**}]
— **no adaptation-rule**
— **cbs** *size-in-kbytes*
— **no cbs**
— **high-prio-only** *percent*
— **no high-prio-only**
— **mbs** *size-in-kbytes*
— **no mbs**
— **rate** *pir-rate* [**cir** *cir-rate*]
— **no rate**
— **scheduler-policy** *scheduler-policy-name*
— **no scheduler-policy**
— **secondary-shaper** *secondary-shaper-name* **rate** {**max** | *rate*}
— **secondary-shaper** *secondary-shaper-name*
— **vport** *name* [**create**]
— **no vport** *name*
— **description** *description-string*
— **no description**
— **host-match** **dest** *description-string* [**create**]
— **no host-match** *destination-string*
— **port-scheduler-policy** *port-scheduler-policy-name*
— **no port-scheduler-policy**
— **ingress**
— **queue-group** *queue-group-name* [**create**]
— **no queue-group** *queue-group-name*
— **accounting-policy** *acct-policy-id*
— **no accounting-policy**
— [**no**] **collect-stats**
— **description** *description-string*
— **no description**
— **queue-overrides**
— **queue** *queue-id* [**create**]
— **no queue** *queue-id*

— **adaptation-rule** [**pir** {**max** | **min** | **closest**}] [**cir** {**max** | **min** | **closest**}]
— **no adaptation-rule**
— **cbs** *size-in-kbytes*
— **no cbs**
— **high-prio-only** *percent*
— **no high-prio-only**
— **mbs** *size-in-kbytes*
— **no mbs**
— **rate** *pir-rate* [**cir** *cir-rate*]
— **no rate**
— **scheduler-policy** *scheduler-policy-name*
— **no scheduler-policy**
— **secondary-shaper** *secondary-shaper-name* **rate** {**max** | *rate*}
— **secondary-shaper** *secondary-shaper-name*
— **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**
— [**no**] **use-broadcast-address**
— **duplex** {**full** | **half**}
— **efm-oam**
— [**no**] **accept-remote-loopback**
— **hold-time** *time-value*
— **no hold-time**
— **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**
— **elmi**
    — **mode** {**none**|**uni-n**}
    — **n393** [2..10]
    — **no n393**
    — **t391** [5..30]
    — **no t391**
    — **t392** [5..30]
    — **no t392**
— **encap-type**
— **encap-type** {**dot1q** | **null** | **qinq**}
— **no encap-type**
— **hold-time** {[**up** *hold-time* **up**] [**down** *hold-time* **down**] [**seconds**| **centiseconds**]}
— **no hold-time**
— [**no**] **hsmda-scheduler-overrides**
    — **group** *group-id* **rate** *rate*
    — **no group** *group-id*
    — **max-rate** *rate*
    — **no max-rate**
    — **scheduling-class** *class* **rate** *rate*
    — **scheduling-class** *class* **weight** *weight-in-group*
    — **no scheduling-class** *class*
— **ingress-rate** *ingress-rate*
— **no ingress-rate**
— [**no**] **lacp-tunnel**
— **lldp**
    — **dest-mac** {**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**}
    — **admin-status** {**rx** | **tx** | **tx-rx** | **disabled**}
    — [**no**] **notification**
    — **tx-mgmt-address** [**system**]
    — **no tx-mgmt-address**
    — **tx-tlvs** [**port-desc**] [**sys-name**] [**sys-desc**] [**sys-cap**]
    — **no tx-tlvs**
— **load-balancing-algorithm** *option*
— **no load-balancing-algorithm**
— **mac** *ieee-address*
— **no mac**
— **mode** {**access** | **network** | **hybrid**}
— **no mode**
— **mtu** *mtu-bytes*
— **no mtu**
— **network**
    — **accounting-policy** *policy-id*
    — **no accounting-policy**
    — [**no**] **collect-stats**
    — **egress**
        — **queue-group** *queue-group-name* [**create**]
        — **no queue-group** *queue-group-name*
            — **accounting-policy** *acct-policy-id*
            — **no accounting-policy**
            — **agg-rate-limit** *kilobits-per-second* [**queue-frame-based-accounting**]
            — **no agg-rate-limit**
            — [**no**] **collect-stats**

— **description** *description-string*
— **no description**
— **host-match dest** *destination-string* [**create**]
— **no host-match dest** *destination-string*
— **queue-overrides**
  — **queue** *queue-id* [**create**]
  — **no queue** *queue-id*
    — **adaptation-rule** [**pir** {**max** | **min** | **closest**}] [**cir** {**max** | **min** | **closest**}]
    — **no adaptation-rule**
    — **cbs** *size-in-kbytes*
    — **no cbs**
    — **high-prio-only** *percent*
    — **no high-prio-only**
    — **mbs** *size-in-kbytes*
    — **no mbs**
    — **rate** *pir-rate* [**cir** *cir-rate*]
    — **no rate**
— **scheduler-policy** *scheduler-policy-name*
— **no scheduler-policy**
— **queue-policy** *name*
— **no queue-policy**
— **pbb-etype** [**0x0600..0xffff**]
— **no pbb-etype**
— **qinq-etype** *0x0600..0xffff*
— **no qinq-etype**
— [**no**] **report-alarm** [**signal-fail**] [**remote**] [**local**] [**no-frame-lock**]
— [**no**] **single-fiber**
— **speed** {**10** | **100** | **1000**}
— **ssm**
  — [**no**] **shutdown**
  — **network-type sonet** | **sdh**
  — [**no**] **tx-dus**
— **xgig** {**lan** | **wan**}

Interface Group Handler Commands

config
— [**no**] **interface-group-handler** *group-id*
  — [**no**] **member** *portid*
  — **threshold** *min*
  — **no threshold**

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**
— **mlfr**
— **ack-timeout** *seconds*
— **no ack-timeout**
— **egress**
— **qos-profile** *profile-id*
— **no qos-profile**
— **frame-relay**
— **lmi-type** {**ansi** | **itu** | **none** | **rev1**}
— **mode** {**dce** | **dte** | **bidir**}
— **n391dte** *intervals*
— **n392dce** *threshold*
— **n392dte** *threshold*
— **n393dce** *count*
— **n393dte** *count*
— **t391dte** *keepalive*
— **t392dce** *keepalive*
— **hello-timeout** *seconds*
— **no hello-timeout**
— [**no**] **identifier** *bundle-id-string*
— **ingress**
— **qos-profile** *profile-id*
— **no qos-profile**
— **retry-limit** *integer*
— **no retry-limit**
— **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**
— [**no**] **magic-number**
— **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
                    — [no] frf-12
                        — egress
                            — qos-profile profile-id
                            — no qos-profile
```

— **fragment-threshold** *threshold*
— **no fragment-threshold**
— **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**
— **mac** *ieee-address*
— **no mac**
— **mode** {**access** | **network** | **hybrid**}
— **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**
— **keepalive** *time-interval* [**dropcount** *drop-count*]
— **no keepalive**
— [**no**] **report-alarm** [**pais**] [**plop**] [**prdi**] [**pplm**] [**prei**] [**puneq**] [**plcd**]
— [**no**] **scramble**
— [**no**] **shutdown**
— **signal-label** *value*
— **no signal-label**
— **trace-string** [*trace-string*]
— **no trace-string**
— [**no**] **report-alarm** [**loc**] [**lais**] [**lrdi**] [**ss1f**] [**lb2er-sd**] [**lb2er-sf**] [**slof**][**slos**] [**lrei**]
— **section-trace** {**increment-z0** | **byte** *value* | **string** *string*}
— [**no**] **single-fiber**
— **speed** {**oc3** | **oc12**}
— **no speed**
— [**no**] **suppress-lo-alarm**
— **threshold** {**ber-sd** | **ber-sf**} **rate** *threshhold-rate*
— **no threshold** {**ber-sd** | **ber-sf**}
— [**no**] **tx-dus**

TDM Commands

config
- — [**no**] **port** {*port-id*}
  - — **tdm**
    - — **buildout** {**long** | **short**}
    - — [**no**] **ds1** *ds1-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*
        - — **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**}
        - — [**no**] **description** *description-string*
        - — [**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**] **encap-type** {**atm** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
        - — **frame-relay**
          - — [**no**] **frf-12**
            - — **egress**
              - — **qos-profile** *profile-id*
              - — **no qos-profile**
            - — **fragment-threshold** *threshold*
            - — **no fragment-threshold**
          - — [**no**] **identifier** *frf16-link-id-string*
          - — **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**
— [**no**] **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**
— [**no**] **ber-sf-link-down**
— **compress** {**acfc** [**pfc**] | **pfc** [**acfc**]}
— **no compress**
— **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**}
— **framing (DS-1)** {**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**}
— **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** {**atm** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
— [**no**] **feac-loop-respond**
— **frame-relay**
    — [**no**] **frf-12**
        — **egress**
            — **qos-profile** *profile-id*
            — **no qos-profile**
        — **fragment-threshold** *threshold*
        — **no fragment-threshold**
    — **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**}
— **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*
    — [**no**] **encap-type** {**atm** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
    — **frame-relay**
        — [**no**] **frf-12**
            — **egress**
                — **qos-profile** *profile-id*

— **no qos-profile**
— **fragment-threshold** *threshold*
— **no fragment-threshold**
— [**no**] **identifier** *frf16-link-id-string*
— **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**
— [**no**] **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**
— [**no**] **ber-sf-link-down**
— **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**}
— **framing (E-1)** {**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** {**atm** | **bcp-null** | **bcp-dot1q** | **ipcp** | **ppp-auto** | **frame-relay** | **wan-mirror** | **cisco-hdlc** | **cem**}
— [**no**] **feac-loop-respond**
— **frame-relay**
— [**no**] **frf-12**
— **egress**
— **qos-profile** *profile-id*
— **no qos-profile**
— **fragment-threshold** *threshold*
— **no fragment-threshold**
— **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 (E-3)** {**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**
— **lbo** [**0dB** | **-7.5dB** | **-15.0dB** | **-22.5dB**]
— **length** {**133** | **266** | **399** | **533** | **655**}
— **line-impedance** {**75** | **100** | **120**}

LAG Commands

config
- — [**no**] **lag** [*lag-id*]
  - — **access**
    - — **adapt-qos** *type*
    - — [**no**] **per-fp-ing-queuing**
  - — **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**| **hybrid**}
  - — **no mode**
  - — **port** *port-id* [*port-id* …up to 16 total] [**priority** *priority*] [**sub-group** *sub-group-id*]
  - — **no port** *port-id* [*port-id* …up to 16 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**

Ethernet Ring Commands

config

- — **eth-ring** *ring-id*
- — **no eth-ring**
  - — **description** *long-description-string*
  - — **no description**
  - — **guard-time** *time*
  - — **revert-time** *time*
  - — **ccm-hold-time {down** *down-timeout* | **up** *up-timeout***}**
  - — [**no**] **rpl-node <owner | nbr>**
  - — **node-id** *timeout*
  - — **path {a | b}** <*portid*> **raps-tag** <*VID*>
    - — **description** *long-description-string*
    - — [**no**] **rpl-end**
    - — **eth-cfm**
      - — [**no**] **mep** *mep-id* **domain** *md-index* **association** *ma-index*
        - — [**no**] **ccm-enable**
        - — [**no**] **ccm-ltm-priority** *priority*
        - — [**no**] **eth-test-enable**
        - — **bit-error-threshold** *bit-errors*
        - — **mac-address** *mac-address*
        - — **one-way-delay-threshold** *time*
        - — [**no**] **shutdown**
    - — [**no**] **shutdown**
- — [**no**] **shutdown**

Ethernet Tunnel Commands

config
- — **eth-tunnel** *tunnel-id*
- — **no eth-tunnel**
  - — **ccm-hold-time** {**down** *down-timeout* | **up** *up-timeout*}
  - — **no ccm-hold-time**
  - — **description** *long-description-string*
  - — **no description**
  - — **ethernet**
    - — **encap-type** {**dot1q**|**qinq**}
    - — **no encap-type**
    - — [**no**] **mac** *ieee-address*
  - — **hold-time**
    - — **member down** *time*
    - — **no member**
  - — **lag-emulation**
    - — **access**
      - — **adapt-qos** {**distribute** | **link**}
      - — **no adapt-qos**
      - — [**no**] **per-fp-ing-queuing**
    - — **path-threshold** *num-paths*
    - — **nopath-threshold**
  - — [**no**] **path** *path-index*
    - — **description** *description-string*
    - — **no description**
    - — **control-tag** *vlan-id*
    - — **no control-tag**
    - — **eth-cfm**
      - — [**no**] **mep** *mep-id* **domain** *md-index* **association** *ma-index*
        - — [**no**] **ccm-enable**
        - — **ccm-ltm-priority** *priority*
        - — **no ccm-ltm-priority**
        - — [**no**] **eth-test-enable**
          - — **test-pattern** {**all zeros** | **all-ones**} [**crc-enable**]
          - — **no test-pattern**
        - — **low-priority-defect** {**allDef** | **macRemErrXcon** | **remErrXcon** | **errXcon** | **xcon** | **noXcon**}
        - — **mac-address** *mac-address*
        - — **no mac-address**
        - — [**no**] **control-mep**
        - — [**no**] **shutdown**
    - — **member** *pord-id*
    - — **no member**
    - — **precedence** {**primary** | **secondary**}
    - — **no precedence**
    - — [**no**] **shutdown**
  - — **protection-type** {**g8031-1to1** | **loadsharing**}
  - — **revert-time** *time*
  - — **no revert-time**
  - — [**no**] **shutdown**

Multi-Chassis Redundancy Commands

config
- — **redundancy**
  - — **bgp-multi-homing**
    - — **boot-timer** *seconds*
    - — **no boot-timer**
    - — **site-activation-timer** *seconds*
    - — **no site-activation-timer**
  - — **multi-chassis**
    - — [**no**] **peer** *ip-address*
      - — **authentication-key** [*authentication-key* | *hash-key*] [**hash** | **hash2**]
      - — **no authentication-key**
      - — **description** *description-string*
      - — **no description**
      - — [**no**] **mc-endpoint**
        - — [**no**] **bfd-enable**
        - — **boot-timer** *interval*
        - — **no boot-timer**
        - — **hold-on-neighbor-failure** *multiplier*
        - — **no hold-on-neighbor-failure**
        - — **keep-alive-interval** *interval*
        - — **no keep-alive-interval**
        - — [**no**] **passive-mode**
        - — [**no**] **shutdown**
        - — **system-priority** *value*
        - — **no system-priority**
      - — [**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** *remote-lag-id*] **system-priority** *system-priority* **source-bmac-lsb** *use-lacp-key*
        - — **lag** *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *remote-lag-id*] **system-priority** *system-priority* **source-bmac-lsb** *MAC-Lsb*
        - — **lag** *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *remote-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

- — **aps** [**port** *port-id*] [**group** *group-name*] [**detail**]
- — **chassis** [**environment**] [**power-supply**]
- — **card** [*slot-number*] [**detail**]
- — **card state**
- — **elmi**
  - — **evc** [*port-id* [**vlan** *vlan-id*]]
  - — **uni** [*port-id*]
- — **eth-tunnel**
- — **interface-group-handler** [*igh-id*]
- — **mcm** *slot* [*/mcm*] [**detail**]
- — **mda** *slot* [*/mda*] [**detail**]
- — **pools** *mda-id*[*/port*] [*access-app* [*pool-name* | **service** *service-id*]]
- — **pools** *mda-id*[*/port*] [*access-app* [*pool-name* | **service** *service-id* | **queue-group** *queue-group-name*]]
- — **pools** *mda-id*[*/port*] [**network-app** [*pool-name* | **queue-group** *queue-group-name*]]
- — **pools** *mda-id*[*/port*] [**direction** [*pool-name*|**service** *service-id* | **queue-group** *queue-group-name*]]
- — **lag** [*lag-id*] [**detail**] [**statistics**]
- — **lag** *lag-id* **associations**
- — **megapools** *slot-number*
- — **megapools** *slot-number* **fp** *forwarding-plane* [**service-id** *service-id*] [**queue-group** *queue-group-name*] [**ingress** | **egress**]
- — **multilink-bundle** [*bundle-id* | *bpgrp-id* | *slot/mda* | **type** {**mlppp** | **ima-grp** | **mlfr** }][**detail**]
- — **multilink-bundle** [*bundle-id* | *bpgrp-id* | *slot/mda*] [**ppp** | **ima** | **mlfr**]
- — **multilink-bundle** [*bundle-id* | *bpgrp-id*] **relations**
- — **multilink-bundle** *bundle-id* **mlfr** [**frame-relay** [**detail**]]
  - — **ima**
    - — **atm** [**detail**]
      - — **connections**
      - — **port-connection** [**detail**]
      - — **pvc** [**detail**]
      - — **pvp** [*vpi*] [**detail**]
      - — **pvt** [*vpi.vci*] [**detail**]
  - — **ppp** [**multiclass**]
  - — **relations**
- — **port** *port-id* [**count**] [**detail**]
- — **port** *port-id* **description**
- — **port** *port-id* **associations**
- — **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** *port-id* **cisco-hdlc** [**detail**]
- — **port** *port-id* **mlfr-link**[**detail**]
- — **port port** *port-id* **otu** [**detail**]
- — **port** *port-id* **ppp** [**detail**]
- — **port** *port-id* **frame-relay** [**detail**]
- — **port** *port-id* **queue-group** [**ingress**|**egress**] [**queue-group-name**] [**access**|**network**] [{**statistic**|**associations**}]
- — **port** *port-id* **dot1x** [**detail**]
- — **port** *port-id* **ethernet** [**efm-oam** | **detail**]

— **lldp** [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**]
— **port aps** [**detail**]
— **port cem**
— **port** *port-id* **ima-link**
— **port** *port-id* **ima-link**
— **port-tree** *port-id*
— **redundancy**
  — **multi-chassis all**
  — **multi-chassis mc-lag**
  — **multi-chassis sync**
    — **mc-lag peer** *ip-address* [**lag** *lag-id*]
    — **mc-lag** [**peer** *ip-address* [**lag** *lag-id*]] **statistics**
    — **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**
— **system**
  — **switch-fabric high-bandwidth-multicast**

Monitor Commands

For more information about monitor commands, refer to the 7750 SR OS Basic System Configuration Guide for command usage and CLI syntax.

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

Clear Commands

clear
- — **card** *slot-number* **soft**
- — **lag** *lag-id* **statistics**
- — **mda** *mda-id* [**statistics**]
- — **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**
- — **port** *port-id* **queue-group** *queue-group-name* [**access** | **network**] {**ingress** | **egress**} [**access**|**network**] [{**statistics**|**associations**}]

Debug Commands

debug
- — **atm**
- — **cisco-hdlc** *port-id*
- — **frame-relay**
  - — **lmi** [*port-id*]
  - — [**no**] **frf16** *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**
  - — **aps** *aps-id* [**clear**]
  - — **aps mc-aps-signaling** [**clear**]
  - — **aps mc-aps-ppp** [**clear**]
  - — **eth-tunnel** *tunnel-index* [**clear**]
  - — **frame-relay** *port-id*

— **lag lag-id lag-id**
— **map-to-phy-port** {**ccag** *ccag-id* **|** **lag** *lag-id* **|** **eth-tunnel** *tunnel-index*} {**isid** *isid* **[end-isid** *isid*] **|** **service** *service-id* | *svc-name* [**end-service** *service-id* | *svc-name*]} [**summary**]
— **lag** *port-id*
— **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**}]

tools
— **perform**
  — **aps**
    — **clear** *aps-id* {**protect** | **working**}
    — **exercise** *aps-id* {**protect** | **working**}
    — **force** *aps-id* {**protect** | **working**}
    — **lockout** *aps-id*
    — **request** *aps-id* {**protect** | **working**}
  — **ima**
    — **reset** *bundle-id*

Configuration Commands

Generic Commands

description

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

Context config>port
config>port>ethernet>access>egr>vport
config>port>ethernet>access>egr>qgrp
config>port>ethernet>access>ing>qgrp
config>port>ethernet>network>egr>qgrp
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>interface-group-handler
config>port
config>port>ethernet
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>multilink-bundle>ima>test-pattern-procedure
config>port>sonet-sdh>path>atm>ilmi
config>lag
config>port>ethernet>efm-oam
config>redundancy>multi-chassis>peer
config>redundancy>mc>peer>mcr
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**.

interface group handler (IGH) — The default state for an IGH is **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), 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.

SR-1: *slot-number* = 1
SR-7: *slot-number* = 1 — 5
SR-12: *slot-number* = 1 — 10

capability

Syntax **capability** {**sr | ess**} [**now**]

Context config>card

Description This command sets the desired capability for the associated slot and card.

By default, the capability will be set to that of the base chassis type. To set this to a non-default value, the **mixed-mode** command must be enabled at the system level.

Changing the capability of a slot or card will result in the associated slot being reset. The card-type must first be configured before the capability command can be issued.

Default **capability ess** on a 7450 chassis

Parameters **now —** This optional keyword can be added to the interactive command to force the command to be executed immediately without further question. If this keyword is not present, then the user will be presented with a question to ensure they understand that as a result of this command, the associated slots will be reset immediately to enable **mixed-mode**.

card-type

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

Context config>card

Description This mandatory command adds an IOM 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.

Because the IOM-3 integrated card does not have the capability in install separate MDAs, the configuration of the MDA is automatic. This configuration only includes the default parameters such as default buffer policies. Commands to manage the MDA such as **shutdown**, named buffer pool etc will remain in the MDA configuration context.

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-20g, iom2-20g, iom-20g-b, iom3-20g, iom3-40g, iom3-xp, imm48-1gb-sfp, imm48-1gb-tx, imm4-10gb-xfp, imm5-10gb-xfp, imm8-10gb-xfp, imm12-10gb-SF+, imm1-40gb-cfp, imm1-oc768-tun, imm1-100g-cfp, iom3-xp

named-pool-mode

Syntax [**no**] **named-pool-mode**

Context config>card

Description This command places an IOM in the named pool mode. When in named pool mode, the system will change the way default pools are created and allow for the creation of MDA and port level named buffer pools. When not enabled, the system will create default ingress and egress pools per port. When enabled, the system will not create per port pools, instead a default network and access pool is created for ingress and egress and is shared by queues on all ports.

The named pool mode may be enabled and disabled at anytime. Care should be taken when changing the pool mode for an IOM as the process of changing to or from named pool mode causes an IOM reset if MDAs are currently provisioned on the slot. If MDAs have not been provisioned at the time the named-pool-mode or no named-pool-mode command is executed, the IOM is not reset (for example, when the system is booting, the named pool mode command does not reset the IOM since the mode is set prior to provisioning the IOM's MDAs).

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

The **no** form of the command converts the pool mode on the IOM card to the default mode. If MDAs are currently provisioned on the IOM, the card is reset.

named-pool-mode

Syntax **named-pool-mode**

Context config>card>mda
config>port

Description The named-pool-mode CLI context is used to store the MDA and port level named pool mode configuration commands. Currently, only the ingress and egress named-pool-policy commands are supported. Any future named pool mode configuration commands or overrides will be placed in the named-pool-mode CLI context. Within the context is an ingress and egress context.

Enter the named-pool-mode to define the ingress and egress named pool policy associations for either an MDA or port. The node may be entered regardless of the current named-pool-mode state of the IOM.

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, mcm-v2

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. Slots are numbered 1 and 2. On vertically oriented slots, the top MDA slot is number 1, and the bottom MDA slot is number 2. On horizontally oriented slots, the left MDA is number 1, and the right MDA slot is number 2. For 7750 SR-c12/4 systems, MDAs may not be provisioned before MCMs are configured for the same slot. MCMs are not required for CMA provisioning.

Values 1, 2

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 type to the device configuration for the slot. The MDA can be preprovisioned but an MDA must be provisioned before ports can be configured. Ports can be configured once the MDA is properly provisioned.

A maximum of two MDAs can be provisioned on an IOM. Only one MDA can be provisioned per IOM MDA slot. To modify an MDA slot, shut down all port associations.

A maximum of six MDAs or eight CMAs (or a combination) can be provisioned on a 7750 SR-c12. 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 MDA can only be provisioned in a slot if the MDA type is allowed in the MDA slot. An error message is generated when an MDA is provisioned in a slot where it is not allowed.

A medium severity alarm is generated if an MDA is inserted that does not match the MDA type configured for the slot. This alarm is cleared when the correct MDA is inserted or the configuration is modified.

A high severity alarm is raised when an administratively enabled MDA is removed from the chassis. This alarm is cleared if the either the correct MDA type is inserted or the configuration is modified. A low severity trap is issued if an MDA is removed that is administratively disabled.

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

All parameters in the MDA context remain and if non-default values are required then their configuration remains as it is on all existing MDAs.

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

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

Parameters *mda-type* — The type of MDA 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, m4-choc3-ces-sfp, m1-choc3-ces-sfp, m4-10gb-xp-xfp, m2-10gb-xp-xfp, m1-10gb-xp-xfp, m10-1gb-xp-sfp, m20-1gb-xp-sfp, m20-1gb-xp-tx, m1-choc12-ces-sfp, imm24-1gb-xp-sfp, imm24-1gb-xp-tx, imm5-10gb-xp-xfp, imm4-10gb-xp-xfp, imm2-10gb-xp-xfp, imm12-10gb-xp-SF+, imm1-oc768-xp-tun, imm1-100gb-xp-cfp, isa-video, m1-10gb-dwdm-tun

7750 SR-c12/4: 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, m4-choc3-ces-sfp, m10-1gb-xp-sfp, m20-1gb-xp-sfp, m20-1gb-xp-tx

ingress

Syntax **ingress**

Context config>card>mda>named-pool-mode
config>port>named-pool-mode

Description The ingress node within the named-pool-mode context is used to contain the ingress named-pool-policy configuration. Enter the ingress node when defining or removing the MDA or port level ingress named pool policy.

egress

Syntax **egress**

Context config>card>mda>named-pool-mode
config>port>named-pool-mode

Description The egress node within the named-pool-mode context is used to contain the egress named-pool-policy configuration. Enter the egress node when defining or removing the MDA or port level egress named pool policy.

named-pool-policy

Syntax **named-pool-policy** *policy-name*
no named-pool-policy

Context config>card>mda>named-pool-mode>ingress
config>card>mda>named-pool-mode>egress
config>port>named-pool-mode>ingress
config>port>named-pool-mode>egress

Description The named-pool-policy command is used to associate a named pool policy with an MDA or port ingress or egress context. The policy governs the way that named pools are created at the MDA or port level. The policy may be applied regardless of whether the IOM is in named pool mode; however, a named pool policy to an MDA or port to a card that is not on named pool mode will be ignored. Pools may not be created due to insufficient resources or pool name collisions. Pool name collisions are allowed. The name check is performed independently between ingress and egress. A port on ingress may have a named pool defined that is also on the egress side at the MDA level. Multiple ports on the same MDA may have the same policy or the same named pools defined. Ports on the same MDA may also have different named pool policies defined.

Parameters *policy-name* — The defined policy-name must be an existing named pool policy on the system. If policy-name does not exist, the named-pool-policy command will fail. If another named pool policy is currently associated, it will continue to be associated on the MDA or port. If the policy-name does exist, the pools within the current policy (if a policy is currently associated) will be removed and the pools defined within the new policy will be created. Queues on the port or MDA will be moved to the new pools. If a pool being used by a queue existed on the previous policy, but not in the new policy, the queue is moved to the appropriate default pool and marked as ‘pool-orphaned’. The policy-name may be changed at any time.

Values Any existing Named Pool Policy

Default None

The **no** named-pool-policy command removes any existing policy associated with the MDA or port.

hi-bw-mcast-src

Syntax **hi-bw-mcast-src** [**alarm**] [**group** *group-id*]
no hi-bw-mcast-src

Context config>card>mda

Description This command designates the MDA as a high-bandwidth IP multicast source, expecting the ingress traffic to include high-bandwidth IP multicast traffic. When configured, the system attempts to allocate a dedicated multicast switch fabric plane (MSFP) to the MDA. If a group is specified, all MDAs in the group will share the same MSFP. If the alarm parameter is specified and the system cannot allocate a dedicated MSFP to the new group or MDA, the MDAs will be brought online and generate an event (SYSTEM: 2052 - mdaHiBwMulticastAlarm). Similarly, if during normal operation there is a failure or removal of resources, an event will be generated if the system cannot maintain separation of MSFPs for the MDAs.

This feature is supported on the 7750 SR-7 and 7750 SR-12.

The **no** form of the command removes the high-bandwidth IP multicast source designation from the MDA.

Default no hi-bw-mcast-src

Parameters **alarm —** Enables event generation if the MDA is required to share an MSFP with another MDA that is in a different group. MDAs within the same group sharing an MSFP will not cause this alarm.

group *group-id* **—** Specifies the logical MSFP group for the MDA. MDAs configured with the same *group-id* will be placed on the same MSFP.

Values 0 — 32 (A value of 0 removes the MDA from the group.)

Default By default, “none” is used, and the system will attempt to assign a unique MSFP to the MDA.

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.

hsmda-pool-policy

Syntax **hsmda-pool-policy** *policy-name*
no hsmda-pool-policy

Context config>card>mda>egress
config>card>mda>ingress

This command specifies an HSMDA buffer pool policy. The policy may be assigned to an ingress or egress HSMDA. The policy contains the needed commands to provision the behavior for the class and root buffer pools on an HSDMA. The policy may be applied using the hsmda-pool-policy command within the config card slot-id mda mda-number ingress or config card slot-id mda mda-number egress contexts. When applied at ingress, the policy manages the ingress HSMDA buffer pools. The egress context manages the egress HSMDA buffer pools.

hsmda-scheduler-overrides

Syntax [**no**] **hsmda-scheduler-overrides**

Context config>card>mda>ingress

Description This command enables the context to configure ingress HSMDA scheduler policy overrides.

The **no** form of the command returns the default values.

Default none

max-rate

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

Context config>card>mda>ingress>hsmda-scheduler-override

Description This command configures the explicit maximum frame-based bandwidth limit. This object overrides values specified in the **config>qos>hsmda-scheduler-policy>max-rate** context.

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

scheduling-class

Syntax **scheduling-class** *class* **rate** *rate*
scheduling-class *class* **weight** *weight-in-group*
no scheduling-class *class*

Context config>card>mda>ingress>hsmda-scheduler-override

Description This command configures scheduling class override parameters.

Parameters *class* — Identifies the scheduling class to be being overridden.

Values 1 — 8

rate *rate* **—** Overrides the HSMDA scheduler policies maximum rate for the scheduling class and requires either the **max** keyword or a rate defined in megabits-per-second. In order for the **rate** keyword to be specified, the scheduling class cannot be a member of a weighted scheduling group as defined on the HSMDA scheduling policy. The **rate** keyword is mutually exclusive with the **weight** keyword. Also, either the **rate** or **weight** keyword must be specified.

The **max** keyword removes any existing rate limit imposed by the HSMDA scheduler policy for the scheduling class allowing it to use as much total bandwidth as possible.

Values 1 — 40000, max (Mbps)

weight *weight-in-group* **—** Overrides the weighted scheduler group weight for the scheduling class as defined in the HSMDA scheduler policy. In order for a weight keyword to be specified, the scheduling class must be a member of a weighted scheduling group as defined on the HSMDA scheduling policy. A value represented by group-weight must follow the **weight** keyword. The new weight will be used to determine the bandwidth distribution for member scheduling classes within the group of which the scheduling class is a member.

Values 1 — 100

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 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.

sync-e

Syntax [**no**] **sync-e**

Context config>card>mda

Description This command enables synchronous Ethernet on the MDA. Then any port on the MDA can be used as a source port in the sync-if-timing configuration.

The **no** form of the command disables synchronous Ethernet on the 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.

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.

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

egress

Syntax **egress**

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

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.

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

pool

Syntax [**no**] **pool** [*name*]

Context config>card>mda>access>egress
config>card>mda>access>ingress
config>card>mda>network>egress
config>port>access>egress
config>port>access>ingress
config>port>network>egress
config>port>network>ingress
config>port>access>uplink>egress

Description This command configures pool policies.

On the MDA level, access and network egress and access ingress pools are only allocated on channelized MDAs. On the MDA level, access and network egress and access ingress pools are only allocated on channelized MDAs. Network ingress pools are allocated on the MDA level for non-channelized MDAs.

Default default

Parameters *name* — Specifies the pool name, a string up to 32 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.

resv-cbs

Syntax **resv-cbs** *percent-or-default*
no resv-cbs

Context config>port>access>egress>pool
config>port>ethernet>network
config>card>mda>access>egress
config>card>mda>access>ingress
config>card>mda>network>egress
config>card>mda>network>ingress
config>port>access>egress>channel>pool
config>port>access>ingress>pool
config>port>network>egress>pool

Description This command defines the percentage or specifies the sum of the pool buffers that are used as a guideline for CBS calculations for access and network ingress and egress queues. Two actions are accomplished by this command.

- A reference point is established to compare the currently assigned (provisioned) total CBS with the amount the buffer pool considers to be reserved. Based on the percentage of the pool reserved that has been provisioned, the over provisioning factor can be calculated.
- The size of the shared portion of the buffer pool is indirectly established. The shared size is important to the calculation of the instantaneous-shared-buffer-utilization and the average-shared-buffer-utilization variables used in Random Early Detection (RED) per packet slope plotting.

It is important to note that this command does not actually set aside buffers within the buffer pool for CBS reservation. The CBS value per queue only determines the point at which enqueuing packets are subject to a RED slope. Oversubscription of CBS could result in a queue operating within its CBS size and still not able to enqueue a packet due to unavailable buffers. The resv-cbs parameter can be changed at any time.

If the total pool size is 10 MB and the resv-cbs set to 5, the ’reserved size’ is 500 KB.

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

Default default (30%)

Parameters *percent-or-default* — Specifies the pool buffer size percentage.

Values 0 — 100, default

slope-policy

Syntax **slope-policy** *name*
no slope-policy

Context config>port>access>egress>pool
config>card>mda>access>egress
config>card>mda>access>ingress
config>card>mda>network>egress
config>card>mda>network>ingress
config>port>access>egress>channel>pool
config>port>access>ingress>pool
config>port>network>egress>pool

Description This command specifies an existing slope policy which defines high and low priority RED slope parameters and the time average factor. The policy is defined in the **config>qos>slope-policy** context.

General Port Commands

port

Syntax **port** {*port-id* **|** *bundle-id* **|** *bpgrp-id* **|** *aps-id*}
no port {*bundle-id* **|** *bpgrp-id* **|** *aps-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-ima-*slot/mda.bundle-num* (Creates an IMA bundle.)
bundle-fr-*slot/mda.bundle-num* (Creates an MLFR bundle.)
bundle: keyword
slot: IOM/MDA slot numbers
bundle-num: 1 — 336

For example:
router1>config# port bundle-ppp-5/1.1 (multilink PPP bundle)
router1>config# port bundle-ima-5/1.2 (IMA 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 **4/5/6** sonet-sdh report-alarm lb2er-sd

For example:

```
A:ALA-48>config>port>aps# info
----------------------------------------------
            working-circuit 1/2/3
            protect-circuit 4/5/6
----------------------------------------------
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 — 64

Example: **port aps**-64

bpgrp-id — Creates a bundle protection group (BPG). The BPGrp consists of a working and protection bundles that provide APS protection to each other using bi-directional APS as supported on the 7750 SR-Series family of products. All members of a working/protection bundle must be on the same working/protection circuit respectively of the same, already provisioned APS group.
The working bundle must have already been created in the **config>port** context before services can be created on a BPGrp.

Syntax: **bpgrp**-*type*-*bpgrp-num*

bpgrp:	keyword	
type:	**ppp** — Provides protection of one PPP bundle by another.	
	ima —	Provides protection of one IMA bundle by another IMA bundle.
bpg-num:	1 — 1600	

Example: **port bpgrp-ima**-29

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

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.

dwdm

Syntax **dwdm**

Context config>port

Description This command configures the Dense Wavelength Division Multiplexing (DWDM) parameters.

channel

Syntax **channel** *channel*

Context config>port>dwdm

Description

- This command configures the Dense Wavelength Division Multiplexing (DWDM) ITU channel at which a tunable MDA optical interface will be configured to operate. It is expressed in a form that is derived from the laser's operational frequency. For example 193.40 THz corresponds to DWDM ITU channel 34 in the 100 GHz grid and 193.45 THz corresponds to DWDM ITU channel 345 in the 50 GHz grid.Provisioning rules:The provisioned MDA type must have DWDM tunable optics (m1-10gb-dwdm-tun)
- The 'dwdm channel' must set to a non zero value before the port is set to 'no shutdown'
- The port must be 'shutdown' before changing the dwdm channel.
- The port must be a physical port to set the dwdm channel

Parameters *channel* — Specifies the channel.

Values 0, 17-61, 175-605]
where: 17-61 is used for 100GHz channels
175, 185 — 605 is used for 50GHz channels
0 only valid on disabled (shutdown) ports

The DWDM channel number range is listed in the following table.

Table 29: DWDM Channel Numbers

C-Band

100 GHz Grid			50GHz Grid		
nm	**THz**	**ITU Channel**	**nm**	**THz**	**ITU Channel**
1528.77	196.10	61	1529.16	196.05	605
1529.55	196.00	60	1529.94	195.95	595
1530.33	195.90	59	1530.72	195.85	585
1531.12	195.80	58	1531.51	195.75	575
1531.90	195.70	57	1532.29	195.65	565
1532.68	195.60	56	1533.07	195.55	555
1533.47	195.50	55	1533.86	195.45	545
1534.25	195.40	54	1534.64	195.35	535
1535.04	195.30	53	1535.43	195.25	525
1535.82	195.20	52	1536.22	195.15	515
1536.61	195.10	51	1537.00	195.05	505
1537.40	195.00	50	1537.79	194.95	495

Table 29: DWDM Channel Numbers (Continued)

C-Band					
100 GHz Grid			50GHz Grid		
nm	THz	ITU Channel	nm	THz	ITU Channel
1538.19	194.90	49	1538.58	194.85	485
1538.98	194.80	48	1539.37	194.75	475
1539.77	194.70	47	1540.16	194.65	465
1540.56	194.60	46	1540.95	194.55	455
1541.35	194.50	45	1541.75	194.45	445
1542.14	194.40	44	1542.54	194.35	435
1542.94	194.30	43	1543.33	194.25	425
1543.73	194.20	42	1544.13	194.15	415
1544.53	194.10	41	1544.92	194.05	405
1545.32	194.00	40	1545.72	193.95	395
1546.12	193.90	39	1546.52	193.85	385
1546.92	193.80	38	1547.32	193.75	375
1547.72	193.70	37	1548.11	193.65	365
1548.51	193.60	36	1548.91	193.55	355
1549.32	193.50	35	1549.72	193.45	345
1550.12	193.40	34	1550.52	193.35	335
1550.92	193.30	33	1551.32	193.25	325
1551.72	193.20	32	1552.12	193.15	315
1552.52	193.10	31	1552.93	193.05	305
1553.33	193.00	30	1553.73	192.95	295
1554.13	192.90	29	1554.54	192.85	285
1554.94	192.80	28	1555.34	192.75	275
1555.75	192.70	27	1556.15	192.65	265
1556.55	192.60	26	1556.96	192.55	255
1557.36	192.50	25	1557.77	192.45	245
1558.17	192.40	24	1558.58	192.35	235
1558.98	192.30	23	1559.39	192.25	225
1559.79	192.20	22	1560.20	192.15	215
1560.61	192.10	21	1561.01	192.05	205
1561.42	192.00	20	1561.83	191.95	195

Table 29: DWDM Channel Numbers (Continued)

C-Band					
100 GHz Grid			50GHz Grid		
nm	THz	ITU Channel	nm	THz	ITU Channel
1562.23	191.90	19	1562.64	191.85	185
1563.05	191.80	18	1563.45	191.75	175
1563.86	191.70	17			

wavetracker

Syntax **wavetracker**

Context config>port>dwdm

Description This command validates whether or not the port supports Wavetracker.

Default None

power-control

Syntax [**no**] **power-control**

Context config>port>dwdm>wavetracker>power-control

Description This command specifies whether the power control loop should be turned on to actively control the laser's launch power to the specified target power. When power-control is disabled, the launch power is set to the laser's maximum achievable power.

Default no power-control

Parameters *no power-control* — Laser output power is set to maximum.

power-control — Actively control the laser's output power to achieve the target power.

target-power

Syntax **target-power** *dBm*

Context config>port>dwdm>wavetracker>power-control

Description This command specifies launch power in dBm for the DWDM Wavetracker-enabled interface.

Default -20.00 dBm

Parameters *power* — Specify the desired average output power in dBm.

Values -22.00 — 3.00

report-alarm

Syntax [**no**] **report-alarm** [**encode-fail**] [**encode-degrade**] [**power-fail**] [**power-degrade**] [**power-high**] [**power-low**]

The no form of the command removes the alarm parameters.

Context config>port>dwdm>wavetracker>

Description This command specifies the alarms which are enabled or outstanding against a Wave Tracker-enabled interface.

Values
encode-fail — Encoder failure
encode-degrade — Encoder degrade
power-fail — Power control failure
power-degrade — Power control degrade
power-high — Power control high limit reached
power-low — Power control low limit reached

encode

Syntax **encode** *wave-key* **key2** *wave-key*
no encode

Context config>port>dwdm>wavetracker

Description This command specifies whether or not Wavetracker keys should be encoded on the transmitted optical signal.

Default no encode

Parameters ***wave-key*** — The *wave-key* values must be selected based on the currently configured DWDM ITU channel. Both keys must be odd or both keys must be even. One even key and one odd key cannot be configured. The ranges of values for each key are defined in the table below:

DWDM ITU Channel Number	Key 1 Minimum	Key 1 Maximum	Key 2 Minimum	Key 2 Maximum
17	1276	1290	1760	1774
18	1259	1273	1743	1757
19	1242	1256	1726	1740
20	1225	1239	1709	1723
21	528	542	1072	1086
22	511	525	1055	1069
23	494	508	1038	1052
24	477	491	1021	1035
25	1208	1222	1692	1706
26	460	474	1004	1018
27	443	457	987	1001
28	426	440	970	984
29	409	423	953	967
30	1191	1205	1675	1689
31	392	406	936	950
32	375	389	919	933
33	358	372	902	916
34	341	355	885	899
35	1174	1188	1658	1672
36	324	338	868	882
37	307	321	851	865
38	290	304	834	848
39	273	287	817	831
40	1157	1171	1641	1655
41	256	270	800	814
42	239	253	783	797
43	222	236	766	780
44	205	219	749	763
45	1140	1154	1624	1638
46	188	202	732	746

DWDM ITU Channel Number	Key 1 Minimum	Key 1 Maximum	Key 2 Minimum	Key 2 Maximum
17	1276	1290	1760	1774
18	1259	1273	1743	1757
47	171	185	715	729
48	154	168	698	712
49	137	151	681	698
50	1123	1137	1607	1621
51	120	134	664	678
52	103	117	647	661
53	86	100	630	644
54	69	83	613	627
55	1106	1120	1590	1604
56	52	66	596	610
57	35	49	579	593
58	18	32	562	576
59	1	15	545	559
60	1089	1103	1573	1587
61	1548	1548	2032	2032
175	3553	3567	4065	4079
185	3536	3550	4048	4062
195	3519	3533	4031	4045
205	3502	3516	4014	4028
215	3840	3854	2304	2318
225	3823	3837	2287	2301
235	3806	3820	2270	2284
245	3789	3803	2253	2267
255	3485	3499	3997	4011
265	3772	3786	2236	2250
275	3755	3769	2219	2233
285	3738	3752	2202	2216
295	3721	3735	2185	2199
305	3468	3482	3980	3994
315	3704	3718	2168	2182
325	3687	3701	2151	2165

DWDM ITU Channel Number	Key 1 Minimum	Key 1 Maximum	Key 2 Minimum	Key 2 Maximum
17	1276	1290	1760	1774
18	1259	1273	1743	1757
335	3670	3684	2134	2148
345	3653	3667	2117	2131
355	3451	3465	3963	3977
365	3636	3650	2100	2114
375	3619	3633	2083	2097
385	3602	3616	2066	2080
395	3585	3599	2049	2063
405	3434	3448	3946	3960
415	1548	1562	2032	2046
425	1531	1545	2015	2029
435	1514	1528	1998	2012
445	1497	1511	1981	1995
455	3908	3922	2372	2386
465	1480	1494	1964	1978
475	1463	1477	1947	1961
485	1446	1460	1930	1944
495	1429	1443	1913	1927
505	3891	3905	2355	2369
515	1412	1426	1896	1910
525	1395	1409	1879	1893
535	1378	1392	1862	1876
545	1361	1375	1845	1859
555	3874	3888	2338	2352
565	1344	1358	1828	1842
575	1327	1341	1811	1825
585	1310	1324	1794	1808
595	1293	1307	1777	1791
605	3857	3871	2321	2335

rxdtv-adjust

Syntax [**no**] **rxdtv-adjust**

Context config>port>dwdm

Description This command enables you to adjust the optical receive decision threshold voltage (RxDTV).

Default no rxdtv-adjust

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, you can change certain SONET/SDH parameters to reflect the SONET/SDH requirements for this port. When you configure a port for LAN mode, all SONET/SDH parameters are 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.

otu

Syntax [**no**] **otu**

Context config>port

Description This command specifies whether or not to enable the OTU encapsulation type (encapsulated 10GE-LAN/WAN or OC192). The port must be shut down before OTU is enabled.

The no form of this command disables OTU (clear channel 10GE-LAN/WAN or OC192).

Default no otu

fec

Syntax [**no**] **fec** {**enhanced | g709**}

Context config>port>otu>fec

Description This command enables the Forwarding Error Correction (FEC) encoder/decoder and specifies the FEC encoder/decoder mode to use when enabled.

The following rules must be followed:

- The port's OTU must be enabled to set or change the FEC mode.
- The port must be shut down before changing the FEC mode.
- The sf-sd-method must be changed to BIP8 before setting the FEC mode to disabled.

The **no** form of the command disables FEC encoder and decoder.

Default no fec

Parameters **enhanced** — Enables the FEC encoder and decoder with a proprietary enhanced FEC algorithm.

g709 — Enables the FEC encoder and decoder with the standard G.709 FEC algorithm.

otu2-lan-data-rate

Syntax **otu2-lan-data-rate** {**11.049** | **11.0957**}

Context config>port>otu

Description This command specifies the data rate to use when configured for an OTU encapsulated 10GE-LAN signal. The port must be shut down before changing the 10GE LAN OTU2 data rate.

Default 11.049

Parameters **11.049** — Configures the port to transmit and receive an 11.049 Gb/s synchronous OTU encapsulated 10GE-LAN signal (No fixed stuffing bytes in the OTU2 frame).

11.0957 — Configures the port to transmit and receive an 11.0957 Gb/s synchronous OTU encapsulated 10GE-LAN signal (with fixed stuffing bytes in the OTU2 frame).

sf-sd-method

Syntax **sf-sd-method** {**bip8** | **fec**}

Context config>port>otu>sf-sd-method

Description This command specifies the method used to determine the signal fail and signal degrade alarms. When select the bip8 method is selected, the SM-BIP8 errors are used. When the FEC method is selected, the FEC corrected bits are used.

The following rules must be followed:

- The port's OTU must be enabled to set or change the sf-sd-method.
- The FEC mode must be enhanced or g709 before setting the sf-sd-method to fec.
- The SF threshold must be 5 or higher before setting the sf-sd-method to bip8.

Default fec

Parameters **bip8** — The SM-BIP8 errors are used to declare the presence of the Signal Fail and Signal Degrade condition.

fec — The FEC corrected bit errors are used to declare the presence of the Signal Fail and Signal Degrade condition.

sf-threshold

Syntax **sf-threshold** *threshold*

Context config>port>otu>sf-threshold

Description This command specifies the error rate at which to declare the signal fail condition for the the signal fail (SF) threshold. The value represents an error rate of 10E-<value>.

The SF threshold must:

- Be less than the SD threshold.
- Be 5 or higher before setting the sf-sd-method to bip8.

Default 4

Parameters *threshold* — Specifies the signal fail (SF) threshold.

Values 3 —7

sd-threshold

Syntax **sd-threshold** *threshold*

Context config>port>otu>sd-threshold

Description This command specifies the error rate at which to declare the signal fail condition for the signal degrade (SD). The value represents an error rate of 10E-*value*.

The SD threshold must::

- Be greater than the SF threshold.
- Be 5 or higher before setting the sf-sd-method to bip8.

Default 7

Parameters *threshold* — Specifies the exponent of the error rate, thus an error rate from 10E-3 to 10E-7.

Values 5 — 9

sm-tti

Syntax **sm-tti**

Context config>port>otu

Description This command enables the context to configure section monitoring trail trace identifier parameters.

expected

Syntax **expected** {**string** *string* | **bytes** *byte-sequence* | **auto-generated** | **use-rx**}

Context config>port>otu>sm-tti

Description This command enables the user to configure the expected RX Trail Trace Identifier (TTI) for Section Monitoring (SM) in the OTU overhead. This identifier can be a string or a non-printable sequence of bytes. The length of the string or sequence of bytes cannot exceed 64 bytes. This trace should match the expected far-end port's SM trace. When this trace does not match the received SM trace, the OTU-TIM alarm will be reported if enabled.

Default Blank (all zeros)

Parameters **auto-generated —** Sets the default

string *string* — Sets the SM TTI to the string provided by the user. If the string is less than 64 bytes, the remaining bytes will be set to 0.

bytes — [byte1 byte2 ... byte64]. Sets the SM TTI to the sequence of bytes provided by the user. If the user provides less than 64 bytes, the remaining bytes will be set to 0.

use-rx — Copies the received sm-tti to the expected either as a string or a sequence of bytes depending on the received sm-tti data.

mismatch-reaction

Syntax **mismatch-reaction** {**none** | **squelch-rx**}

Context config>port>otu>sm-tti

Description This command allows the user to configure the consequent action to a sm-tti mismatch.

Default None

Parameters **none —** The received traffic is passed through.

squelch-rx — The received traffic is blocked.

pm-tti

Syntax **pm-tti**

Context config>port>otu

Description This command enables the context to configure path monitoring trail trace identifier parameters.

tx

Syntax **tx auto-generated**
tx *bytes bytes* [*bytes*...(up to 64 max)]
tx *string identifier*
tx auto-generated | string *identifier* **| bytes** *byte1* [*byte2*...(up to 64 bytes)]}
no tx

Context config>port>otu>pm-tti>tx

Description This command enables the user to configure the transmit (tx) trail trace identifier (TTI) for path monitoring (PM) in the ODU overhead. This identifier can be a string or a non-printable sequence of bytes. The length of the string or sequence of bytes cannot exceed 64 bytes.

The **no** form of the command reverts to the default TTI.

Default Auto-generated in the format of *nodename:iomnum/mdanum/portnum/dwdmchan*

The auto-generated value has five sections:

- Nodename — The first section is the name of the node.
- iomnum — The second section contains the IOM slot number.
- mdanum — The third section contains the MDA slot number.
- portnum — The fourth section contains the port number.
- dwdmchan — The fifth section contains the DWDM channel number (see Table 29, DWDM Channel Numbers, on page 280).

Parameters **auto-generated —** Specifies to use the system generated (default) TTI.

string *identifier* **—** Sets the PM TTI to the string provided by the user. If the string is less than 64 bytes, the remaining bytes will be set to 0.

bytes byte1 [byte2...(up to 64 bytes)] **—** Sets the PM TTI to the sequence of bytes provided by the user. If the user provides less than 64 bytes, the remaining bytes will be set to 0. A 1 byte sequence of 0xFF will set the default strings.

Values 0 — FF, in hexidecimal byte notation

tx

Syntax **tx** {**auto-generated | string** *identifier* **| bytes** *byte1* [*byte2*...(up to 64 bytes)]}
no tx

Context config>port>otu>sm-tti>tx

Description This command allows the user to configure the transmit (tx) trail trace identifier (TTI) for section monitoring (SM) in the OTU overhead. This identifier can be a string or a non-printable sequence of bytes. The length of the string or sequence of bytes cannot exceed 64 bytes.

The **no** form of the command reverts to the default TTI.

Default Auto-generated in the format of *nodename:iomnum/mdanum/portnum/dwdmchan*

The auto-generated value has five sections:

- Nodename — The first section is the name of the node.
- iomnum — The second section contains the IOM slot number.
- mdanum — The third section contains the MDA slot number.
- portnum — The fourth section contains the port number.
- dwdmchan — The fifth section contains the DWDM channel number (see Table 29, DWDM Channel Numbers, on page 280).

Parameters **auto-generated —** Specifies to use the system generated (default) TTI.

string *identifier* **—** Sets the SM TTI to the string provided by the user. If the string is less than 64 bytes, the remaining bytes will be set to 0.

bytesbyte1 [byte2...(up to 64 bytes)] **—** Sets the SM TTI to the sequence of bytes provided by the user. If the user provides less than 64 bytes, the remaining bytes will be set to 0. A 1 byte sequence of 0xFF will set the default strings.

Values 0 — FF, in hexidecimal byte notation

tx

Syntax **tx** {*value* | **auto**}

Context config>port>otu>psi-payload

Description This command allows the user to configure the transmit payload type value in byte 0 of the payload structure identifier (PSI) of the OPU overhead.

Default 3 for 10GE-LAN/WAN or OC192 with OTU encapsulation; 5 for GFP framed 10GE-LAN with OTU encapsulation.

Parameters **auto —** Transmits the standard value in the payload type field.

value — Non-standard payload type value to transmit in the payload type field.

expected

Syntax **expected auto-generated**
expected bytes *byte* [*byte*...(up to 64 max)]
expected string *identifier*
expected use-rx

Context config>port>otu>pm-tti

Description This command allows the user to configure the expected RX trail trace identifier (TTI) for path monitoring (PM) in the ODU overhead. This identifier can be a string or a non-printable sequence of bytes. The length of the string or sequence of bytes cannot exceed 64 bytes. This trace should match the far-end port's PM trace. When this trace does not match the received PM trace, the ODU-TIM alarm will be reported if enabled.

Default Blank (all zeros)

Parameters **auto-generated —** Sets the default

string *string* — Sets the PM TTI to the string provided by the user. If the string is less than 64 bytes, the remaining bytes will be set to 0.

bytes — [byte1 byte2 ... byte64]. Sets the PM TTI to the sequence of bytes provided by the user. If the user provides less than 64 bytes, the remaining bytes will be set to 0.

use-rx — Copies the received pm-tti to the expected either as a string or a sequence of bytes depending on the received pm-tti data.

mismatch-reaction

Syntax **mismatch-reaction** {**squelch-rx**}
no mismatch-reaction

Context config>port>otu>pm-tti

Description This command allows the user to configure the consequent action to a pm-tti mismatch.

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

Default none, the received traffic is passed through.

Parameters **squelch-rx** — The received traffic is blocked.

psi-tti

Syntax **psi-tti**

Context config>port>otu

Description This command enables the context to configure payload structure identifier trail trace identifier parameters.

tx

Syntax **tx** {**string** *identifier* | **bytes** *byte-sequence* | **auto-generated**}

Context config>port>otu>psi-trace

Description This command allows the user to configure the transmit trace in bytes 1 to 255 (skipping byte 0) of the payload structure identifier (PSI) of the OPU overhead. This identifier can be a string or a non-printable sequence of bytes. The length of the string or sequence of bytes cannot exceed 255 bytes.

Default Blank (all zeros)

Parameters **auto-generated —** Sets the default PSI trace

string *identifier* **—** Sets the PSI trace to the string provided by the user. If the string is less than 255 bytes, the remaining bytes will be set to 0.

bytes byte1 [byte2...(up to 64 bytes)] **—** Sets the PSI trace to the sequence of bytes provided by the user. If the user provides less than 64 bytes, the remaining bytes will be set to 0. A 1 byte sequence of 0xFF will set the default strings.

Values 0 — FF, in hexidecimal byte notation

expected

Syntax **expected** {**string** *string* **| bytes** *byte-sequence* **| auto-generated | use-rx**}

Context config>port>otu>pm-tti

Description This command allows the user to configure the expected RX in bytes 1 to 255 (skipping byte 0) of the Payload structure identifier (PSI) of the OPU overhead. This identifier can be a string or a non-printable sequence of bytes. The length of the string or sequence of bytes cannot exceed 255 bytes. This trace should match the far-end port's PSI trace. When this trace does not match the received PSI trace, the OPU-TIM alarm will be reported if enabled.

Default Blank (all zeros)

Parameters **auto-generated —** Sets the default

string *string* — Sets the PSI trace to the string provided by the user. If the string is less than 64 bytes, the remaining bytes will be set to 0.

bytes — [byte1 byte2 ... byte64]. Sets the PSI trace to the sequence of bytes provided by the user. If the user provides less than 64 bytes, the remaining bytes will be set to 0.

use-rx — Copies the received psi-tti to the expected either as a string or a sequence of bytes depending on the received psi-tti data.

mismatch-reaction

Syntax **mismatch-reaction** {**none | squelch-rx**}

Context config>port>otu>psi-tti

Description This command allows the user to configure the consequent action to a psi-tti mismatch.

Default None

Parameters **none —** The received traffic is passed through.

squelch-rx — The received traffic is blocked.

psi-payload

Syntax **psi-payload**

Context config>port>otu

Description This command enables the context to configure payload structure identifier payload parameters.

expected

Syntax **expected** {*value* | **auto**}

Context config>port>otu>psi-payload

Description This command allows the user to configure the expected received payload type value in byte 0 of the Payload structure identifier (PSI) of the OPU overhead. When this values does not match the received value, the OPU-PLM alarm will be reported if it is enabled.

Default 3 for 10GE-LAN/WAN or OC192 with OTU encapsulation; 5 for GFP framed 10GE-LAN with OTU encapsulation.

Parameters **auto —** Sets the expected value to the standard value in the payload type field.

value — Expect a non-standard payload type value in the rx payload type field.

mismatch-reaction

Syntax **mismatch-reaction** {**none** | **squelch-rx**}

Context config>port>otu>psi-payload

Description This command allows the user to configure the consequent action to a psi-payload type mismatch.

Default None

Parameters **none —** The received traffic is passed through.

squelch-rx — The received traffic is blocked.

async-mapping

Syntax [**no**] **async-mapping**

Context config>port>otu

Description This command allows the user to configure the port to support asynchronous mapping of the payload inside the OTU. If the port is configured for async-mapping and the payload clock is asynchronous to the OTU clock, there will be positive or negative pointer justification that will show up in the OTU statistics and the data will be received error free. If the port is configured for synchronous mapping and the received data is asynchronously mapped, there will be errors in the received data.

The **no** form of this command configures the port to receive synchronously mapped data.

Default no async-mapping

report-alarms

Syntax [**no**] **no report-alarms** [**loc**] [**los**] [**lof**] [**lom**] [**otu-ais**] [**otu-ber-sf**] [**otu-ber-sd**] [**otu-bdi**] [**otu-tim**] [**otu-iae**] [**otu-biae**] [**fec-sf**] [**fec-sd**] [**fec-fail**] [**fec-uncorr**] [**odu-ais**] [**odu-oci**] [**odu-lck**] [**odu-bdi**] [**odu-tim**] [**opu-tim**] [**opu-plm**]

Context config>port>otu

Description This command enables OTU alarms. Specify specific alarms to add to the list of reported alarms.

The **no** form of the command disables OTU alarm reporting.

Default loc, los, lof, lom, otu-ais, otu-bdi, fec-sf, fec-sd, odu-ais, odu-oci, odu-lck, odu-bdi, opu-plm

Parameters **alarms —** Refer to the following table for alarm descriptions.

Alarm	Description
loc	Loss of lock
los	Loss of signal transitions on the data
lof	Loss of OTU framing
lom	Loss of Multi-frame
otu-ais	OTU Alarm Indication Signal (all 1s, overwrites all OTU overhead, even framing bytes)
otu-ber-sf	SM Signal Fail (based on BPI8)
otu-ber-sd	SM Signal Degrade (based on BPI8)
otu-bdi	SM Backward defect indication
otu-tim	SM Trace Id Mismatch
otu-iae	SM Incoming Alignment Error
otu-biae	SM Backward Incoming Alignment Error
fec-sf	Signal Fail (based on FEC corrected bits)
fec-sd	Signal Degrade (based on FEC corrected bits)
fec-fail	FEC Mode mismatch (EFEC-GFEC) or High Uncorrectable rate (>10E-2)
fec-uncorr	One or More Uncorrectable FEC errors
odu-ais	ODU Alarm Indication Signal

Alarm	Description (Continued)
odu-oci	ODU Open connection Indication
odu-lck	ODU Locked
odu-bdi	PM Backward Defect indication
odu-tim	PM Trace Id Mismatch
opu-tim	OPU PSI Trace Mismatch
opu-plm	OPU PSI Payload Type Mismatch

hybrid-buffer-allocation

Syntax **hybrid-buffer-allocation**

Context config>port

Description This command enables the context for configuring hybrid port buffer allocation parameters.

ing-weight

Syntax **ing-weight access** *access-weight* **network** *network-weight*
no ing-weight

Context config>port>hybrid-buffer-allocation

Description This command configures the sharing of the ingress buffers allocated to a hybrid port among the access and network contexts. By default, it is split equally between network and access.

The **no** form of this command restores the default values for the ingress access and network weights.

Parameters *access-weight* — Specifies the access weight as an integer.

Values 0 to 100

Default 50

network-weight — Specifies the network weight as an integer.

Values 0 to 100

Default 50

egr-weight

Syntax **egr-weight access** *access-weight* **network** *network-weight*
no egr-weight

Context config>port>hybrid-buffer-allocation

Description This command configures the sharing of the egress buffers allocated to a hybrid port among the access and network contexts. By default, it is split equally between network and access.

The **no** form of this command restores the default values for the egress access and network weights.

Parameters *access-weight* — Specifies the access weight as an integer.

Values 0 to 100

Default 50

network-weight — Specifies the network weight as an integer.

Values 0 to 100

Default 50

modify-buffer-allocation-rate

Syntax **modify-buffer-allocation-rate**

Context config>port

Description This command enables the context to configure ingress and egress percentage of rate parameters. This command only applies to physical ports (for example, it will not work on APS or similar logical ports). The percentage of rate commands are used to define a percentage value that affects the amount of buffers used by ingress and egress port managed buffer space. Enter the modify-buffer-allocation-rate context when editing the port's percentage of rate commands.

ing-percentage-of-rate

Syntax **ing-percentage-of-rate** *rate-percentage*
no ing-percentage-of-rate

Context config>port>modify-buffer-allocation-rate

Description This command increases or decreases the active bandwidth associated with the ingress port that affects the amount of ingress buffer space managed by the port. Changing a port's active bandwidth using the ing-percentage-of-rate command is an effective means of artificially lowering the buffers managed by one ingress port and giving them to other ingress ports on the same MDA.

The ing-percentage-of-rate command accepts a percentage value that increases or decreases the active bandwidth based on the defined percentage. A value of 50% causes the active bandwidth to be reduced by 50%. A value of 150% causes the active bandwidth to be increased by 50%. Values from 1 to 1000 percent are supported.

A value of 100 (the default value) is equivalent to executing the no ing-percentage-of-rate command and restores the ingress active rate to the normal value.

Parameters *rate-percentage* — The rate-percentage parameter is required and defines the percentage value used to modify the current ingress active bandwidth of the port. This does not actually change the bandwidth available on the port in any way. The defined rate-percentage is multiplied by the ingress active bandwidth of the port. A value of 150 results in an increase of 50% (1.5 x Rate).

Values 1 to 1000

Default 100 (no change to active rate)

The **no** ing-percentage-of-rate command is used to remove any artificial increase or decrease of the ingress active bandwidth used for ingress buffer space allocation to the port. The no ing-percentage-of-rate command sets rate-percentage to 100%.

egr-percentage-of-rate

Syntax **egr-percentage-of-rate** *rate-percentage*
no egr-percentage-of-rate

Context config>port>modify-buffer-allocation-rate

Description The egr-percentage-of-rate command is used to increase or decrease the active bandwidth associated with the egress port that affects the amount of egress buffer space managed by the port. Changing a ports active bandwidth using the egr-percentage-of-rate command is an effective means of artificially lowering the buffers managed by one egress port and giving them to other egress ports on the same MDA.

The egr-percentage-of-rate command accepts a percentage value that increases or decreases the active bandwidth based on the defined percentage. A value of 50% causes the active bandwidth to be reduced by 50%. A value of 150% causes the active bandwidth to be increased by 50%. Values from 1 to 1000 percent are supported.

A value of 100 (the default value) is equivalent to executing the no egr-percentage-of-rate command and restores the egress active rate to the normal value.

Parameters *rate-percentage* — The rate-percentage parameter is required and defines the percentage value used to modify the current egress active bandwidth of the port. This does not actually change the bandwidth available on the port in any way. The defined rate-percentage is multiplied by the egress active bandwidth of the port. A value of 150 results in an increase of 50% (1.5 x Rate).

Values 1 to 1000

Default 100 (no change to active rate)

The **no** egr-percentage-of-rate command is used to remove any artificial increase or decrease of the egress active bandwidth used for egress buffer space allocation to the port. The no egr-percentage-of-rate command sets rate-percentage to 100%.

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 7750 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 command used to associate an egress scheduler policy on the port is overloaded for HSMDA. HSMDA policies should be associated with HSMDA ports.

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.

elmi

Syntax **elmi**

Context config>port>ethernet

Description This command configures Ethernet Local Management Interface (E-LMI)parameters for the Ethernet port. E-LMI is only supported on Ethernet access ports with Dot1q encapsulation type.

mode

Syntax **mode** {**none | uni-n**}

Context config>port>ethernet>elmi

Description This command configures the the Ethernet LMI mode.

Default none

Parameters **none —** Specifies that theE LMI mode is set to none.

uni-n — Specifies that theE LMI mode is set to uni-n.

n393

Syntax **n393** [2..10]
no n393

Context config>port>ethernet>elmi

Description This command configures the monitored count of consecutive errors.

Parameters **2** .. **10 —** Specifies the monitored count of consecutive errors.

t391

Syntax **t391** [5..30]
no t391

Context config>port>ethernet>elmi

Description This command configures the polling timer for UNI-C.

Parameters **5** ..**30 —** Specifies the polling timer for UNI-C.

t392

Syntax **t392** [5..30]
no t392

Context config>port>ethernet>elmi

Description This command configures the polling verification timer for UNI-N.

Parameters **5** .. **30 —** Specifies the polling verification timer for UNI-N.

mode

Syntax **mode** {**access** | **network** | **hybrid**}
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, network or hybrid** 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, a TDM channel or SONET path. Note that ATM, Frame Relay, and cHDLC port parameters can only be configured in the access mode.

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, a TDM channel or SONET path. Note that ATM, 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.

When network mode is selected on a SONET/SDH path, 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.

A hybrid Ethernet port allows the combination of network and access modes of operation on a per-VLAN basis and must be configured as either dot1q or QinQ encapsulation.

When the hybrid port is configured to the dot1q encapsulation, the user configures a SAP inside a service simply by providing the SAP ID which must include the port-id value of the hybrid mode port and an unused VLAN tag value. The format is <*port-id*>:*qtag1*. A SAP of format <*port-id*>:* also supported.

The user configures a network IP interface under config>router>interface>port by providing the port name which consists of the port-id of the hybrid mode port and an unused VLAN tag value. The format is <*port-id*>:*qtag1*. The user must explicitly enter a valid value for qtag1. The <*port-id*>:* value is not supported on a network IP interface. The 4096 VLAN tag space on the port is shared among VLAN SAPs and VLAN network IP interfaces.

When the hybrid port is configured to QinQ encapsulation, the user configures a SAP inside a service simply by providing the SAP ID which must include the port-id value of the hybrid mode port and the outer and inner VLAN tag values. The format is <port-id>:qtag1.qtag2. A SAP of format <*port-id*>:*qtag1*.* is also supported. The outer VLAN tag value must not have been used to create an IP network interface on this port. In addition, the qtag1.qtag2 value combination must not have been used by another SAP on this port.

The user configures a network IP interface under config>router>interface>port by providing the port name which consists of the port-id of the hybrid mode port and a VLAN tag value. The format is <*port-id*>:*qtag1*.*. An outer VLAN tag qtag2 of * is used to create an IP network interface. In addition, the qtag1.qtag2 value combination must not have been used on another SAP or IP network interface on this port.

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, ASAP, and ATM MDAs.

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

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

hybrid — Configures the Ethernet port for hybrid 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
config>eth-tunnel

Description This command assigns a specific MAC address to an Ethernet port, Link Aggregation Group (LAG), Ethernet tunnel, 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 from the chassis MAC address pool.

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, Gig, or 10GigE	Access	null	1514
10/100, Gig, or 10GigE	Access	dot1q	1518
10/100, Gig, or 10GigE	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

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.

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.

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 DS--3/E-3 port or channel, a DS-1/E-1 channel or a DS-0 channel.

Default no ppp

compress

Syntax **compress** {**acfc** [**pfc**] | **pfc** [**acfc**]}
no compress

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

Description This command enables and disables Protocol Field Compression (PFC) per RFC 1661, *The Point-to-Point Protocol (PPP),* Section 6.5 and Address and Control Field Compression (ACFC) as per Section 6.6.

This command is only supported on DS-1 and E-1 channel groups on ASAP MDAs.

The **no** form of the command disables the header compression.

Default no compress

Parameters **acfc —** Specifies address and control field compression.

pfc — specifies protocol field compression.

ber-sf-link-down

Syntax [**no**] **ber-sf-link-down**

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

Description This command enables the port down on BER-SF alarm. When enabled, the link will be placed out of service once ber-sf is detected.

The **no** form of the command reverts to normal operation where the link remains in-service when ber-sf is encountered.

Default no ber-sf-link-down

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 DS-3 and E-3 alarms for a DS-3/E-3 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

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.

An APS group contains a working and a protect circuit and can span a single node (SC-APS) or two nodes (MC-APS).

The working and protection configurations on Alcatel-Lucent 7750 SRs must match the circuit configurations on the peer. This means that the working circuit on the 7750 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

hold-time-aps

Syntax **hold-time-aps** [**lsignal-failure** *sf-time*] [**lsignal-degrade** *sd-time*]
no hold-time-aps

Context config>port>aps

Description This command configures hold-down timers to debounce signal failure conditions (lais, b2err-sf) and signal degrade conditions (b2err-sd) for Uni 1+1 Sig+Data APS switching mode (switching mode uni-1plus1).

The **no** version of this command resets hol a specified string expression from an app-filter definition.

Default 0 (disabled)

Parameters *sf-time* — Specifies an integer to define the signal failure hold-down time in milliseconds.

Values 1 — 100

sd-time — Specifies an integer to define the signal degrade hold-down time in milliseconds.

Values 1 — 100

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 317 for information about modifying the timer defaults in the event of communication delays between the APS controllers.

rdi-alarms

Syntax **rdi-alarms** [**suppress** | **circuit**]

Context config>port>aps

Description This command configures how RDI alarms (line, path, section) are generated on physical circuits of an APS ports. The command configuration changes are supported only for switching-mode set to uni_1plus1. The configuration can be changed only when no working and protecting circuit has been added. Options:

- circuit–RDI alarms are H/W-generated independently on each working and protect circuit based on RX failure of that circuit regardless of APS line status.
- suppress–RDI H/W generation on working and protect circuits is suppressed. No alarms are generated on RX failure of that circuit.

Default **rdi-alarms circuit**

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** {**uni-1plus1 (R8.0)| bi-directional | uni-directional**}

Context config>port>aps

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

Parameters **bi-directional —** Configures the group to operate in Bidirectional 1+1 Signalling APS mode.

uni-directional — Configures the group to operate in Unidirectional 1+1 Signalling APS mode.

uni-1plus1 — Configures the group to operate in Unidirectional 1+1 Signalling and Datapath APS mode (7750 SR-c4/c12 platforms only).

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 375**.

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          : 2/1/5 7750-SR-7         Section Trace Mode  : string
Rx S1 Byte         : 0x00 (stu)              Rx K1/K2 Byte       : 0x00/0x00
Tx S1 Byte         : 0x0f (dnu)              Tx DUS/DNU          : disabled
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 unprotected port these timer are different:
A:NS044050253# show port 2/2/2
===============================================================================
SONET/SDH Interface
===============================================================================
Description        : OC-48 SONET/SDH
Interface          : 2/2/2                   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 (stu)              Rx K1/K2 Byte       : 0x00/0x00
Tx S1 Byte         : 0x0f (dnu)              Tx DUS/DNU          : disabled
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-SR1
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, gigabit, or 10Gig Ethernet LAN ports on an appropriate MDA.

mode

Syntax **mode {access | network | hybrid}**
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 for access, network, or hybrid mode of operation. It also configures a 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, a TDM channel or SONET path. Note that ATM, 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.

When network mode is selected on a SONET/SDH path, 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.

A hybrid Ethernet port allows the combination of network and access modes of operation on a per-VLAN basis and must be configured as either dot1q or QinQ encapsulation.

When the hybrid port is configured to the dot1q encapsulation, the user configures a SAP inside a service simply by providing the SAP ID which must include the port-id value of the hybrid mode port and an unused VLAN tag value. The format is <*port-id*>:*qtag1*. A SAP of format <*port-id*>:* also supported.

The user configures a network IP interface under config>router>interface>port by providing the port name which consists of the port-id of the hybrid mode port and an unused VLAN tag value. The format is <*port-id*>:*qtag1*. The user must explicitly enter a valid value for qtag1. The <*port-id*>:* value is not supported on a network IP interface. The 4096 VLAN tag space on the port is shared among VLAN SAPs and VLAN network IP interfaces.

When the hybrid port is configured to QinQ encapsulation, the user configures a SAP inside a service simply by providing the SAP ID which must include the port-id value of the hybrid mode port and the outer and inner VLAN tag values. The format is <port-id>:qtag1.qtag2. A SAP of format <*port-id*>:*qtag1*.* is also supported. The outer VLAN tag value must not have been used to create an IP network interface on this port. In addition, the qtag1.qtag2 value combination must not have been used by another SAP on this port.

The user configures a network IP interface under config>router>interface>port by providing the port name which consists of the port-id of the hybrid mode port and a VLAN tag value. The format is <*port-id*>:*qtag1*.*. An outer VLAN tag qtag2 of * is used to create an IP network interface. In addition, the qtag1.qtag2 value combination must not have been used on another SAP or IP network interface on this port.

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

Default network — for Ethernet ports

access — for TDM channel or SONET paths

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.

hybrid — Configures the Ethernet port for hybrid use.

access

Syntax **access**

Context config>port>ethernet

Description This command configures Ethernet access port parameters.

egress

Syntax **egress**

Context config>port>ethernet>access
config>port>ethernet>network

Description This command configures Ethernet access egress port parameters.

ingress

Syntax **ingress**

Context config>port>ethernet>access

Description This command configures Ethernet access ingress port parameters.

queue-group

Syntax **queue-group** *queue-group-name* [**create**]
no queue-group *queue-group-name*

Context config>port>ethernet>access>egr
config>port>ethernet>access>ing

Description This command creates an ingress or egress queue group on an Ethernet port. A queue group is a collection of queues identified by a group name. Queue groups are used as an alternative queue destination for SAPs or egress IP interfaces. Queue groups are not supported on HSMDA Ethernet ports.

Within a SAP, a forwarding class may be redirected from the local SAP queue to a port queue group queue. The forwarding classes from multiple SAPs may be redirected to the same queue group which can be used to minimize the number of per-SAP queues.

Within a network IP interface, an egress forwarding class may be redirected from the port network queue (created by the network-queue policy applied to the network port) to an egress port queue group. The egress queue groups may be used to create queues per egress IP interface. In this case, each IP interface would be mapped to a different queue group and the network QoS policy applied to the IP interface will dictate which forwarding classes are redirected to the queue group. As an alternative, multiple IP interfaces may share the same queue group.

Queue groups may be created on both access and network oriented ports. When the port is in access mode, the queue groups must be created within the port access node. Queue groups on network mode ports are created within the network node.

Within the access and network nodes, queue groups are also configured as ingress or egress. Access ingress queue groups can only be used by ingress SAP forwarding classes and only a single ingress queue group per port is supported. Multiple access egress queue groups may be created on a single port and are used by egress SAP forwarding classes. On network mode ports, queue groups are only supported on the egress side and are used by forwarding classes on egress IP interfaces.

When the queue group is created in an ingress port context, the group-name must be an existing ingress queue group template. Similarly, queue groups created in an egress port context must have a group-name of an existing egress queue group template. Two ingress queue groups with the same name cannot be created on the same port. Two egress queue groups cannot be created on the same port with the same name.

The queues defined in the template are created on the queue group. The queue parameters within the template are used as the default queue parameters for each queue in the queue group. The default queue parameters for each queue may be overridden on the queue group with specific queue parameters.

Each queue group supports the application of a scheduler-policy for the purpose of managing the queues within the group into an aggregate SLA. The queues defined within the template may be configured with parent scheduler defining the mapping of a queue to one of the schedulers within the scheduler policy. Egress queue groups also support the agg-rate-limit parameter and the queues in the egress template support the port-parent command. Each command is used for configuring egress port virtual scheduling behavior.

Each queue group allows the application of an accounting policy and the ability to enable and disable collecting statistics. The statistics are derived from the queue counters on each queue within the queue group. The accounting policy defines which queue counters are collected and to which accounting file they will be written.

A queue group does not have an administrative shutdown or no shutdown command. A queue group is considered to be always ?p?once created.

When creating a queue group, the system will attempt to allocate queue resources based on the queues defined in the queue group template. If the appropriate queue resources do not currently exist, the queue group will not be created. Ingress port queue groups do not support the shared-queuing or multipoint-shared queuing behavior.

When the queue group is created on a LAG (Link Aggregation Group), it must be created on the primary port member. The primary port member is the port with the lowest port ID based on the slot, MDA position and port number on the MDA. A queue group created on the primary LAG port will be automatically created on all other port members. If a new port is being added to a LAG with an existing queue group, the queue group must first be created on the port prior to adding the port to the LAG. If the LAG queue group has queue overrides, the queue overrides must also be defined on the port queue group prior to adding the port to the LAG.

A port queue group cannot be removed from the port when a forwarding class is currently redirected to the group. All forwarding class redirections must first be removed prior to removing the queue group.

Default none

Parameters *group-name* — The group-name parameter is required when executing the port queue-group command. The specified group-name must exist as an ingress or egress queue group template depending on the ingress or egress context of the port queue group. Only a single queue group may be created on an ingress port. Multiple queue groups may be created on an egress port.

create — Keyword used to associate the queue group. The **create** keyword requirement can be enabled/disabled in the **environment>create** context.

agg-rate-limit

Syntax **agg-rate-limit** *kilobits-per-second* [**queue-frame-based-accounting**]
no agg-rate-limit

Context config>port>ethernet>access>egr>qgrp
config>port>ethernet>access>ing>qgrp
config>port>ethernet>network>egr>qgrp

Description This command defines the maximum total rate of all egress queues in this queue-group.

If a port scheduler is not defined on the egress port, the queues are allowed to operate based on their own bandwidth parameters.

The **no** form of the command removes the aggregate rate limit from theconfiguration.

Parameters *agg-rate* — Defines the rate, in kilobits-per-second, that the maximum aggregate rate the queues on the port can operate.

Values 1 — 40000000, max

queue-frame-based-accounting — This keyword enables frame based accounting on all queues associated with the port. If frame based accounting is required when an aggregate limit is not necessary, the max keyword should precede the queue-frame-based-accounting keyword. If frame based accounting must be disabled, execute agg-rate-limit without the queue-frame-based-accounting keyword present.

host-match

Syntax **host-match dest** *destination-string* [**create**]
no host-match dest *destination-string*

Context config>port>ethernet>access>egr>qgrp

Description This command configures host matching for the Ethernet port egress queue-group.

The no form of the command removes

Parameters **dest** *destination-string* **—** Specify a host match destination string up to 32 characters in length.

create — Keyword used to create the host match. The **create** keyword requirement can be enabled/ disabled in the **environment**>**create** context.

queue-overrides

Syntax **queue-overrides**

Context config>port>ethernet>access>egr>qgrp
config>port>ethernet>access>ing>qgrp
config>port>ethernet>network>egr>qgrp

Description This command enables the context to define optional queue parameter overrides for each queue within the queue group.

queue

Syntax **queue** *queue-id* [*queue-type*] [**create**]
no queue *queue-id*

Context config>port>ethernet>access>egr>qgrp>qover
config>port>ethernet>access>ing>qgrp>qover
config>port>eth>network>egr>qgrp>qover

Description This command associates a queue for use in a queue group template. The defined queue-id acts as a repository for the default parameters for the queue. The template queue is created on each queue-group object which is created with the queue group template name. Each queue is identified within the template by a queue-id number. The template ensures that all queue groups created with the template's name will have the same queue-ids providing a uniform structure for the forwarding class redirection commands in the SAP egress QoS policies. The parameters within the template queue will be used as the default settings for each queue in the actual queue group. The queue parameters may be individually changed for each queue in each queue group using per queue overrides.

The **no** form of the command removes the queue-id from the configuration.

Default none

adaptation-rule

Syntax **adaptation-rule** [**pir** *adaptation-rule*] [**cir** *adaptation-rule*]
no adaptation-rule

Context config>port>ethernet>access>egr>qgrp>qover>q
config>port>ethernet>access>ing>qgrp>qover>q
config>port>ethernet>network>egr>qover>q

Description This command specifies the method used by the system to derive the operational CIR and PIR settings when the queue is provisioned in hardware. For the CIR and PIR parameters individually, the system attempts to find the best operational rate depending on the defined constraint.

The **no** form of the command removes any explicitly defined constraints used to derive the operational CIR and PIR created by the application of the policy. When a specific **adaptation-rule** is removed, the default constraints for **rate** and **cir** apply.

Default adaptation-rule pir closest cir closest

Parameters **pir** **—** Defines the constraints enforced when adapting the PIR rate defined within the **queue** *queue-id* **rate** command. The **pir** parameter requires a qualifier that defines the constraint used when deriving the operational PIR for the queue. When the **rate** command is not specified, the default applies.

cir — Defines the constraints enforced when adapting the CIR rate defined within the **queue** queue-id **rate** command. The **cir** parameter requires a qualifier that defines the constraint used when deriving the operational CIR for the queue. When the **cir** parameter is not specified, the default constraint applies.

adaptation-rule — Specifies the adaptation rule to be used while computing the operational CIR or PIR value.

Values **max** — The **max** (maximum) option is mutually exclusive with the **min** and **closest** options. When **max** is defined, the operational PIR for the queue will be equal to or less than the administrative rate specified using the **rate** command.

min — The **min** (minimum) option is mutually exclusive with the **max** and **closest** options. When **min** is defined, the operational PIR for the queue will be equal to or greater than the administrative rate specified using the **rate** command.

closest — The **closest** parameter is mutually exclusive with the **min** and **max** parameter. When **closest** is defined, the operational PIR for the queue will be the rate closest to the rate specified using the **rate** command.

cbs

Syntax **cbs** *size-in-kbytes*
no cbs

Context config>port>ethernet>access>egr>qgrp>qover>q
config>port>ethernet>access>ing>qgrp>qover>q
config>port>ethernet>network>egr>qover>q

Description The cbs command is used to define the default committed buffer size for the template queue. Overall, the cbs command follows the same behavior and provisioning characteristics as the cbs command in the SAP ingress QoS policy. The exception is the addition of the cbs-value qualifier keywords bytes or kilobytes.

The **no** form of this command restores the default CBS size to the template queue.

Default default

Parameters *size-in-kbytes* — The size parameter is an integer expression of the number of kilobytes reserved for the queue. If a value of 10KBytes is desired, enter the value 10. A value of 0 specifies that no reserved buffers are required by the queue (a minimal reserved size can still be applied for scheduling purposes).

Values 0 — 131072 or default

high-prio-only

Syntax **high-prio-only** *percent*
no high-prio-only

Context config>port>ethernet>access>egr>qgrp>qover>q
config>port>ethernet>access>ing>qgrp>qover>q
config>port>ethernet>network>egr>qover>q

Description The **high-prio-only** command specifies the percentage of buffer space for the queue, used exclusively by high priority packets. The specified value overrides the default value for the context.

The priority of a packet can only be set in the SAP ingress QoS policy and is only applicable on the ingress queues for a SAP. The **high-prio-only** parameter is used to override the default value derived from the **network-queue** command.

The **no** form of this command restores the default high priority reserved size.

Parameters *percent* — The percentage reserved for high priority traffic on the queue. If a value of 10KBytes is desired, enter the value 10.

Values 0 — 100, default

mbs

Syntax **mbs** *size-in-kbytes*
no mbs

Context config>port>ethernet>access>egr>qgrp>qover>q
config>port>ethernet>access>ing>qgrp>qover>q
config>port>ethernet>network>egr>qover>q

Description The Maximum Burst Size (MBS) command specifies the default maximum buffer size for the template queue. The value is given in kilobytes.

The MBS value is used by a queue to determine whether it has exhausted all of its buffers while enqueuing packets. Once the queue has exceeded the amount of buffers allowed by MBS, all packets are discarded until packets have been drained from the queue.

The sap-ingress context for mbs provides a mechanism for overriding the default maximum size for the queue.

The sum of the MBS for all queues on an ingress access port can oversubscribe the total amount of buffering available. When congestion occurs and buffers become scarce, access to buffers is controlled by the RED slope a packet is associated with. A queue that has not exceeded its MBS size is not guaranteed that a buffer will be available when needed or that the packets RED slope will not force the discard of the packet. Setting proper CBS parameters and controlling CBS oversubscription is one major safeguard to queue starvation (when a queue does not receive its fair share of buffers). Another is properly setting the RED slope parameters for the needs of services on this port or channel.

If the CBS value is larger than the MBS value, an error will occur, preventing the MBS change.

The **no** form of this command returns the MBS size assigned to the queue to the value.

Default default

Parameters *size-in-kbytes* — The size parameter is an integer expression of the maximum number of kilobytes of buffering allowed for the queue. For a value of 100 kbps, enter the value 100. A value of 0 causes the queue to discard all packets.

Values 0 — 131072 or default

rate

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

Context config>port>ethernet>access>egr>qgrp>qover>q
config>port>ethernet>access>ing>qgrp>qover>q
config>port>ethernet>network>egr>qover>q

Description This command specifies the administrative Peak Information Rate (PIR) and the administrative Committed Information Rate (CIR) parameters for the queue. The PIR defines the maximum rate that the queue can transmit packets out an egress interface (for SAP egress queues). Defining a PIR does not necessarily guarantee that the queue can transmit at the intended rate. The actual rate sustained by the queue can be limited by oversubscription factors or available egress bandwidth.

The CIR defines the rate at which the system prioritizes the queue over other queues competing for the same bandwidth. In-profile packets are preferentially queued by the system at egress and at subsequent next hop nodes where the packet can traverse. To be properly handled as in- or out-of-profile throughout the network, the packets must be marked accordingly for profiling at each hop.

The CIR can be used by the queue's parent commands *cir-level* and *cir-weight* parameters to define the amount of bandwidth considered to be committed for the child queue during bandwidth allocation by the parent scheduler.

The **rate** command can be executed at anytime, altering the PIR and CIR rates for all queues created through the association of the SAP egress QoS policy with the *queue-id*.

The **no** form of the command returns all queues created with the *queue-id* by association with the QoS policy to the default PIR and CIR parameters (**max**, 0).

Default **rate max cir 0 —** The **max** default specifies the amount of bandwidth in kilobits per second (thousand bits per second). The **max** value is mutually exclusive to the **pir-rate** value.

Parameters *pir-rate* — Defines the administrative PIR rate, in kilobits, for the queue. When the **rate** command is executed, a valid PIR setting must be explicitly defined. When the **rate** command has not been executed, the default PIR of **max** is assumed.
Fractional values are not allowed and must be given as a positive integer.

The actual PIR rate is dependent on the queue's **adaptation-rule** parameters and the actual hardware where the queue is provisioned.

Values 1 — 100000000, **max**

Default max

cir-rate — The **cir** parameter overrides the default administrative CIR used by the queue. When the **rate** command is executed, a CIR setting is optional. When the **rate** command has not been executed or the **cir** parameter is not explicitly specified, the default CIR (0) is assumed. Fractional values are not allowed and must be given as a positive integer.

Values 0 — 100000000, **max**

Default 0

scheduler-policy

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

Context config>port>ethernet>access>egr>qgrp
config>port>ethernet>access>ing>qgrp
config>port>ethernet>network>egr>qgrp

Description This command associates a virtual scheduler policy with a port queue group. Scheduler policies are defined in the **config>qos>scheduler-policy** *scheduler-policy-name* context.

The **no** form of this command removes the configured ingress or egress scheduler policy from the queue-group.

Parameters *scheduler-policy-name* — The *scheduler-policy-name* parameter applies an existing scheduler policy that was created in the **config>qos>scheduler-policy** *scheduler-policy-name* context to create the hierarchy of ingress or egress virtual schedulers.

secondary-shaper

Syntax **secondary-shaper** *secondary-shaper-name* **rate** {**max** | *rate*}
no secondary-shaper *secondary-shaper-name*

Context config>port>ethernet>access>egress

Description This command configures the Ethernet access egress secondary shaper on this port.

Parameters *secondary-shaper-name* — Specifies the secondary shaper name to apply to this port.

rate {**max** | **rate**} **—** The **max** keyword and *rate* parameter are mutually exclusive.

max — The **max** keyword specifies that the egress aggregate rate limit is unlimited.

rate — The *rate* parameter defines the actual egress rate.

Values 1 — 10000 Mbps

vport

Syntax **vport** *name* [**create**]
no vport *name*

Context config>port>ethernet>access>egress

Description This command configures a scheduling node, referred to as virtual port, within the context of an egress Ethernet port. The vport scheduler operates exactly like a port scheduler with the difference that multiple vport objects can be configured on the egress context of an Ethernet port.

The vport is always configured at the port level even when a port is a member of a LAG.

The user applies a port scheduler policy to a vport using the following command:

configure>port>ethernet>acess>egress>vport>port-scheduler-policy port-scheduler-policy-name

A vport cannot be parented to the port scheduler. The CLI will not allow the user to apply a port scheduler policy to a vport if one has been applied to the port. Conversely, the CLI will not allow the user to apply a port scheduler policy to the egress of an Ethernet port if one has been applied to any vport defined on the access egress context of this port. It is thus important the user ensures that the sum of the max-rate parameter value in the port scheduler policies of all vport instances on a given egress Ethernet port does not oversubscribe the port? rate.

SAP and subscriber host queues can be port-parented to a vport scheduler in a similar way they port-parent to a port scheduler.

Parameters *name* — Specifies the name of the vport scheduling node and can be up to 32 ASCII characters in length. This does not need to be unique within the system but is unique within the port or a LAG.

host-match

Syntax **host-match dest** *description-string* [**create**]
no host-match dest *destination-string*

Context config>port>ethernet>access>egress>vport

Description This command specifies the destination and organization strings to be used for matching subscriber hosts with this vport.

The parent vport of a subscriber host queue, which has the port-parent option enabled, is determined by matching the destination string **dest** string associated with the subscriber and the organization string org string associated with the subscriber host with the strings defined under a vport on the port associated with the subscriber.

If a given subscriber host queue does not have the port-parent option enabled, it will be foster-parented to the vport used by this subscriber and which is based on matching the dest string and org string. If the subscriber could not be matched with a vport on the egress port, the host queue will not be bandwidth controlled and will compete for bandwidth directly based on its own PIR and CIR parameters.

By default, a subscriber host queue with the port-parent option enabled is scheduled within the context of the port's port scheduler policy.

Parameters *description-string* — The destination character string. Allowed values are any string up to 80 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.

port-scheduler-policy

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

Context config>port>ethernet>access>egress>vport

Description This command specifies the destination and organization strings to be used for matching subscriber hosts with this vport.

The parent vport of a subscriber host queue, which has the port-parent option enabled, is determined by matching the destination string dest string associated with the subscriber and the organization string org string associated with the subscriber host with the strings defined under a vport on the port associated with the subscriber.

If a given subscriber host queue does not have the port-parent option enabled, it will be foster-parented to the vport used by this subscriber and which is based on matching the dest string and org string. If the subscriber could not be matched with a vport on the egress port, the host queue will not be bandwidth controlled and will compete for bandwidth directly based on its own PIR and CIR parameters.

By default, a subscriber host queue with the port-parent option enabled is scheduled within the context of the port? port scheduler policy.

The no form of the command removes the port-scheduler-policy-name from the configuration.

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

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.

7750 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.

Default no accept-remote-loopback

hold-time

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

Context config>port>ethernet>efm-oam

Description This command configures efm-oam operational transition dampening timers which reduce the number of efm-oam state transitions reported to upper layers.

Default 0

Parameters *time-value* — Indicates the number of seconds that the efm-oam protocol will wait before going back to the operational state after leaving the operational state. Note that the hold-time does not apply if efm-oam moved from operational to link-fault.

A hold-time value of zero indicates that there should be no delay in transitioning to the operational state. A non-zero value will cause the efm-oam protocol to attempt to negotiate with a peer if possible, but it will remain in the send-local-remote-ok state until the hold time has expired if negotiation is successful.

If efm-oam is administratively shutdown while it was in the operational state and then re-enabled when a non-zero hold time is configured, efm-oam will not transition to the operational state until the hold-time expires.

Values 0 — 50

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.

Default transmit-interval 10 multiplier 5

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.

Default no 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

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*] [**seconds | centiseconds**]}
no hold-time

Context config>port>ethernet

Description This command configures port link dampening timers which reduce the number of link transitions reported to upper layer protocols. The **hold-time** value is used to dampen interface transitions.

When an interface transitions from an up state to a down state, 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** seconds — No port link down dampening is enabled; link down transitions are immediately reported to upper layer protocols.
up 0 seconds — 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 or centiseconds, to notify the upper layers after an interface transitions from a down state to an up state.

Values 0 — 900 seconds
0, 10 — 90000 centiseconds in 5 centisecond increments

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

Values 0 — 900 seconds
0, 10 — 90000 centiseconds in 5 centisecond increments

seconds | **centiseconds** — Specify the units of your hold time in **seconds** or **centiseconds**.

Note: The centisecond option is not available on the 7750 SR-1 chassis.

hsmda-scheduler-overrides

Syntax [**no**] **hsmda-scheduler-overrides**

Context config>port>ethernet

Description This command enables the context to configure ingress and egress HSMDA scheduler override parameters. Executing hsmda-scheduler-override places the current CLI context into the egress scheduler override node either at the ingress MDA or egress port level.

Default values are:

Values

Command	**Configuration**
description	no description
max-rate	no max-rate
group	group 1 rate max
	group 2 rate max
scheduling-class	scheduling-class 1 rate max
	scheduling-class 2 rate max
	scheduling-class 3 rate max
	scheduling-class 4 rate max
	scheduling-class 5 rate max
	scheduling-class 6 rate max
	scheduling-class 7 rate max
	scheduling-class 8 rate max

The **no** form of the command removes the overridden parameters from the HSMDA egress port or ingress MDA scheduler. Once existing overrides are removed, the scheduler reverts all scheduling parameters back to the parameters defined on the hsmda-scheduler-policy associated with the egress port or ingress MDA.

group

Syntax **group** *group-id* **rate** *rate*
no group *group-id*

Context config>port>ethernet>hsmda
config>card>mda>ingress>hsmda-scheduler-override

Description This command changes the maximum rate allowed for a weighted scheduling group on the local HSMDA scheduler. Scheduling classes within the group are managed with an aggregate rate limit when either an explicit group rate is defined on the HSMDA scheduling policy or a local override is defined based on the group override command.

The **no** form of the command removes the local overrides for the weighted scheduling group. Once removed, the defined behavior within the HSMDA scheduling policy for the weighted scheduling group is used.

Parameters *group-id* — Identifies the two weighted scheduling groups to be overridden.

Values 1, 2

rate — The *megabits-per-second* parameter specifies a local limit on the total bandwidth for the weighted scheduling group and overrides any rate defined in the HSMDA scheduler policy for the weighted scheduling group. The parameter is specified in Megabits per second in a base 10 context. A value of 1 equals a rate of 1000000 bits per second.

The **max** keyword removes any existing rate limit imposed by the HSMDA scheduler policy for the weighted scheduling group allowing it to use as much total bandwidth as possible.

Values 1 — 40000, max (Mbps)

max-rate

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

Context config>port>ethernet>hsmda

Description This command overrides the **max-rate** parameters configured in the hsmda-scheduler-policy associated with the egress port or ingress MDA. When a **max-rate** is defined at the override level, the HSMDA scheduler policy's **max-rate** parameter is ignored.

The **hsmda-scheduler-override max-rate** command supports a **max** 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 HSMDA scheduler policy has an explicit maximum rate defined and it is desirable to remove this limit at the port instance.

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

Parameters *rate* — The **rate** parameter is mutually exclusive to specifying the **max** keyword. When executing the max-rate override command either the keyword **max** or a rate in megabits-per-second must be specified.

Values 1 — 40000000, max (Mbps)

max — The **max** keyword is mutually exclusive to specifying a **rate** in megabits-per-second. When executing the **max-rate** override command either the keyword **max** or a rate in megabits-per-second must be specified. The max keyword removes an existing rate limit from the HSMDA scheduler context.

scheduling-class

Syntax **scheduling-class** *class* **rate** *rate*
scheduling-class *class* **weight** *weight-in-group*
no scheduling-class *class*

Context config>port>ethernet>hsmda

Description This command overrides the maximum rate allowed for a scheduling class or the weight of the class within a weighted scheduling group. The scheduling-class override cannot be used to change scheduling class weighted group membership; weighted group membership may only be defined within the HSMDA scheduling policy.

Scheduling classes correspond directly to the queue-IDs used by every queue on an HSMDA. All queues with an ID of 1 associated with the scheduler are members of scheduling class 1 on the scheduler. Queues with an ID of 2 are members of scheduling class 2. This is true through scheduling class 8.

When the scheduling class is not a member of a weighted group, the scheduling-class command may be used to modify the maximum rate allowed for the scheduling class. This is done using the rate parameter followed by either the max keyword or an actual rate defined as megabits-per-second. Use the rate max combination to locally remove a rate limit defined for the class on the scheduling policy. When the rate megabits-per-second combination is used, the scheduling class defined as class-id is rate limited to the specified rate. Either the keyword max or a value for megabits-per-second must follow the rate keyword.

The rate keyword is mutually exclusive with the weight keyword. The weight keyword may only be specified when class-id is a member of a weighted scheduling group. When the weight keyword is specified, a weight value specified as weight must follow. The new weight locally overrides the weight defined for the scheduling class in the HSMDA scheduling policy.

When the scheduling-class command is executed, either the rate or weight keyword must follow.

When a scheduling class has a local rate override, the HSMDA policy associated with the override cannot move the scheduling class into a weighted scheduling group. Similarly, when a scheduling class has a local weight override, the HSMDA policy associated with the override cannot define a rate (neither max nor a megabit-per-second value) for the scheduling class. The local overrides of the scheduling class must be removed before these changes may be made.

The **no** form of the command removes the local overrides for the scheduling class. Once removed, the defined behavior for the scheduling class within the HSMDA scheduling policy will used.

Parameters *class* — Identifies the scheduling class to be being overridden.

Values 1 — 8

rate — Overrides the HSMDA scheduler policies maximum rate for the scheduling class and requires either the **max** keyword or a rate defined in megabits-per-second. In order for the **rate** keyword to be specified, the scheduling class cannot be a member of a weighted scheduling group as defined on the HSMDA scheduling policy. The **rate** keyword is mutually exclusive with the **weight** keyword. Also, either the **rate** or **weight** keyword must be specified.

The **max** keyword removes any existing rate limit imposed by the HSMDA scheduler policy for the scheduling class allowing it to use as much total bandwidth as possible.

Values 1 — 40000000, max (Mbps)

weight *weight-in-group* **—** Overrides the weighted scheduler group weight for the scheduling class as defined in the HSMDA scheduler policy. In order for the weight keyword to be specified, the scheduling class must be a member of a weighted scheduling group as defined on the HSMDA scheduling policy. A value represented by group-weight must follow the **weight** keyword. The new weight will be used to determine the bandwidth distribution for member scheduling classes within the group of which the scheduling class is a member.

Values 1 — 100

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 24 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 104) 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**]

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.

single-fiber

Syntax [**no**] **single-fiber**

Context config>port>ethernet

Description This command enables packet gathering and redirection of IP packets from a single fiber (RX) port of the Ethernet or SONET/SDH interface and redistributes packets to other interfaces through either static routes or policy-based forwarding.

This parameter can be applied in conjunction with the strip-label command. If they are applied together, the port must have the single-fiber option configured before it can be associated with an interface that is configured with the strip-label option.

Once a port is configured with single-fiber, traffic will no longer be transmitted out of that port.

Default no single-fiber

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.

ssm

Syntax **ssm**

Context config>port>ethernet

Description This command enables Ethernet Synchronous Status Message (SSM).

network-type

Syntax **network-type** [**sonet | sdh**]

Context config>port>ethernet>ssm

Description This command configures the encoding of synchronous status messages. For example, whether to use an SDH or SONET set of values. Configuring the network-type is only applicable to SyncE ports. It is not configurable on SONET/SDH ports. For the network-type, sdh refers to ITU-T G.781 Option I, while sonet refers to G.781 Option II (equivalent to Telcordia GR-253-CORE). For compatibility with Release 7.0, sdh is the default.

Default sdh

Parameters **sdh —** Specifies the values used on a G.781 Option 1 compliant network.

sonet — Specifies the values used on a G.781 Option 2 compliant network.

tx-dus

Syntax [**no**] **tx-dus**

Context config>port>ethernet>ssm

config>port>sonet-sdh

Description This command forces the QL value transmitted from the SSM channel of the SONET/SDH port or the Synchronous Ethernet port to be set to QL-DUS/QL-DNU. This capability is provided to block the use of the interface from the SR/ESS for timing purposes.

Default no tx-dus

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 7750 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 7750 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 7750 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 7750 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 7750 SR waits for the RADIUS server to responds to its access request message. When this timer expires, the 7750 SR will re-send the access request message, up to the specified 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 7750 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 7750 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

use-broadcast-address

Syntax [**no**] **use-broadcast-address**

Context config>port>ethernet>dwl

Description This command specifies whether or not the down when looped destination MAC address is the broadcast address, or the local port MAC address, as specified in the port's MAC address.

LLDP Port Commands

lldp

Syntax **lldp**

Context config>port>ethernet

Description This command enables the context to configure Link Layer Discovery Protocol (LLDP) parameters on the specified port.

dest-mac

Syntax **dest-mac** {*bridge-mac*}

Context config>port>ethernet>lldp

Description This command configures destination MAC address parameters.

Parameters **bridge-mac —** Specifies destination bridge MAC type to use by LLDP.

Values
nearest-bridge — Specifies to use the nearest bridge.
nearest-non-tpmr — Specifies to use the nearest non-Two-Port MAC Relay (TPMR) .
nearest-customer — Specifies to use the nearest customer.

admin-status

Syntax **admin-status** {**rx** | **tx** | **tx-rx** | **disabled**}

Context config>port>ethernet>lldp>dstmac

Description This command configures LLDP transmission/reception frame handling.

Parameters **rx —** Specifies the LLDP agent will receive, but will not transmit LLDP frames on this port.

tx — Specifies that the LLDP agent will transmit LLDP frames on this port and will not store any information about the remote systems connected.

tx-rx — Specifies that the LLDP agent will transmit and receive LLDP frames on this port.

disabled — Specifies that the LLDP agent will not transmit or receive LLDP frames on this port. If there is remote systems information which is received on this port and stored in other tables, before the port's admin status becomes disabled, then the information will naturally age out.

notification

Syntax [**no**] **notification**

Context config>port>ethernet>lldp>dstmac

Description This command enables LLDP notifications.

The **no** form of the command disables LLDP notifications.

tx-mgmt-address

Syntax **tx-mgmt-address** [**system**]
no tx-mgmt-address

Context config>port>ethernet>lldp>dstmac

Description This command specifies which management address to transmit.

The no form of the command resets value to the default.

Default no tx-mgmt-address

Parameters **system —** Specifies to use the system IP address. Note that the system address will only be transmitted once it has been configured if this parameter is specified.

tx-tlvs

Syntax **tx-tlvs** [**port-desc**] [**sys-name**] [**sys-desc**] [**sys-cap**]
no tx-tlvs

Context config>port>ethernet>lldp>dstmac

Description This command specifies which LLDP TLVs to transmit. The TX TLVS, defined as a bitmap, includes the basic set of LLDP TLVs whose transmission is allowed on the local LLDP agent by the network management. Each bit in the bitmap corresponds to a TLV type associated with a specific optional TLV. Organizationally-specific TLVs are excluded from the this bitmap.

There is no bit reserved for the management address TLV type since transmission of management address TLVs are controlled by another object.

The **no** form of the command resets the value to the default.

no tx-tlvs

Parameters **port-desc —** Indicates that the LLDP agent should transmit port description TLVs.

sys-name — Indicates that the LLDP agent should transmit system name TLVs.

sys-desc — Indicates that the LLDP agent should transmit system description TLVs.

sys-cap — Indicates that the LLDP agent should transmit system capabilities TLVs.

Network Port Commands

network

Syntax **network**

Context config>port>ethernet
config>port>sonet-sdh>path
config>port>tdm>ds1
config>port>tdm>ds3
config>port>tdm>e1
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>access>egr>qgrp
config>port>ethernet>access>ing>qgrp
config>port>ethernet>network>egr>qgrp
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.

The **no** form of this command removes the accounting policy association from the network interface, and the acccounting policy reverts to the default.

Default No accounting policies are specified by default. You must explicitly specify a policy. If configured, the accounting policy configured as the default is used.

Parameters *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.

Values 1 — 99

collect-stats

Syntax [**no**] **collect-stats**

Context config>port>ethernet>access>egr>qgrp
config>port>ethernet>access>ing>qgrp
config>port>ethernet>network>egr>qgrp
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 IOM 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>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.

Interface Group Handler Commands

interface-group-handler

Syntax [**no**] **interface-group-handler** *group-id*

Context config

Description This command creates an interface group handler that can be associated with a number of independent IP links. The purpose of the group is to operationally disable all interfaces in a common group if the number of active links drops below the minimum interface threshold.

The **no** form of this command deletes the interface group handler. All members must be removed before the IGH can be deleted.

Default None

Parameters *group-id* — Identifies the specific Interface Group Handler.

Values 1—100

member

Syntax [**no**] **member** *portid*

Context config>interface-group-handler

Description This command binds the specified port with the associate Interface Group Handler. Up to eight **member** commands can be issued to add multiple ports to the associated IGH. The **member** must be a port or channel on a SONET or POS MDA. It must be a physical port or channel in network mode, and not bound to any router interfaces. A port or channel cannot be a member of more than one IGH at the same time. MLPPP bundles and their members cannot be IGH members.

The **no** form of this command removes the specified port ID from the associated IGH.

Default None

Parameters *portid* — Identifies the port to be associated with the interface group handler.

threshold

Syntax **threshold** *min*
no threshold

Context config>interface-group-handler

Description This command identifies the minimum number of active links that must be present for the interface group handler to be active. A threshold of 1 effectively disables the effect of the interface group handler.

The **no** form of this command resets the threshold to 1. 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.

Default None

Parameters *min* — Specifies the minimum number of active links that must be present for the interface group handler to be active.

Values 1 — 8

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*
fragment-threshold unlimited
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. Note that the value range is dependent on the MDA type. For example: channelized MDAs, such as the m1-choc12-sfp, m4-choc3-sfp, m12-chds3, and m4-chds3, support values of 128, 256, 512; ASAP channelized MDAs support any value in the valid range.

Values 128 — 512 bytes inclusive for MLPPP and MLFR bundles
128 bytes for IMA bundles

unlimited — This keyword disables fragmentation (MLPPP and MLFR only).

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 to a multilink bundle. For IMA and MLFR groups, this command binds a channel group filling up the entire DS-1 or E-1. MLPPP groups containing E1 links only allow channel groups filling up the entire E1. MLPPP Groups containing DS1 links with multiclass configured allow fractional (n x ds0) channel-groups or channel groups filling up the entire DS1. If a MLPPP group containing DS1 links does not have multiclass configured, only channel groups filling up the entire DS1 are allowed.

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

mlfr

Syntax **mlfr**

Context config>port>multilink-bundle

Description This command enables the context to configure a Multi-link Frame Relay (MLFR) bundle.

identifier

Syntax [**no**] **identifier** *bundle-id-string*

Context config>port>multilink-bundle>mlfr

Description This command defines the identifier for the MLFR bundle. The **no** form of this command resets the value to null.

Default null

Parameters *bundle-id string* — Specifies the bundle ID string.

identifier

Syntax [**no**] **identifier** *frf16-link-id-string*

Context config>port>tdm>channel-group>frame-relay

Description This command defines the identifier for a frame-relay link when used in an MLFR bundle. The **no** form of this command resets the value to null.

Default null

Parameters *frf16-link-id-string* — Specifies the bundle ID string.

ingress

Syntax **ingress**

Context config>port>multilink-bundle>mlfr

Description This command enables the context to configure the ingress QoS profile for the MLFR bundle.

egress

Syntax **egress**

Context config>port>multilink-bundle>mlfr
config>port>tdm>ds1>channel-group>frame-relay>frf-12
config>port>tdm>e1>channel-group>frame-relay>frf-12
config>port>tdm>ds3>frame-relay>frf-12
config>port>tdm>e3>frame-relay>frf-12
config>port>sonet-sdh>path>frame-relay>frf-12

Description This command enables the context to configure the egress QoS profile for an MLFR bundle or a Frame Relay port with FRF.12 UNI/NNI fragmentation enabled.

qos-profile

Syntax **qos-profile** *profile-id*
no qos-profile

Context config>port>multilink-bundle>mlfr>ingress
config>port>multilink-bundle>mlfr>egress
config>port>tdm>channel-group>frame-relay>egress
config>port>sonet-sdh>path>frame-relay>egress

Description This command specifies the ingress or egress QoS profile to be used for the configuration of the ingress or egress QoS parameters of an MLFR bundle or a Frame Relay port with FRF.12 UNI/NNI fragmentation enabled. Note that qos-profile on ingress is only applicable to MLFR.

The no form of the command removes the parameters from the configuration.

Parameters *profile-id* — Specifies the profile number. The value can only be modified if the MLFR bundle or FR port is shut down.

Values 1-128

frame-relay

Syntax **frame-relay**

Context config>port>multilink-bundle>mlfr

Description This command configures the Frame Relay parameters.

lmi-type

Syntax **lmi-type** {**ansi | itu | none | rev1**}

Context config>port>multi-link-bundle>mlfr>frame-relay

Description This command configures the LMI type.

Parameters **ansi** — Use ANSI T1.617 Annex D.

itu — Use ITU-T Q933 Annex A.

none — Disable Frame Relay LMI on the given bundle.

rev1 — Use the Rev 1 version of ANSI T1.617 Annex D.

mode

Syntax **mode** {**dce** | **dte** | **bidir**}

Context config>port>multilink-bundle>mlfr>frame-relay

Description This command configures the DCE/DTE mode of the Frame Relay interface.

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>multilink-bundle>mlfr>frame-relay

Description This command confgures the number of DTE full status polling intervals for the LMI.

Parameters *ntervals* — 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>multilink-bundle>mlfr>frame-relay

Description This command configures the DCE error threshold for the LMI.

Default 3

Parameters *threshold* — Specify the number of errors that will place the bundle in an operationally down state.

Values 1 — 10

n392dte

Syntax **n392dte** *threshold*
no n392dte

Context config>port>multilink-bundle>mlfr>frame-relay

Description This command configures the DTE error threshold for the LMI.

Parameters *count* — Specify the number of errors that will place the bundle in an operationally down state.

Values 1 — 10

n393dce

Syntax **n393dce** *count*
no n393dce

Context config>port>multilink-bundle>mlfr>frame-relay

Description This command configures the DCE monitored event count for the LMI.

Parameters *count* — Specify the diagnostic window used to verify link integrity on the DCE interface.

Values 1 — 10

n393dte

Syntax **n393dte** *count*
no n393dte

Context config>port>multilink-bundle>mlfr>frame-relay

Description This command configures the DTE monitored event count for the LMI.

Parameters *count* — Specify the diagnostic window used to verify link integrity on the DTE interface.

Values 1 — 10

t391dte

Syntax **t391dte** *keepalive*
no t391dte

Context config>port>multilink-bundle>mlfr>frame-relay

Description This command configures the DTE keepalive timer value for the LMI.

Parameters *keepalive* — Specify the interval in seconds between status inquiries issued by the DTE.

Values 5 — 30

t392dce

Syntax **t392dce** *keepalive*
no t392dce

Context config>port>multilink-bundle>mlfr>frame-relay

Description This command configures the DCE keepalive timer value for the LMI.

Parameters *keepalive* — Specify the expected interval in seconds between status inquiries issued by the DTE equipment.

Values 5 — 30

hello-timeout

Syntax **hello-timeout** *seconds*
no hello-timeout

Context config>port>multilink-bundle<mlfr

Description This command specifies the value of the MLFR bundle T_HELLO timer. The timer controls the rate that hello messages are sent. Following a period of T_HELLO duration, a HELLO message is transmitted onto the bundle link.

Note that T_HELLO timer is also used during the bundle link add process as an additional delay before resending an ADD_LINK message to the peer bundle link when the peer bundle link does not answer as expected.

Default 10 seconds

Parameters *seconds* — [1-180 seconds]

ack-timeout

Syntax **ack-timeout** *seconds*
no ack-timeout

Context config>port>multilink-bundle>mlfr

Description This command specifies the value of the MLFR bundle T_ACK timer.

This timer defines the maximum period to wait for a response to any message sent onto the bundle link before attempting to retransmit a message onto the bundle link.

Default 4 seconds

Parameters *seconds* — [1-10 seconds]

retry-limit

Syntax **retry-limit** *integer*
no retry-limit

Context config>port>multilink-bundle>mlfr

Description This command specifies the value of the MLFR bundle N_RETRY counter.

The counter specifies the number of times a retransmission onto a bundle link will be attempted before an error is declared and the appropriate action taken.

Default 2

Parameters *integer* — Specifies the number of retransmission attempts.

Values 1 — 5

frf.12

Syntax **frf.12**

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

Description This command defines the context to configure the parameters of FRF.12 frame relay fragmentation.

fragment-threshold

Syntax **fragment-threshold** *fragment-threshold*
no fragment-threshold

Context config>port>tdm>ds1>channel-group>frame-relay>frf.12
config>port>tdm>e1>channel-group>frame-relay>frf.12
config>port>tdm>ds3>frame-relay>frf.12
config>port>tdm>e3>frame-relay>frf.12
config>port>sonet-sdh>path>frame-relay>frf.12

Description This command sets the maximum length in bytes of a fragment transmitted across a frame relay port with the FRF.12 UNI/NNI fragmentation enabled.

The **no** form of this command resets the fragment threshold back to the default value.

Default 128

Parameters *fragment-threshold* — Specifies the maximum fragment length, in bytes, to be transmitted across the FRF.12 port.

Values 128-512 bytes

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.

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 the bundle is shutdown.

Values 1 — 128

endpoint-discriminator

Syntax **endpoint-discriminator class** {**ip-address | global-mac-address | null**} [**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, null

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 the bundle is shutdown.

Values 1 — 128

magic-number

Syntax [**no**] **magic-number**

Context config>port>ml-bundle>mlppp

Description This command allows loopback detection to be enabled and disabled for MLPPP bundles. It is disabled by default. When the magic number option is disabled, the magic number option will not be requested when a member is trying to bring up the LCP layer on a member link; if the remote peer requests this option, it will be rejected. When transmitting echo-requests a magic number of 0 is used. When responding to echo-requests a magic number of 0 is sent.

The magic number option is sent to the remote peer during protocol negotiation. If this option is rejected by the remote peer, the router will bring the link up but will be unable to detect loopbacks since the router will always send a magic number of 0 in the echo messages. If this option is accepted by the remote peer, the router will send echo messages with randomly generated magic-numbers. If the SR receives a config-req with the same magic number that was sent out, the router will calculate a new magic number to use and send out another config-request. If the router is persistently seeing the randomly generated magic number in the received config-req, the router will declare a loopback.

The **no** form of the command disables the loopback detection.

Default no magic-number

multiclass

Syntax **multiclass** *count*
no multiclass

Context config>port>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 protection multilink bundle in the bundle protection group. The command syntax must be configured as follows:

Syntax: bundle-*type-slot/mda.bundle-num*
bundle-PPP or IMA-*slot/mda.bundle-num* (Creates an MLPPP or IMA 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 links within a multilink bundle. The differential delay is calculated as the round-trip differential delay for MLPPP bundles, and as uni-directional differential delay for IMA bundles.

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 link 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 working multilink bundle in the bundle protection group. The command syntax must be configured as follows:

Syntax: bundle-*type-slot/mda.bundle-num*
bundle-**PPP or IMA**-*slot/mda.bundle-num* (Creates an MLPPP or IMA 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 differential delay is calculated as the round-trip differential delay for MLPPP bundles.

The no form of this command removes the yellow-differential-delay.

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 interface. 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 or LODS alarm. The time specified determines how long is needed for member links to stabilize before being activated.

Values 1 — 30000 milli-seconds

Default 10000

deactivate *milli-seconds* **—** Specifies the time, in milli-seconds, used to raise an LIF or LODS 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 is 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 E-1 — 1920kbps or DS-1 — 1539kbps. E-1 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 is 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.

Default 1-1

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 and OC-192 SONET/SDH ports on an appropriate MDA.

The 10 Gigabit Ethernet LAN port also has SONET/SDH characteristics. However, these characteristics are predetermined and not configurable.

clock-source

Syntax **clock-source** {**loop-timed | node-timed**}

Context config>port>sonet-sdh

Description This command configures the clock to be used for transmission of data out towards the line. The options are to use the locally recovered clock from the line's receive data stream or the node central reference.

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. Note that all SONET/SDH MDAs/CMAs support loop timing. The following table show MDAs that support loop timing:

Sonet/SDH	Loop Timed	Default
OC-192	Yes	loop-timed
OC-48	Yes	loop-timed
OC-12	No	node-timed
OC-3	No	node-timed
Channelized OC-12	Yes	loop-timed
Channelized OC-3	Yes	loop-timed
Channelized ASAP OC-12	Yes	loop-timed
Channelized ASAP OC-3	Yes	loop-timed
CES OC-3	Yes	loop-timed
ATM OC-12	No	node-timed
ATM 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 312.

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>ethernet
config>port>sonet-sdh

Description This command enables packet gathering and redirection of IP packets from a single fiber (RX) port of the Ethernet or SONET/SDH interface and redistributes packets to other interfaces through either static routes or policy-based forwarding.

This parameter can be applied in conjunction with the strip-label command. If they are applied together, the port must have the single-fiber option configured before it can be associated with an interface that is configured with the strip-label option.

Once a port is configured with single-fiber, traffic will no longer be transmitted out of that port. This command can be used in conjunction with strip-label.

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.

suppress-lo-alarm

Syntax [**no**] **suppress-lo-alarm**

Context config>port>sonet-sdh

Description This command enables the suppression of lower order alarms on SONET/SDH port such as MLPPP bundle alarms, DS1/E1 links alarms and 336 APS channel groups alarms.

The **no** form of the command disables the suppression of lower order alarms on SONET/SDH port.

tx-dus

Syntax [**no**] **tx-dus**

Context config>port>ethernet>ssm
config>port>sonet-sdh

Description This command forces the QL value transmitted from the SSM channel of the SONET/SDH port or the Synchronous Ethernet port to be set to QL-DUS/QL-DNU. This capability is provided to block the use of the interface from the SR/ESS for timing purposes.

Default no tx-dus

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 276.

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-192	STS-48-index STS-12-index STS-3-index STS-1-index	STM-64	AUG-16-index AUG-4-index AUG-1-index AU-3-index
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 DS-3 STS1/VC3 payload as DS-3.

e3 — Configures the port or channel as E-3 STS1/VC3 payload as E-3.

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 DS-1

e1 — Configures VT2 payload as E-1.

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, DS-1, DS-3
32 for OC-12, OC-48, ATM-OC12/3, ATMOC-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 and ASAP 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 7750 SR) where XXX is the platform name, such as "7750", 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. The nodes at the two endpoints of the cHDLC link should be 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 must be received in order to declare the link up.

Values 1 — 3

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
config>port>multilink-bundle>ima

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
config>port>multilink-bundle>ima>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 DS-3 channels. The mapping value specifies the cell mapping that is to be used on this ATM interface.

Default direct cell mapping

Parameters *mapping* — The mapping value 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>multilink-bundle>ima>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. It is recommended to change this to the traffic profile as defined in the ILMI specification.

Default atm-td-profile 1

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 DS-0 channel group, or a DS-3/E-3 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.

frf-12

Syntax [**no**] **frf-12**

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

Description This command defines the context to configure the parameters of FRF.12 Frame Relay fragmentation.

egress

Syntax **egress**

Context config>port>multilink-bundle>mlfr
config>port>tdm>ds1>channel-group>frame-relay
config>port>tdm>e1>channel-group>frame-relay>frf-12
config>port>tdm>ds3>frame-relay>frf-12
config>port>tdm>e3>frame-relay>frf-12
config>port>sonet-sdh>path>frame-relay>frf-12

Description This command enables the context to configure the egress QoS profile for an MLFR bundle or a Frame Relay port with FRF.12 UNI/NNI fragmentation enabled.

qos-profile

Syntax **qos-profile** *profile-id*
no qos-profile

Context config>port>tdm>channel-group>frame-relay>egress
config>port>sonet-sdh>path>frame-relay>egress

Description This command specifies the ingress or egress QoS profile to be used for the configuration of the egress QoS parameters of a Frame Relay port with FRF.12 UNI/NNI fragmentation enabled.

The no form of the command removes the parameters from the configuration.

Parameters *profile-id* — Specifies the profile number. The value can only be modified if the FR port is shut down.

Values 1-128

fragment-threshold

Syntax **fragment-threshold** *fragment-threshold*
no fragment-threshold

Context config>port>tdm>channel-group>frame-relay>frf.12
config>port>sonet-sdh>path>frame-relay>frf.12

Description This command sets the maximum length in bytes of a fragment transmitted across a frame relay port with the FRF.12 UNI/NNI fragmentation enabled.

The no form of this command resets the fragment threshold back to the default value.

Default 128

Parameters *fragment-threshold* — Specifies the maximum fragment length, in bytes, to be transmitted across the FRF.12 port.

Values 128-512 bytes

identifier

Syntax [**no**] **identifier** *frf16-link-id-string*

Context config>port>tdm>ds1>channel-group>frame-relay

Description This command defines the identifier for the FR bundle when used in an MLFR bundle. The **no** form of this command resets the value to null.

Default null

Parameters *frf16-link--id-string* — Specifies the bundle ID string.

Values 50 chars maximum

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 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* — Specify 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* — Specify 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* — Specify 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 DS-1/E-1 and DS-3/E-3 parameters for a port on a channelized MDA T1/E1. 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 (DS-1) 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 T-1 (DS-1) 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.

T-1 transmits DS-1-formatted data at 1.544 Mbps through the network. The corresponding European carrier is E-1 with a data rate of 2.048 Mbps. E-1 and T-1 (DS-1) can be interconnected for international use.

The **no** form of this command disables DS-1 capabilities.

Default None

Parameters *ds1-id* — Identifies the DS-1 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 DS-3 parameters. DS-3 lines provide a speed of 44.736 Mbps and is also frequently used by service providers. DS-3 lines carry 28 DS-1 signals and a 44.736 Mbps data rate.

A DS-3 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 DS-3 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 DS-3 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 DS-3 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 E-1 parameters. E-1 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 E-1 capabilities.

Default none

Parameters *e1-id* — Specifies the E-1 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 E-3 parameters. E-3 lines provide a speed of 44.736 Mbps and is also frequently used by service providers. E-3 lines carry 16 E-1 signals with a data rate of 34.368 Mbps.

A E-3 connection typically supports data rates of about 43 Mbps. A E-3 line actually consists of 672 individual channels, each supporting 64 Kbps. E-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 E-3 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 E-3 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.

The **no** form of this command disables E-3 capabilities.

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 DS-1/E-1 or DS-3/E-3 circuit.

The associated DS-1, E-1, DS-3, or E-3 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.

Notes:

- This command is not saved in the router configuration between boots.
- The 4-port OC-3/STM-1 and the 1-port OC-12/STM-4 ASAP MDA supports up to 28 concurrent BERT tests per MDA. The 4-port and 12-port DS-3/E-3 ASAP MDAs support a single BERT test per MDA. An attempt to configure more BERT tests can result in an error indicating an operation failure due to resource exhaustion.
- If the ASAP MDA BERT error insertion **rate** command is executed when tests are running, it will not take effect until test is restarted.

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. Not available on channelized ASAP MDAs.

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 DS-1/DS-3 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 DS-1 port configured with a 'long' buildout (see the **buildout** command). Specify 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 DS-1 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 DS-1 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>channel-group
config>port>tdm>e1>channel-group

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 or E1 channel.

Default None

Description *channel-group-id* — Identifies the channel-group ID number.

Values DS1: 1 — 24
E1: 1 — 32

channelized

Syntax **channelized** {**ds1** | **e1**}
no channelized

Context config>port>tdm>ds3

Description This command specifies that the associated DS-3 is a channelized DS-3 with DS-1/E-1 sub-channels. Depending on the MDA type, the DS-3 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 DS-3 is a clear channel circuit and cannot contain sub-channel DS-1s/E-1s. The sub-channels must be deleted first before the **no** command is executed.

Default no channelized.

Parameters **ds1 —** Specifies that the channel is DS-1.

e1 — Specifies that the channel is E-1.

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**}

Context config>port>tdm>ds1
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e3

Description This command configures the clock to be used for transmission of data out towards the line. The options are to use the locally recovered clock from the line's receive data stream, the node central reference, or an adaptively recovered clock using the received packets.

The following tables show MDAs that support loop timing at DS3/E3 and DS1/E1 channelization options.

TDM DS3/E3	LoopTimed	Default
Channelized OC-12	No	node-timed
Channelized OC-3	No	node-timed
Channelized DS3/E3	No	node-timed
Channelized ASAP OC-12	Yes	node-timed
Channelized ASAP OC-3	Yes	node-timed
Channelized ASAP DS3/E3	Yes	node-timed
CES OC-3	Yes	node-timed

TDM DS1/E1	LoopTimed	Default
Channelized OC-12	Yes	loop-timed
Channelized OC-3	Yes	loop-timed
Channelized DS3/E3	Yes	loop-timed
Channelized ASAP OC-12	Yes	loop-timed
Channelized ASAP OC-3	Yes	loop-timed
Channelized ASAP DS3/E3	Yes	loop-timed
CES OC-3	Yes	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. Adaptive timing is only supported on ds1 and e1 channels.

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 DS-1, E-1 and for non-ATM E-3 and DS-3 channel/ports.

32 for ATM channel-groups configured under DS-1 and E-1, and for ATM E-3 and DS-3 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 Severely 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*. Note that multiple events occurring within a second will be counted as 1 event for ASAP 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 **no** form of this command restores the default.

Default **bcp-null**

Parameters **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 DS-3 interface to respond to remote loop signals.

The DS-3 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. DS-3 loopbacks at the far-end terminal from the local terminal are initiated.

The **no** form of this command prevents the associated DS-3/E-3 interface from responding to remote loop signals.

Default no feac-loop-respond

framing (DS-1)

Syntax **framing** {**esf | sf | ds1-unframed**}

Context config>port>>tdm>ds1

Description This command specifies the DS-1 framing to be used with the associated channel.

Default DS1: esf

Parameters **esf** — Configures the DS-1 port for extended super frame framing.

sf — Configures the DS-1 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 (E-1)

Syntax **framing** {**no-crc-g704 | g704 | e1-unframed**}

Context config>port>tdm>e1

Description This command specifies the E-1 framing to be used with the associated channel .

Default g704

Parameters **g704** — Configure the E-1 port for G.704 framing.

no-crc-g70 — Configures the E-1 for G.704 with no CRC4.

e1-unframed — Specifies E-1 unframed (G.703) mode for E-1 interfaces. This parameter also allows the configuration of an unstructured E-1 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 E-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 CHDLC and CEM encapsulations.

framing (DS3)

Syntax **framing** {**c-bit | m23**}

Context config>port>tdm>ds3

Description This command specifies DS-3 framing for the associated DS-3 port or channel.

Default **c-bit**

Parameters **c-bit —** Configures the DS-3 port/channels for C-Bit framing.

m23 — Configures the DS-3 port/channel for M23 framing.

framing (E-3)

Syntax **framing** {**g751 | g832**}

Context config>port>tdm>e3

Description This command specifies E-3 framing for the associated E-3 port or channel.

Default E-3 non-ATM: g751 and cannot be changed.
E-3 ATM: g832 and cannot be changed.

Parameters **g751 —** Configures the E-3 port/channel for g751 framing.

g832 — Configures the E-3 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, E-1, E-3, DS-1, or DS-3 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.

idle-payload-fill

Syntax **idle-payload-fill pattern** *pattern*
no idle-payload-fill
idle-payload-fill {**all-ones**}

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.

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 DS-3/E-3.

This command is only applicable if the DS-3/E-3 is using C-bit framing (see the **framing (DS3)** 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 DS-3.

eic — Specifies the equipment ID code up to 10 characters long.

lic — Specifies the equipment 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 DS-3/E-3 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 abled, 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**] [**ber-sd**] [**ber-sf**]

Context config>port>tdm>ds1
config>port>tdm>e1

Description This command enables logging of DS-1/DS-3 or E-1/E-3 alarms for DS-1/DS-3 or E-1/E-3 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.

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

Default

signal-mode

Syntax **signal-mode** {**cas**}
no signal-mode

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.

The **no** form of the command reverts to the default value.

Default no signal-mode

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 DS-0 channels used in the associated channel-group.

If the higher order channel is a channelized DS-3 then the channels must be DS-1s.

If the higher order channel is a channelized E-3 then the channels must be E-1s.

Default 64

Parameters **56 —** Specifies that 56k byte (7-bits per byte) encoding will be used for the associated DS-0 channels.

64 — Specifies that 64k byte (8-bits per byte) encoding will be used for the associated DS-0 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 DS-3 subrate standards.

This configuration applies only for non-channelized DS-3s. This command is not supported on channelized ASAP MDAs.

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 DS-3.

Values 1 — 147

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.

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 DS-0 timeslots to be used in the DS-1 or E-1 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 DS-0 timeslots from a channel group.

Default no timeslots — Non-ATM channel groups.1-24 — Channel groups configured under DS-1 with encap set to ATM.
2-16,18-32 — Channel groups configured under E-1 with encap set to ATM.

Description *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 DS-1 interfaces (the full range is auto-configured for ATM channel groups and cannot be changed).
2 — 32 for E-1 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 16 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 16 links can be supported in a single LAG, up to 200 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.

7750 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 — 200 (7750 SR-1and 7750 SR-c12/4: 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 LAG member port.
distribute — Creates an additional internal virtual scheduler per IOM as parent of the configured SAP queues and vitual schedulers per LAG member port on that IOM. This internal virtual scheduler limits the total amount of egress bandwidth for all member ports on the IOM to the bandwidth specified in the egress qos policy.

per-fp-ing-queuing

Syntax [**no**] **per-fp-ing-queuing**

Context config>lag

Description This command specifies whether a more efficient method of queue allocation for LAG SAPs should be utilized.

The **no** form of the command disables the method of queue allocation for LAG SAPs.

dynamic-cost

Syntax [**no**] **dynamic-cost**

Context config>lag *lag-id*

Description This command enables OSPF/ISIS 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 802.3ax standard (formerly 802.3ad), 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

port

Syntax **port** *port-id* [*port-id …*up to 16 total] [**priority** *priority*] [**subgroup** *sub-group-id*]
no port *port-id* [*port-id …*up to 16 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 16 (space separated) ports can be added or removed from the LAG link assuming the maximum of 16 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 down 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 lowest 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 IOM (all ports of the same IOM 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 — 15

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.

Eth Ring Commands

eth-ring

Syntax **eth-ring** *ring-id*
no eth-ring

Context config

Description This command configures a G.8032 protected Ethernet ring. G.8032 Rings may be configured as major rings with two paths (a&b).

The **no** form of this command deletes the Ethernet ring specified by the ring-id.

Default no eth-ring

Parameters *ring-id* — Specifies the ring ID.

Values 1-512

description

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

Context config>eth-ring

Description This command adds a text description for the ring. The no form of this command removes the text description.

Default “Eth ring”

Parameters *string* — Specifies the text description up to 160 characters in length.

guard-time

Syntax **guard-time** *time*
no guard-time

Context config>eth-ring

Description This command configures the guard time for an Eth-Ring. The guard timer is standard and is configurable from x ms to 2 seconds

The **no** form of this command restores the default guard-time.

Default 5 deciseconds

Parameters *value* — Specifies the guard-time.

Values 1-20 deciseconds

revert-time

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

Context config>eth-ring

This command configures the revert time for an Eth-Ring. It ranges from 60 seconds to 720 second by 1 second intervals.

The no form of this command this command means non-revertive mode and revert time essentially is 0 meaning the revert timers are not set.

Default 300 seconds

Parameters *value* — Specifies the guard-time.

Values 60-720 seconds

ccm-hold-time

Syntax **ccm-hold-time** {**down** *down-timeout* **|** **up** *up-timeout*}
no ccm-hold-time

Context config>eth-ring

This command configures eth-ring dampening timers.

The **no** form of this command set the up and down timer to the default values.

down

Syntax **down** *down-timeout*

Context config>eth-ring>ccm-hold-time

This command specifies the timer, which controls the delay between detecting that ring path is down and reporting it to the G.8032 protection module. If a non-zero value is configured, the CPM will wait for the time specified in the value parameter before reporting it to the G.8032 protection module. Note that this parameter applies only to ring path CCM. It does NOT apply to the ring port link state. To damp ring port link state transitions, use hold-time parameter from the physical member port.

Default 0 - the fault will be reported immediately to the protection module.

Parameters *value* — Specifies the down timeout.

Values 0-5000 deciseconds

up

Syntax **up** *up-timeout*

Context config>eth-ring>ccm-hold-time

This command specifies the timer, which controls the delay between detecting that ring path is up and reporting it to the G.8032 protection module. If a non-zero value is configured, the CPM will wait for the time specified in the value parameter before reporting it to the G.8032 protection module. Note that this parameter applies only to ring path CCM. It does NOT apply to the member port link state. To damp member port link state transitions, use hold-time parameter from the physical member port.

Default 20 deciseconds

Parameters *value* — Specifies the hold-time for reporting the recovery.

Values 0-5000 deciseconds

rpl-node

Syntax **rpl-node** <**owner | nbr**>
no rpl-node

Context config>eth-ring

This command configures the G.8032 ring protection link type as owner or neighbor. The no form of the command means this node is not connected to an RPL link. When RPL owner or neigh is specified either the a or b path must be configure with the RPL end command. An owner is responsible for operation of the rpl link. Configuring the RPL as neighbor is optional (can be left as no rpl-node) but if the command is used the nbr is mandatory.

The **no** form of this command removes the RPL link.

Default no rpl-node

node-id

Syntax **node-id** *timeout*
no node-id

Context config>eth-ring

This optional command configures the MAC address of the RPL control. The default is to use the chassis MAC for the ring control. This command allows the chassis MAC to be overridden with another MAC address. This command is primarily used for configurations where

The no form of this command removes the RPL link.

Default no node-id

Parameters *value* — <xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx>

path

Syntax **path {a | b}** <*portid*> **raps-tag** <*VID*>
[**no**] **path {a | b}**

Context config>eth-ring

Description This command assigns the ring (major or sub-ring) path to a port and defines the Ring APS tag. Rings typically have two paths a and b.

The no form of this command removes the path a or b.

Default no path

Parameters raps-tag <*VID*> — Specifies the VID.

Values Dot1q: 1-4094

Values QinQ: 1-4094.1-4094

description

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

Context config>eth-ring>path

Description This command adds a text description for the ring path. The no form of this command removes the text description.

Default “”

Parameters *string* — Specifies the text description up to 160 characters in length.

rpl-end

Syntax **rpl-end**
no rpl-end

Context config>eth-ring

Description This command configures the G.8032 path as a ring protection link end. The ring must have been declared as either a RPL owner or RPL neighbor for this command to be allowed. Only path a or path b can be declared an RPL-end.

The no form of this command sets the rpl-end to default no rpl-end.

Default no rpl-end

eth-cfm

Syntax **eth-cfm**

Context config>eth-ring>path

Description This command enables the context to configure ETH-CFM parameters.

mep

Syntax [**no**] **mep** *mep-id* **domain** *md-index* **association** *ma-index*

Context config>eth-ring>path>eth-cfm

Description This command provisions an 802.1ag maintenance endpoint (MEP).

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

Parameters *mep-id* — ppecifies the maintenance association end point identifier.

Values 1 — 81921

md-index — Specifies the maintenance domain (MD) index value.

Values 1 — 4294967295

ma-index — Specifies the MA index value.

Values 1 — 4294967295

ccm-enable

Syntax [**no**] **ccm-enable**

Context config>eth-ring>path>eth-cfm>mep

Description This command enables the generation of CCM messages.

The **no** form of the command disables the generation of CCM messages.

ccm-ltm-priority

Syntax **ccm-ltm-priority** *priority*
no ccm-ltm-priority

Context config>eth-ring>path>eth-cfm>mep

Description This command specifies the priority value for CCMs and LTMs transmitted by the MEP.

The **no** form of the command removes the priority value from the configuration.

Default The highest priority on the bridge-port.

Parameters *priority* — Specifies the priority of CCM and LTM messages.

Values 0 — 7

eth-test-enable

Syntax [**no**] **eth-test-enable**

Context config>eth-ring>path>eth-cfm>mep

Description This command enables eth-test functionality on MEP. For this test to work, operators need to configure ETH-test parameters on both sender and receiver nodes. The ETH-test then can be done using the following OAM commands:

oam eth-cfm eth-test *mac-address* mep *mep-id* domain *md-index* association *ma-index* [priority *priority*] [data-length *data-length*]

A check is done for both the provisioning and test to ensure the MEP is an Y.1731 MEP (MEP provisioned with domain format none, association format icc-based). If not, the operation fails. An error message in the CLI and SNMP will indicate the problem.

test-pattern

Syntax **test-pattern** {**all-zeros** | **all-ones**} [**crc-enable**]
no test-pattern

Context config>eth-ring>path>eth-cfm>mep>eth-test-enable

Description This command configures the test pattern for eth-test frames.

The **no** form of the command removes the values from the configuration.

Parameters **all-zeros** — Specifies to use all zeros in the test pattern.

all-ones — Specifies to use all ones in the test pattern.

crc-enable — Generates a CRC checksum.

Default all-zeros

bit-error-threshold

Syntax **bit-error-threshold** *bit-errors*

Context config>eth-ring>path>eth-cfm>mep

Description This command specifies the lowest priority defect that is allowed to generate a fault alarm.

Default 1

Parameters *bit-errors* — Specifies the lowest priority defect.

Values 0 — 11840

mac-address

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

Context config>eth-ring>path>eth-cfm>mep

Description This command specifies the MAC address of the MEP.

The **no** form of this command reverts the MAC address of the MEP back to that of the port (if the MEP is on a SAP) or the bridge (if the MEP is on a spoke SDP).

Parameters *mac-address — Specifies the MAC address of the MEP.*

Values 6-byte unicast mac-address (xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx) of the MEP. Using the all zeros address is equivalent to the no form of this command.

one-way-delay-threshold

Syntax **one-way-delay-threshold** *time*

Context config>eth-ring>path>eth-cfm>mep

Description This command enables one way delay threshold time limit.

Default 3 seconds

Parameters *priority* — Specifies the value for the threshold.

Values 0 — 600

shutdown

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

Context config>eth-ring>path>eth-cfm>mep

Description This command administratively enables/disables the MEP.

The **no** form of this command disables/enables the MEP.

Default shutdown

shutdown

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

Context config>eth-ring>path

Description This command administratively enables/disables the path.

The **no** form of this command disables/enables the path.

Default shutdown

shutdown

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

Context config>eth-ring

Description This command administratively enables/disables the ethernet ring.

The **no** form of this command disables/enables the path.

Default shutdown

Eth Tunnel Commands

eth-tunnel

Syntax **eth-tunnel** *tunnel-id*
no eth-tunnel

Context config

Description This command configures a G.8031 protected Ethernet tunnel.

The **no** form of this command deletes the Ethernet tunnel specified by the tunnel-id.

Default no eth-tunnel

Parameters *tunnel-id* — Specifies the tunnel ID.

Values 1 — 64

ccm-hold-time

Syntax **ccm-hold-time** {**down** *down-timeout* **|** **up** *up-timeout*}
no ccm-hold-time

Context config>eth-tunnel

Description This command configures eth-tunnel CCM dampening timers.

The no form of the command reverts to the default.

Default no ccm-hold-time

Parameters **down** *down-timeout* **—** Specfies the eth-tunnel CCM down timers.

Values 0 — 1000 in 100ths of seconds

Default 0

up *up-timeout* **—** Specfies the eth-tunnel CCM up timers.

Values 0 — 5000 in 10ths of seconds

Default 20

description

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

Context config>eth-tunnel

Description This command adds a text description for the eth-tunnel.

The **no** form of this command removes the text description.

Default "Eth-tunnel"

Parameters *string* — Specifies the text description up to 160 characters in length.

ethernet

Syntax **ethernet**

Context config>eth-tunnel

Description This command is the node where Ethernet parameters can be configured.

encap-type

Syntax **encap-type** {**dot1q**|**qinq**}
no encap-type

Context config>eth-tunnel>ethernet

Description This command configures the encapsulation method.

Parameters **dot1q —** Specifies dot1q encapsulation.

qinq — Specifies qinq encapsulation.

mac

Syntax [**no**] **mac** *ieee-address*

Context config>eth-tunnel>ethernet

Description This command assigns a specific MAC address to an Ethernet port, Link Aggregation Group (LAG), Ethernet tunnel 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 BPDUs are sent with the new MAC address.

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

Default A default MAC address is assigned by the system from the chassis MAC address pool.

hold-time

Syntax **hold-time**

Context config>eth-tunnel

Description This command configures eth-tunnel dampening timers.

member

Syntax **member down** *time*
no member

Context config>eth-tunnel>hold-time

Description A default MAC address is assigned by the system from the chassis MAC address pool.This command specifies the timer, which controls the delay between detecting that member path is down and reporting it to the G.8031 protection module. If a non-zero value is configured, the CPM will wait for the time specified in the value parameter before reporting it to the G.8031 protection module. Note that this parameter applies only to member path CCM. It does NOT apply to the member port link state. To damp member port link state transitions, use hold-time parameter from the physical member port.

The **no** form of this command sets the hold-time to the default value.

Default no member - the fault will be reported immediately to the protection module.

Parameters *value* — Specifies the hold-time for reporting the failure.

Values 1-1000 centiseconds

lag-emulation

Syntax **lag-emulation**

Context config>eth-tunnel

Description This command configures eth-tunnel loadsharing parameters.

access

Syntax **access**

Context config>eth-tunnel>lag-emulation

Description This command configures eth-tunnel loadsharing access parameters

adapt-qos

Syntax **adapt-qos** {**distribute** | **link**}
no adapt-qos

Context config>eth-tunnel>lag-emulation>access

Description This command configures how the Ethernet Tunnel group SAP queue and virtual scheduler buffering and rate parameters are adapted over multiple active MDAs.

The **no** form of the command reverts the default.

Default no adapt-qos

Parameters **distribute —** Each MDA will receive a fraction of the SAP and scheduler parameters.

link — The Ethernet Tunnel group will create the SAP queues and virtual schedulers with the actual parameters on each MDA.

per-fp-ing-queuing

Syntax [**no**] **per-fp-ing-queuing**

Context config>eth-tunnel>lag-emulation>access

Description This command configures whether a more efficient method of queue allocation for Ethernet Tunnel Group SAPs should be utilized.

The **no** form of the command reverts the default.

Default **no per-fp-ing-queuing**

path-threshold

Syntax **path-threshold** *num-paths*
no path-threshold

Context config>eth-tunnel>lag-emulation

Description This command configures the behavior for the eth-tunnel if the number of operational members is equal to or below a threshold level

Parameters *num-paths* — Specifies the threshold for the Ethernet Tunnel group.

Values 0 — 15

protection-type

Syntax **protection-type** {**g8031-1to1** | **loadsharing**}

Context config>eth-tunnel

Description This command configures the model used for determining which members are actively receiving and transmitting data.

The **no** form of the command reverts the default.

Default no path-threshold

Parameters **g8031-1to1 —** As per G.8031 spec, only two members are allowed, and only one of them can be active at one point in time.

loadsharing — Multiple members can be active at one point in time.

revert-time

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

Context config>eth-tunnel

Description This command configure how long to wait before switching back to the primary path after it has been restored to Ethernet tunnel.

Th**e n**o form of this command sets the revert-time to the default value.

Default no revert-time – indicates non-revertive behavior.

Parameters *time* — Specifies the re-activation delay in seconds for the primary path.

Values 1 — 720 seconds

path

Syntax [**no**] **path** *path-index*

Context config>eth-tunnel

Description This command configures one of the two paths supported under the Ethernet tunnel. Although the values indicate 1 — 8, only two paths, 1 and 2, are currently supported.

The **no** form of this command removes the path from under the Ethernet tunnel. If this is the last path, the associated SAP need to be un-configured before the path can be deleted.

Default no path

Parameters *path-index* — Specifies the identifier for the path.

Values 1 — 8

description

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

Context config>eth-tunnel>path

Description This command configures a text description for the path.

The **no** form of this command removes the text description.

Default no description

Parameters *description-string* — Specifies a text description.

Values Maximum 80 characters.

member

Syntax **member** *port-id*
no member

Context config>eth-tunnel>path

Description This command associates a port with the path defined under the Ethernet tunnel. If the operator wants to replace an existing member port or control tag, the whole path needs to be shutdown first. The alternate path will be activated as a result keeping traffic interruption to a minimum. Then the whole path must be deleted, the alternate path precedence modified to primary before re-creating the new path.

The following port-level configuration needs to be the same across the two member ports of an Ethernet tunnel:

- port>ethernet>access>{ingress|egress}>queue-group
- port>ethernet>egress-scheduler-policy
- port>access>egress>pool
- port>ethernet>dot1q-etype
- port>ethernet>qinq-etype
- port>ethernet>pbb-etype
- port>ethernet>mtu

The Ethernet tunnel will inherit the configuration from the first member port for these parameters. Additional member port that is added must have the same configuration.

The operator is allowed to update these port parameters only if the port is the sole member of an Ethernet tunnel. This means that in the example below, the operator needs to remove port 1/1/4 and port 1/1/5 before being allowed to modify 1/1/1 for the above parameters.

eth-tunnel 1

path 1

```
        member 1/1/1
    path 2
        member 1/1/4
eth-tunnel 2
    path 1
        member 1/1/1
    path 2
        member 1/1/5
```

The **no** form of this command is used just to indicate that a member is not configured. The procedure described above, based on 'no path' command must be used to un-configure/change the member port assigned to the path.

Default no member

Parameters *port-id* — specifies the port-id associated with the path in the format x/y/z where x represents the IOM, y the MDA and z the port numbers.

control-tag

Syntax **control-tag** *vlan-id*
no control-tag

Context config>eth-tunnel>path

Description This command specifies the VLAN-ID to be used for Ethernet CFM and G.8031 control plane exchanges. If the operator wants to replace an existing control-tag, the parent path needs to be in shutdown state, then deleted and recreated before a new control-tag can be specified.

The **no** form of this command is used just to indicate that a control-tag is not configured. The procedure described above, based on 'no path' command must be used to un-configure/change the control-tag assigned to the path.

Default no control tag specified

Parameters *vlan-id* — specifies the value of the VLAN ID to be used for the control tag.

Values 1 – 4094, untagged option is not supported.

precedence

Syntax **precedence** {**primary | secondary**}
no precedence

Context config>eth-tunnel>path

Description This command specifies the precedence to be used for the path. Only two precedence options are supported: **primary** and **secondary**.

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

Default secondary

Parameters **primary | secondary —** specifies the path precedence as either primary or secondary.

eth-cfm

Syntax **eth-cfm**

Context config>eth-tunnel>path

Description This command enables the context to configure ETH-CFM parameters.

mep

Syntax [**no**] **mep** *mep-id* **domain** *md-index* **association** *ma-index*

Context config>eth-tunnel>path>eth-cfm

Description This command provisions an 802.1ag maintenance endpoint (MEP).

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

Parameters *mep-id* — ppecifies the maintenance association end point identifier.

Values 1 — 81921

md-index — Specifies the maintenance domain (MD) index value.

Values 1 — 4294967295

ma-index — Specifies the MA index value.

Values 1 — 4294967295

ccm-enable

Syntax [**no**] **ccm-enable**

Context config>eth-tunnel>path>eth-cfm>mep

Description This command enables the generation of CCM messages.

The **no** form of the command disables the generation of CCM messages.

ccm-ltm-priority

Syntax **ccm-ltm-priority** *priority*
no ccm-ltm-priority

Context config>eth-tunnel>path>eth-cfm>mep

Description This command specifies the priority value for CCMs and LTMs transmitted by the MEP.

The **no** form of the command removes the priority value from the configuration.

Default The highest priority on the bridge-port.

Parameters *priority* — Specifies the priority of CCM and LTM messages.

Values 0 — 7

eth-test-enable

Syntax [**no**] **eth-test-enable**

Context config>eth-tunnel>path>eth-cfm>mep

Description This command enables eth-test functionality on MEP. For this test to work, operators need to configure ETH-test parameters on both sender and receiver nodes. The ETH-test then can be done using the following OAM commands:

```
oam eth-cfm eth-test mac-address mep mep-id domain md-index
association ma-index [priority priority] [data-length data-length]
```

A check is done for both the provisioning and test to ensure the MEP is an Y.1731 MEP (MEP provisioned with domain format none, association format icc-based). If not, the operation fails. An error message in the CLI and SNMP will indicate the problem.

test-pattern

Syntax **test-pattern** {**all-zeros** | **all-ones**} [**crc-enable**]
no test-pattern

Context config>eth-tunnel>path>eth-cfm>mep>eth-test-enable

Description This command configures the test pattern for eth-test frames.

The **no** form of the command removes the values from the configuration.

Parameters **all-zeros** — Specifies to use all zeros in the test pattern.

all-ones — Specifies to use all ones in the test pattern.

crc-enable — Generates a CRC checksum.

Default all-zeros

low-priority-defect

Syntax **low-priority-defect** {**allDef** | **macRemErrXcon** | **remErrXcon** | **errXcon** | **xcon** | **noXcon**}

Context config>eth-tunnel>path>eth-cfm>mep

Description This command specifies the lowest priority defect that is allowed to generate a fault alarm.

Default remErrXcon

Values

allDef	DefRDICCM, DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM
macRemErrXcon	Only DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM
remErrXcon	Only DefRemoteCCM, DefErrorCCM, and DefXconCCM
errXcon	Only DefErrorCCM and DefXconCCM
xcon	Only DefXconCCM; or
noXcon	No defects DefXcon or lower are to be reported

mac-address

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

Context config>eth-tunnel>path>eth-cfm>mep

Description This command specifies the MAC address of the MEP.

The **no** form of this command reverts the MAC address of the MEP back to that of the port (if the MEP is on a SAP) or the bridge (if the MEP is on a spoke SDP).

Parameters *mac-address — Specifies the MAC address of the MEP.*

Values 6-byte unicast mac-address (xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx) of the MEP. Using the all zeros address is equivalent to the no form of this command.

control-mep

Syntax [**no**] **control-mep**

Context config>eth-tunnel>path>eth-cfm>mep

Description This command enables the usage of the CC state by the Ethernet tunnel manager for consideration in the protection algorithm. The use of control-mep command is recommended if fast failure detection is required, especially when Link Layer OAM does not provide the required detection time.

The **no** form of this command disables the use of the CC state by the Ethernet tunnel manager\.

Default no control-mep

shutdown

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

Context config>eth-tunnel>path>eth-cfm>mep

Description This command administratively enables/disables the MEP.

The **no** form of this command enables the MEP.

Default shutdown

shutdown

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

Context config>eth-tunnel>path
config>eth-tunnel

Description This command administratively enables/disables the path.

The **no** form of this command enables the path.

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 CPM/CFM card.

now — Switch to standby CPM/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 CPM/CFM.

Values *<boot-env|config>* : keywords

Refer to the 7750 SR OS Basic System Configuration Guide.

synchronize

Syntax **synchronize** {**boot-env** | **config**}

Context config>redundancy

Description This command performs a synchronization of the standby CPM/CFM's images and/or config files to the active CPM/CFM. Either the **boot-env** or **config** parameter must be specified.

In the **config>redundancy** context, this command performs an automatically triggered standby CPM/CFM synchronization.

When the standby CPM/CFM takes over operation following a failure or reset of the active CPM/CFM, it is important to ensure that the active and standby CPM/CFMs have identical operational parameters. This includes the saved configuration, CPM and IOM images.This includes the saved configuration, CPM and IOM images.This includes the saved configuration and CFM images.
The active CPM/CFM ensures that the active configuration is maintained on the standby CPM/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 CPM/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

bgp-multi-homing

Syntax **bgp-multi-homing**

Context config>redundancy

Description This command configures BGP multi-homing parameters.

boot-timer

Syntax **boot-timer** *seconds*
no boot-timer

Context config>redundancy>bgp-mh

Description This command specifies how long the service manager waits after a node reboot before running the MH procedures. The boot-timer value should be configured to allow for the BGP sessions to come up and for the NLRI information to be refreshed/exchanged. The boot-timer is activated after the no shutdown command for a MH site executed from configuration. Upon activation, the boot-timer is compared with the system up-time for the node. If the boot timer is higher than the up-time, then the service manager waits for the boot-timer-sys-up-time, then starts the site-activation-timer.

The no form of this command sets the value to 10.

Default 10 sec

Parameters *seconds* — Spcifies the timer, in seconds.

Values 1..100

site-activation-timer

Syntax **site-activation-timer** *seconds*
no site-activation-timer

Context config>redundancy>bgp-mh

Description This command defines the amount of time the service manager will keep the local sites in standby status, waiting for BGP updates from remote PEs befoer running the DF election algorithm to decide whether the site should be unblocked. THe timer is started when one of the following event occurs only if the site is opporationally up:

- Manual site activation using “no shutdown” at site-id level or at member object(s) level (for example, SAP(s) or PW(s)
- Site activation after a failure

The **no** form of this command sets the value to 2.

Default 2 seconds

Parameters *seconds* — Spcifies the timer, in seconds.

Values 1..100

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 20 multi-chassis redundancy peers. Note that is is only for mc-lag (20) not for mc-sync (4).

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 — Mandatory 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 Endpoint Commands

mc-endpoint

Syntax [**no**] **mc-endpoint**

Context config>redundancy>multi-chassis>peer

Description This command specifies that the endpoint is multi-chassis. This value should be the same on both MC-EP peers for the pseudowires that must be part of the same group.

The **no** form of this command removes the endpoint from the MC-EP. Single chassis behavior applies.

bfd-enable

Syntax [**no**] **bfd-enable**

Context config>redundancy>multi-chassis>peer>mc-ep
config>router>rsvp
config>router>bgp
config>router>bgp>group
config>router>bgp>group>neighbor
config>redundancy>multi-chassis>peer>mc-ep

Description This command enables the use of bi-directional forwarding (BFD) to control the state of the associated protocol interface. By enabling BFD on a given protocol interface, the state of the protocol interface is tied to the state of the BFD session between the local node and the remote node. The parameters used for the BFD are set via the BFD command under the IP interface.

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

Default no bfd-enable

boot-timer

Syntax **boot-timer** *interval*
no boot-timer

Context config>redundancy>multi-chassis>peer>mc-ep

Description This command configures the boot timer interval. This command applies only when the node reboots. It specifies the time the MC-EP protocol keeps trying to establish a connection before assuming a failure of the remote peer. This is different from the keep-alives mechanism which is used just after the peer-peer communication was established. After this time interval passed all the mc-endpoints configured under services will revert to single chassis behavior, activating the best local PW.

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

Default 300

Parameters *interval* — Specifies the boot timer interval.

Values 1 — 600

hold-on-neighbor-failure

Syntax **hold-on-neighbor-failure** *multiplier*
no hold-on-neighbor-failure

Context config>redundancy>multi-chassis>peer>mc-ep

Description This command specifies the number of keep-alive intervals that the local node will wait for packets from the MC-EP peer before assuming failure. After this time interval passed the all the mc-endpoints configured under services will revert to single chassis behavior, activating the best local pseudowire.

The **no** form of this command sets the multiplier to default value

Default 3

Parameters *multiplier* — Specifies the hold time applied on neighbor failure.

Values 2 — 25

keep-alive-interval

Syntax **keep-alive-interval** *interval*
no keep-alive-interval

Context config>redundancy>multi-chassis>peer>mc-ep

Description This command sets the interval at which keep-alive messages are exchanged between two systems participating in MC-EP when bfd is not enabled or is down. These fast 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 5 (0.5s)

Parameters *interval* — The time interval expressed in deci-seconds.

Values 5 — 500 (tenths of a second)

passive-mode

Syntax [**no**] **passive-mode**

Context config>redundancy>multi-chassis>peer>mc-ep

Description This command configures the passive mode behavior for the MC-EP protocol. When in passive mode the MC-EP pair will be dormant until two of the pseudowires in a MC-EP will be signaled as active by the remote PEs, being assumed that the remote pair is configured with regular MC-EP. As soon as more than one pseudowire is active, dormant MC-EP pair will activate. It will use the regular exchange to select the best pseudowire between the active ones and it will block the Rx and Tx directions of the other pseudowires.

The **no** form of this command will disable the passive mode behavior.

Default no passive-mode

system-priority

Syntax **system-priority** *value*
no system-priority

Context config>redundancy>multi-chassis>peer>mc-ep

Description This command allows the operator to set the system priority. The peer configured with the highest value is chosen to be the Master. If system-priority are equal then the one with the lowest system-id (chassis MAC address) is chosen as the Master.

The **no** form of this command sets the system priority to default

Default 0

Parameters *value* — Specifies the priority assigned to the local MC-EP peer.

Values 1— 255

MC LAG Commands

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 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** *remote-lag-id*] **system-priority** *system-priority* **source-bmac-lsb** *use-lacp-key*
lag *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *remote-lag-id*] **system-priority** *system-priority* **source-bmac-lsb** *MAC-Lsb*
lag *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *remote-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. 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 — 200 (7750 SR-1 and 7750 SR-c12/4: 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 — 200

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-bmac-lsb *MAC-Lsb* **—** Configures the last 16 bit of the MAC address to be used for all traffic ingressing the MC-LAG link(s) or if use-lacp-key option is used, it will onlycopy the value of lacp-key (redundancy multi-chassis mc-lag lag lacp-key admin-key). The command will fail if the *value* is the same with any of the following configured attributes:

- source-bmac-lsb assigned to other MC-LAG ports

- lsb 16 bits value for the source-bmac configured at chassis or BVPLS level

The first 32 bits will be copied from the source BMAC of the BVPLS associated with the IVPLS for a specific IVPLS SAP mapped to the MC-LAG. The BVPLS source BMAC can be provisioned for each BVPLS or can be inherited from the chassis PBB configuration.

Values 1 — 65535 or xx-xx or xx:xx

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 **Values** 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 **Values** 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.

Values *service-id*: 1 — 2147483647

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

Values *service-id*: 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

Forwarding Plane Commands

fp

Syntax **fp** [*fp-number*]

Context config>card

Description This command enables the context to configure multicast path management commands for IOM-3 ingress multicast management. Ingress multicast management manages multicast switch fabric paths which are forwarding plane specific. On IOM-1 and IOM-2, each MDA has a dedicated forwarding plane and so have dedicated multicast paths to the switch fabric allowing the multicast management to be defined per MDA. IOM-3 has a single forwarding plane shared by two MDAs. The fp node simplifies ingress multicast management on IOM-3.

While IOM-3 only has a single forwarding plane. In future releases, to accommodate multiple forwarding planes, each forwarding plane will be assigned a value. The default forwarding plane is 1. When entering the fp node, if the forwarding plane number is omitted, the system will assume forwarding plane number 1.

Parameters *fp-number* — The fp-number parameter is optional following the **fp** command. If omitted, the system assumes forwarding plane number 1.

Values 1

Default 1

egress

Syntax **egress**

Context config>card>fp

Description This command enables the egress **fp** node that contains the multicast path management configuration commands for IOM-3 ingress multicast management.

wred-queue-control

Syntax **wred-queue-control**

Context config>card>fp>egress

Description This command enables the context to configure the aggregate WRED queue parameters for all WRED queues on an egress IOM3-XP forwarding plane.

buffer-allocation

Syntax **buffer-allocation min** *percentage* **max** *percentage*
no buffer-allocation

Context config>card>fp>egress>max-wred-control

Description The buffer-allocation command defines the amount of IOM3-XP buffers that will be set aside for WRED queue buffer pools. **Note** that the **min** *percentage* and max *percentage* parameters must be set to the same value. The IOM3-XP protects against cross application buffer starvation by implementing a hierarchy of buffer pools. At the top of the hierarchy are mega-pools. Mega-pools are used to manage buffers at a system application level. Two mega-pools are currently used by the system. The first (default) mega-pool services all non-WRED type queues and when WRED queues are not enabled will contain all available forwarding plane queue buffers. When WRED queuing is enabled, the second mega-pool (the WRED mega-pool) is given buffers from the default mega-pool based on the buffer-allocation command and the size if further fine-tuned by the forwarding class oversubscription factors.

The mega-pools provide buffers to the second tier buffer pools. The default mega-pool services all default pools and explicitly created named pools. As the name implies, the WRED mega-pool services all the WRED buffer pools created for the WRED queues. The WRED mega-pool allows each WRED queue pool to be configured to an appropriate size while allowing the sum of the WRED queue pool sizes to oversubscribe the total amount set aside for WRED queue buffering without affecting the queues using the default or named pools. Further oversubscription controls are described within the resv-cbs command later in this document.

The WRED mega-pool is allowed to expand between the min and max percent of total forwarding plane buffers based on the sum of the WRED queue sizes and the WRED oversubscription factors. As the WRED mega-pool grows, the number of buffers available to the default mega-pool will shrink. If the WRED mega-pool shrinks, the default mega-pool will grow accordingly. When min and max are defined as the same value, the WRED mega-pool size will not fluctuate and the oversubscription factors will have no effect.

No buffers are allocated to the WRED mega-pool until the wred-queue-control shutdown command is set to no shutdown. When the shutdown command is executed, all buffers allocated to the WRED mega-pool are returned to the default mega-pool and all WRED queues are returned either to their default buffer pool or their specified named buffer pool.

FC MBS Oversubscription Factors and WRED Mega-Pool Sizing

Each WRED queue in a SAP egress QoS policy is created on an egress IOM3-XP when the policy is applied to an egress SAP on the IOM and at least one forwarding class is mapped to the queue. For WRED queue buffer management purposes, each forwarding class is configured with an MBS oversubscription factor (OSF) on the IOM using the osf command. The MBS oversubscription factor is used by the system as a provisioning parameter that defines the acceptable level of oversubscription between the sum of the maximum buffer sizes (mbs) of the WRED queues for a given class and the number of buffers for that class in the WRED mega-pool. Since multiple forwarding classes may be mapped to the same queue, the oversubscription factor associated with the highest forwarding class mapped is used for dynamically sizing the WRED mega-pool.

As an example, when a WRED queue is configured with the following attributes:

- MBS equal to 10Kbytes

- AF as the highest forwarding class mapped

And the forwarding plane on the IOM3-XP is configured with the following WRED limits:

- Current WRED mega-pool is sized at 500Kbytes
- AF MBS oversubscription factor is 2 (2:1)

The system will increase the WRED mega-pool size to 505Kbytes (increase of 10Kbytes/2) as long as the maximum buffer allocation percentage equates to a value equal to or greater than 505Kbytes. (If not, the WRED mega-pool will be capped at the maximum level.)

The **no** form of the command immediately restores the default min and max percentage values for sizing the WRED mega-pool.

Parameters **min** *percent-of-total* **—** This required keyword defines the minimum percentage of total IOM3-XP queue buffers that will be applied to the WRED mega-pool. The value given for percent-of-total must be less than or equal to the value given for the **max** *percent-of-total*. Percentages are defined with an accuracy of hundredths of a percent in the nn.nn format (15.65 = 15.65%).

Values 0.00 — 99.99

Default 25.00

max *percent-of-total* **—** This required keyword defines the maximum percentage of total IOM3-XP queue buffers that may be applied to the WRED mega-pool. The value given for percent-of-total must be greater than or equal to the value given for the **min** *percent-of-total*. Percentages are defined with an accuracy of hundredths of a percent in the nn.nn format (15.65 = 15.65%).

Values 0.01 — 99.99

Default 25.00

resv-cbs

Syntax **resv-cbs min** *percentage* **max** *percentage*
no resv-cbs

Context config>card>fp>egress>max-wred-control

Description This command defines the amount of IOM3-XP buffers within the WRED mega-pool that will be set aside for WRED queues operating within their configured CBS thresholds. **Note** that the **min** *percentage* and **max** *percentage* parameters must be set to the same value. The IOM3-XP protects against WRED queue buffer starvation by setting aside a portion of the buffers within the WRED mega-pool. The WRED queue CBS threshold defines when a WRED queue requests buffers from reserved portion of the WRED mega-pool and when it starts requesting buffers from the shared portion of the mega-pool. With proper oversubscription provisioning, this prevents a seldom active queue from being denied a buffer from the mega-pool when the shared portion of the mega-pool is congested. Further control over shared congestion is defined later in this document under the slope-policy command.

The WRED mega-slope reserve CBS size is controlled in the same manner as the overall sizing of the WRED mega-pool. A min and max parameter is provided to scope the range that the reserved portion based on percentages of the WRED mega-pool current size. Forwarding class cbs-factor settings are used in the same way as the mbs-factor parameters to move the actual reserved size between the minimum and maximum thresholds according to appropriate oversubscription factors that are applied to the sum of the WRED queue CBS values.

When min and max are defined as the same value, the WRED mega-pool size will not fluctuate and the oversubscription factors will have no effect.

FC CBS Oversubscription Factors and WRED CBS Reserve Sizing

Each WRED queue in a SAP egress QoS policy is created on an egress IOM3-XP when the policy is applied to an egress SAP on the IOM and at least one forwarding class is mapped to the queue. For WRED queue CBS buffer management purposes, each forwarding class is configured with a CBS oversubscription factor (OSF) on the IOM using the osf command. The CBS oversubscription factor is used by the system as a provisioning parameter that defines the acceptable level of oversubscription between the sum of the committed buffer sizes (CBS) of the WRED queues for a given class and the number of buffers for that class that should be placed in the WRED mega-pool CBS reserve. Since multiple forwarding classes may be mapped to the same queue, the oversubscription factor associated with the highest forwarding class mapped is used for dynamically sizing the WRED mega-pool CBS reserve.

As an example, when a WRED queue is configured with the following attributes:

- CBS equal to 6Kbytes
- AF as the highest forwarding class mapped

And the forwarding plane on the IOM3-XP is configured with the following WRED limits:

- Current WRED mega-pool CBS reserve is sized at 100Kbytes
- AF CBS oversubscription factor is 2 (2:1)

The system will increase the WRED mega-pool CBS reserve size to 103Kbytes (increase of 6Kbytes/2) as long as the maximum buffer allocation percentage for resv-cbs equates to a value equal to or greater than 103Kbytes. (If not, the WRED mega-pool CBS reserve will be capped at the maximum level.)

The **no** form of the command immediately restorse the default min and max percentage values for sizing the WRED mega-pool CBS reserve.

Parameters **min** *percent-of-total* **—** This required keyword defines the minimum percentage of the IOM3-XP WRED mega-pool buffers that will be applied to the CBS reserve. The value given for percent-of-wred must be less than or equal to the value given for the max percent-of-wred. Percentages are defined with an accuracy of hundredths of a percent in the nn.nn format (15.65 = 15.65%).

Values 0.00 — 99.99

Default 25.00

max *percent-of-total* **—** This required keyword defines the maximum percentage of the IOM3-XP WRED mega-pool buffers that may be applied to the CBS reserve. The value given for percent-of-wred must be greater than or equal to the value given for the min percent-of-wred. Percentages are defined with an accuracy of hundredths of a percent in the nn.nn format (15.65 = 15.65%).

Values 0.01 — 99.99

Default 25.00

slope-policy

Syntax **slope-policy** *slope-policy-name*
no slope-policy

Context config>card>fp>egress>max-wred-control

Description This command command configures WRED slopes within the WRED mega-pool. The WRED slopes in the WRED mega-pool are used when WRED queues are requesting buffers from the mega-pool while they are over their CBS threshold. Once over the CBS threshold, the WRED queue stops receiving buffers from the CBS reserve in the mega-pool and starts competing for buffers in the shared portion of the mega-pool. If the packet resulting in the buffer request is in-profile, the packet will be associated with the high priority slope. Out-of-profile packets are associated with the low priority slope. While the queue is within its CBS threshold, the slopes are ignored.

Within the defined slope-policy, each slope is enabled or disabled (no shutdown or shutdown) and each slope's geometry is defined as percentages of shared portion depth.

The slope-policy also defines the time average factor (taf) value that is used to determine how the pool's weighted average depth is calculated. The higher the factor, the slower the average depth tracks the actual pool depth.

The **no** form of the command restores the default slope policy to the WRED mega-pool.

Parameters *slope-policy-name* — This required parameter specifies which slope policy the system should apply to the WRED mega-pool. When slope-policy is not executed, the WRED mega-pool will use the default slope policy. The defined slope policy must already exist or the command will fail.

Default When not defined, the default slope policy is used

hi-bw-mcast-src

Syntax **hi-bw-mcast-src** [**alarm**] [**group** *group-id*]
no hi-bw-mcast-src

Context config>card>fp

Description This command designates the forwarding plane as a high-bandwidth IP multicast source, expecting the ingress traffic to include high-bandwidth IP multicast traffic. When configured, the system attempts to allocate a dedicated multicast switch fabric plane (MSFP) to the forwarding plane. If a group is specified, all MDAs in the group will share the same MSFP. If the alarm parameter is specified and the system cannot allocate a dedicated MSFP to the new group or MDA, the MDAs will be brought online and generate an event (SYSTEM: 2052 - mdaHiBwMulticastAlarm). Similarly, if during normal operation there is a failure or removal of resources, an event will be generated if the system cannot maintain separation of MSFPs for the MDAs.

This feature is supported on the 7750 SR-7 and 7750 SR-12.

The **no** form of the command removes the high-bandwidth IP multicast source designation from the forwarding plane.

Default no hi-bw-mcast-src

Parameters **alarm —** Enables event generation if the MDA is required to share an MSFP with another MDA that is in a different group. MDAs within the same group sharing an MSFP will not cause this alarm.

group *group-id* **—** Specifies the logical MSFP group for the MDA. MDAs configured with the same *group-id* will be placed on the same MSFP.

Values 0 — 32 (A value of 0 removes the MDA from the group.)

Default By default, "none" is used, and the system will attempt to assign a unique MSFP to the MDA.

shutdown

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

Context config>card>fp>egress>max-wred-control

Description This command enables or disables egress WRED queue support on the IOM. By default, WRED queue support is disabled (shutdown). While disabled, the various wred-queue-control commands may be executed on the IOM and SAP egress QoS policies with wred-queue enabled may be applied to egress SAPs. The IOM will allocate WRED pools to the WRED queues and the appropriate WRED mega-pool size and CBS reserve size will be calculated, but the WRED mega-pool will be empty and all buffers will be allocated to the default mega-pool. Each WRED queue will be mapped to either its appropriate default pool or an explicitly defined named pool.

Once the **no shutdown** command is executed, the calculated WRED mega-pool buffers will be moved from the default mega-pool to the WRED mega-pool. The WRED mega-pool CBS reserve size will be applied and each egress WRED queue will be moved from its default mega-pool buffer pool to its WRED pool within the WRED mega-pool hierarchy.

The **no** form of the command enables WRED queuing on an egress IOM3-XP.

ingress

Syntax **ingress**

Context config>card>fp

Description The ingress CLI node within the **fp** node contains the multicast path management configuration commands for IOM-3 ingress multicast management. The **bandwidth-policy** command is supported within the ingress node.

mcast-path-management

Syntax **mcast-path-management**

Context config>card>fp>ingress
config>card>mda>ingress

Description This CLI node contains the forwarding plane or MDA settings for ingress multicast path management. Enter the node to configure the bandwidth-policy, the individual path bandwidth overrides and the administrative state of ingress multicast path management.

bandwidth-policy

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

Context config>card>fp>ingress>mcast-path-management
config>card>mda>ingress>mcast-path-management

Description This command is used to explicitly associate a bandwidth policy to a forwarding plane or MDA. The bandwidth policy defines the dynamic rate table and the multicast paths bandwidth and queuing parameters.

If a bandwidth policy is not explicitly associated with a forwarding plane or MDA, the default bandwidth policy is used when ingress multicast path management is enabled.

The **no** form of the command removes an explicit bandwidth policy from a forwarding plane or MDA and restores the default bandwidth policy.

Parameters *policy-name* — The policy-name parameter is required and defines the bandwidth policy that should be associated with the MDA or forwarding plane for ingress multicast path management. If the policy name does not exist, the bandwidth-policy command will fail.

Values Any existing bandwidth policy name

Default default

primary-override

Syntax **primary-override**

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

Description This command enables the context to configure MDA ingress multicast path-limit overrides.

The path override CLI nodes are not supported on IOM-3.

secondary-override

Syntax **secondary-override**

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

Description This command enables the context to configure MDA ingress multicast path-limit overrides.

The path override CLI nodes are not supported on IOM-3.

ancillary-override

Syntax **ancillary-override**

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

Description This command enables the context to configure MDA ingress multicast path-limit overrides.

path-limit

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

Context config>card>mda>ingress>mcast-mgmt>primary-override
config>card>mda>ingress>mcast-mgmt>secondary-override
config>card>mda>ingress>mcast-mgmt>ancillary-override

Description The path-limit command is used to override the path limits contained in the bandwidth policy associated with the MDA. The path limits are used to give the upper limit that multicast channels may use on each path.

The path-limit commands are not supported on IOM-3.

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

Parameters *megabits-per-second* — The megabits-per-second parameter is required when executing the path-limit command and is expressed as an integer representing multiples of 1,000,000 bits per second.

Values
Primary-override: 1 to 2000
Secondary-override: 1 to 2000
Ancillary-override: 1 to 5000

Default None

cpm

Syntax **cpm**

Context tools>dump>mcast-path-mgr

Description This command dumps multicast path manager CPM information.

Sample Output

```
*A:Dut-C# tools dump mcast-path-mgr cpm
McPathMgr[10][0]: 0x763a52c0 blkHoleEval 0
     pPath     swPlaneID     pathType      availBw    pathLimit
inUseBw    maxUsedBw numSGs
```

```
0x763a54c8            2    secondary      1800000
1800000           0            0      0
0x763a56c0            1      primary      1039959      2000000
960041       960041      6
0x763a58b8           15      primary       879910      2000000
1120090      1120090      7
0x763a5ab0           14      primary       879908      2000000
1120092      1120092      7
0x763a5ca8           13      primary       880007      2000000
1119993      1119993      7
0x763a5ea0           12      primary       880172      2000000
...
0x763a7448            0         none            0
0            0            0      0
0x763a7640            0    blackhole            0
0            0            0      0
McPathMgr[8][0]: 0x7639a9d8 blkHoleEval 0
     pPath     swPlaneID     pathType      availBw    pathLimit
inUseBw    maxUsedBw numSGs
0x7639abe0            1    secondary      1800000
1800000           0            0      0
0x7639add8           15      primary      2000000
2000000           0            0      0
0x7639afd0           14      primary      2000000
...0x7639cd58            0    blackhole            0
0            0            0      0
McPathMgr[9][0]: 0x76398420 blkHoleEval 0
     pPath     swPlaneID     pathType      availBw    pathLimit
inUseBw    maxUsedBw numSGs
0x76398628           15    secondary      1800000
1800000           0            0      0
0x76398820           14      primary      2000000
2000000           0            0      0
0x76398a18           13      primary      2000000
2000000           0            0      0
...
0x7639a7a0            0    blackhole            0
0            0            0      0
SwPlane[0]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98ba320      2000000      2000000            0      2000000
1800000           0      1800000
SwPlane[1]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98ba390      2000000      2000000       960041      1039959
1800000           0      1039959
###################################

stype inst             src             grp currBw pathBw pref repl path exp
    0    1      10.10.6.33      227.0.0.23 159891 159891    0    0    P   N
    0    1      10.10.4.10       225.0.0.0 159990 159990    0    0    P   N
    0    1      10.10.4.27      225.0.0.17 159990 159990    0    0    P   N
    0    1      10.10.4.43      225.0.0.33 159993 159993    0    0    P   N
    0    1      10.10.6.47      227.0.0.37 160049 160049    0    0    P   N
    0    1      10.10.4.59      225.0.0.49 160128 160128    0    0    P   N
SwPlane[2]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
```

```
secBw   secInUseBw   secAvailBw
0x98ba400      2000000      2000000      1119789       880211
1800000            0       880211
###################################
...
###################################

stype inst             src             grp currBw pathBw pref repl path exp
    0    1      10.10.6.29      227.0.0.19 159891 159891    0    0    P   N
    0    1      10.10.4.28      225.0.0.18 159989 159989    0    0    P   N
    0    1      10.10.4.11       225.0.0.1 159990 159990    0    0    P   N
    0    1      10.10.4.41      225.0.0.31 159992 159992    0    0    P   N
    0    1      10.10.6.43      227.0.0.33 160049 160049    0    0    P   N
    0    1      10.10.6.58      227.0.0.48 160052 160052    0    0    P   N
    0    1      10.10.4.55      225.0.0.45 160127 160127    0    0    P   N
SwPlane[16]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98baa20      2000000      2000000            0      2000000
1800000            0      1800000
SwPlane[17]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98baa90      2000000      2000000            0      2000000
1800000            0      1800000
SwPlane[18]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98bab00      2000000      2000000            0      2000000
1800000            0      1800000
SwPlane[19]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98bab70      2000000      2000000            0      2000000
1800000            0      1800000
SwPlane[20]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
0x98babe0      2000000      2000000            0      2000000
1800000            0      1800000
SwPlane[21]
  pSwPlane      totalBw        priBw   priInUseBw   priAvailBw
secBw   secInUseBw   secAvailBw
```

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.

Output **Chassis Output —** The following table describes chassis output fields.

Label	Description
`Name`	The system name for the router.
`Type`	Displays the router 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 IOM/CCM slot(s) and the CPM/CFM slots.

Label	Description (Continued)
`Number of ports`	The total number of ports currently installed in this chassis. This count does not include the Ethernet ports on the CPMs/CFMs that are used for management access.
`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 CPM's/CFM's part number.
`CLEI code`	The code used to identify the router.
`Serial number`	The CPM's/CFM's 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.

Label	Description (Continued)
`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.
`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

Sample Output

```
ALA-1# show chassis
=====================================================
Chassis Information
=====================================================
    Name                            : Dut-D
    Type                            : 7750 SR-7
    Location                        :
    Coordinates                     :
    CLLI code                       :
    Number of slots                 : 7
    Number of ports                 : 19
    Critical LED state              : Off
    Major LED state                 : Off
    Minor LED state                 : Off
    Base MAC address                : 00:03:fa:14:cf:a7
    Admin chassis mode              : a
    Oper chassis mode               : a

Hardware Data
    Part number                     : 3HE00186AAAA01
    CLEI code                       :
    Serial number                   : NS042450133
    Manufacture date                : 06172004
    Manufacturing string            :
    Manufacturing deviations        :
    Time of last boot               : 2007/04/11 09:37:51
    Current alarm state             : alarm cleared
```

```
Environment Information
    Number of fan trays           : 2
    Number of fans                : 4

    Fan tray number               : 1
    Status                        : up
    Speed                         : half speed

    Fan tray number               : 2
    Status                        : up
    Speed                         : half speed

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
=====================================================
ALA-1#

A:ALA-4# show chassis environment
=============================================================================
Chassis Information
Environment Information
    Number of fan trays           : 1
    Number of fans                : 2

    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   : dc
    Status                        : up

    Power supply number           : 2
    Defaulted power supply type   : dc
    Status                        : up
===============================================================================
A:ALA-4#


A:7750-3# show chassis ccm
===============================================================================
```

```
Chassis Information
===============================================================================
Chassis Control Module (CCM) Information
    CCM number                        : 1
    Equipped                          : yes
    Type                              : ccm-xp

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:7750-3>
```

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 Depending on the chassis model, IOM slots can be numbered from 1 - 10
SF/CPM slots are A, B (upper or lowercase)

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:ALU-48# show card
===============================================================================
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom3-xp             iom3-xp             up         up
2         iom3-xp             iom3-xp             up         up
```

```
3        iom3-xp            iom3-xp            up         up
4        iom3-xp                               up         provisioned
5        iom3-xp                               up         provisioned
6        iom3-xp                               up         provisioned
7        iom3-xp                               up         provisioned
8        iom3-xp                               up         provisioned
9        iom3-xp                               up         provisioned
10       iom3-xp                               up         provisioned
A        sfm3-12            sfm3-12            up         up/standby
B        sfm3-12            sfm3-12            up         up/active
===============================================================================
A:ALU-48#
A:ALA-48# show card 1
===============================================================================
Card Summary
===============================================================================
Slot     Provisioned        Equipped           Admin      Operational
         Card-type          Card-type          State      State
-------------------------------------------------------------------------------
1        iom-xp          iom-xp          up         up
A        cfm-xp          cfm-xp          up         up/active
B        cfm-xp                             up         down/standby
===============================================================================
A:ALA-48#
A:ALA-50# show card 1
===============================================================================
Card Summary
===============================================================================
Slot Provisioned Equipped Admin Operational
Card-type Card-type State State
-------------------------------------------------------------------------------
1 iom-c4-xp  iom-c4-xp up up
A cfm-c4-xp cfm-c4-xp up up/active
B cfm-c4-xp up down/standby
===============================================================================
A:ALA-50#
```

Show CardState 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.

Label	Description (Continued)
Num MDA	The number of MDAs installed.
Comments	Indicates whether the SF/CPM is the active or standby.

Sample Output

```
A:ALA-48# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
MDA    Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-20g          iom-20g          up    up                  2
1/1    m60-10/100eth-tx m60-10/100eth-tx up    up            60
1/2    m60-10/100eth-tx m60-10/100eth-tx up    up            60
2      iom-20g                           up    provisioned         2
2/1    m10-1gb-sfp                       up    provisioned   10
2/2    m8-oc12/3-sfp                     up    provisioned   8
3      iom-20g                           up    provisioned         2
3/1    m12-chds3                         down  provisioned   12
3/2    m4-atmoc12/3-sfp                  up    provisioned   4
4      iom-20g                           up    provisioned         2
4/1    m12-chds3                         up    provisioned   12
4/2    m1-choc12-sfp                     up    provisioned   1
5      iom-20g                           up    provisioned         2
5/1    m1-oc192                          down  provisioned   1
5/2    m12-chds3                         down  provisioned   12
6      iom-20g                           up    provisioned         2
6/1    m12-chds3                         up    provisioned   12
6/2    m1-choc12-sfp                     up    provisioned   1
7      iom-20g                           up    provisioned         2
7/1    m12-chds3                         up    provisioned   12
7/2    m1-choc12-sfp                     up    provisioned   1
8      iom-20g                           up    provisioned         2
8/1    m8-oc12/3-sfp                     up    provisioned   8
8/2    m1-choc12-sfp                     up    provisioned   1
9      iom-20g                           up    provisioned         2
9/1    m20-1gb-sfp                       up    provisioned   20
9/2    m4-atmoc12/3-sfp                  up    provisioned   4
10     iom-20g                           up    provisioned         2
10/1   vsm-cca                           up    provisioned   6
10/2   vsm-cca                           up    provisioned   6
A      sfm3-12          sfm-400g         up    up                      Active
B      sfm3-12                           up    provisioned             Standby
===============================================================================
A:ALA-48#
The following example displays the card state for a 7750 SR-c12.
A:7750-3>config>card# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
```

```
1      iom-xp          iom-xp           up    up                  12
1/1    mcm-xp           mcm-xp          up    up
1/3                     mcm-xp          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-xp           cfm-xp          up    up                      Active
B      cfm-xp                           up    down                    Standby
===============================================================================
A:7750-3>
```

Show Card Detail Output — The following table describes detailed card output fields.

Label	Description
`Clock source`	Source of clock for the IOM. Note: Currently this parameter always displays 'none'
`Available MDA slots`	The number of MDA slots available on the IOM.
`Installed MDAs`	The number of MDAs installed on the IOM
`Part number`	The IOM 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 by 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.

Label	Description (Continued)
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.
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:ALA-49# show card 3 detail
===============================================================================
Card 3
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
3         iom2-20g                                up         provisioned

IOM Card Specific Data
    Clock source                  : none
    Available MDA slots           : 2
    Installed MDAs                : 0

Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 :
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : provisioned
    Software boot version         :
    Software version              :
    Time of last boot             : N/A
    Current alarm state           : alarm cleared
    Base MAC address              : 00:00:00:00:00:00
    Memory capacity               : 0 MB
===============================================================================
A:ALA-49#
```

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.
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.

Label	Description (Continued)
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.
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

```
B:Dut-D# show card
===============================================================================
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-20g             iom-20g             up         up
2         iom-20g             iom-20g             up         up
A         sfm-400g            sfm-200g            up         up/standby
B         sfm-400g            sfm-200g            up         up/active
===============================================================================
B:Dut-D#


B:Dut-D# show card A detail
```

```
===============================================================================
Card A
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
A         sfm-400g            sfm-200g            up         up/standby


BOF last modified                 : N/A
Config file version               :
Config file last modified         : N/A
Config file last saved            : N/A
CPM redundancy status             : standby ready

Flash - cf1:
    Administrative State          : up
    Operational state             : not equipped

Flash - cf2:
    Administrative State          : up
    Operational state             : not equipped

Flash - cf3:
    Administrative State          : up
    Operational state             : up
    Serial number                 :     109917C1204W513
    Firmware revision             : HDX 2.1
    Model number                  : SanDisk SDCFBI-128
    Size                          : 125,038 KB
    Free space                    : 116,238 KB

Hardware Data
    Part number                   : 3HE00316AAAA01
    CLEI code                     : IPUCACMFAA
    Serial number                 : NS043610538
    Manufacture date              : 02252005
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 43C
    Temperature threshold         : 75C
    Software boot version         : X-2.0.R12 on Mon Jan 24 12:03:16 PST 2007 *
    Software version              : TiMOS-C-4.0.private cpm/hops ALCATEL SR 77*
    Time of last boot             : 2007/04/11 09:39:23
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:30:7c:3c
    Memory capacity               : 2,016 MB
===============================================================================
B:Dut-D#
```

elmi

Syntax **elmi**

Context show

Description This command displays Ethernet Link Management Interface (eLMI) information.

ELMI Output — The following table describes eLMI output fields.

Field	Description
`Link Status`	Status of the E-LMI protocol when the elmi mode is set to uni-n. Link Status will indicate up if eLMI mode is set to "none".
`T391`	pooling timer used by UNI-C. UNI-N will send the consecutive single EVC asynchronous status messages every (T391/10) rounded to the second interval.
`T392`	Pooling verification timer for UNI-N
`N393`	Status counter for UNI-N
`Rx Enq. Time`	Last time when a status enquiry message was received from UNI-C.
`Rx Enq Msg`	Number of status enquiry messages received.
`Rx Check Time`	Last time when a status enquiry E-LMI check message was received.
`Rx Inv. SeqNum`	Counts the number of E-LMI messages received with invalid sequence number.
`Enq Timeouts`	Counts the number of T392 timer expired.
`Tx Status Time`	Last time when a status message was sent by UNI-N.
`Tx Status Msg`	Number of status messages sent by UNI-N.
`Tx Check Time`	Last time when a status eLMI check message was sent by UNI-N.
`Tx Async Status Msg`	Counter for single EVC asynchronous status messages sent by UNI-N.
`Discard Msg`	Counter for the status enquiry messages discarded due to errors.

evc

Syntax **evc** [*port-id* [**vlan** *vlan-id*]]

Context show>elmi

Description This command displays Ethernet Virtual Connections (EVC). No argument displays all the EVC on the service router. The port and VLAN arguments display information related to EVC associated with the port and VLAN.

Parameters *port-id* — Displays information related to the EVCs configured on the port

Values slot/mda/port

vlan *vlan-id* **—** Specifies the VLAN Identifier of the EVC.

Values 0 — 4094, *

Sample Output

```
*A:Dut-C# show elmi evc
===============================================================================
ELMI EVC Table
===============================================================================
Port      Vlan  Status    Type  Evc Id
-------------------------------------------------------------------------------
1/1/1     10    New-Act   P2p   EVC11110
1/1/3     30    New-Act   P2p   EVC11220
1/1/5     100   Act       P2p   EVC115100
1/1/5     200   Act       P2p   EVC115200
-------------------------------------------------------------------------------
Number of Evcs : 4
===============================================================================
*A:Dut-C#


A:Dut-C# show elmi evc 1/1/5
===============================================================================
ELMI EVC Table
===============================================================================
Port      Vlan  Status    Type  Evc Id
-------------------------------------------------------------------------------
1/1/5     100   Act       P2p   EVC115100
1/1/5     200   Act       P2p   EVC115200
-------------------------------------------------------------------------------
Number of Evcs : 2
===============================================================================
A:Dut-C#


*A:Dut-C# show elmi evc 1/1/5 vlan 100
===============================================================================
Evc Detailed Information
===============================================================================
Port          : 1/1/5                     vlanId        : 100
Evc Status    : Act                       Evc Type      : P2p
Evc Identifier: EVC115100
===============================================================================
*A:Dut-C#
```

uni

Syntax **uni** [*port-id*]

Context show>elmi

Description This command displays information about ELMI (mode, status, number of EVCs (SAPs) configure on the port for all the ports on the service router.

Parameters *port-id* — Displays UNI information for the specified port.

Sample Output

```
*A:Dut-C# show elmi uni
===============================================================================
ELMI UNI-N Table
===============================================================================
Port     Mode  Status   #Evcs Uni Identifier
-------------------------------------------------------------------------------
1/1/1    None  Up       0     10/100 Ethernet TX
1/1/2    None  Up       0     port-21
1/1/3    None  Up       0     10/100 Ethernet TX
1/1/4    None  Up       0     10/100 Ethernet TX
1/1/5    Uni-N Up       2     UNI115
1/1/6    None  Up       0     10/100 Ethernet TX
1/1/7    None  Up       0     10/100 Ethernet TX
1/1/8    None  Up       0     10/100 Ethernet TX
1/1/9    None  Up       0     10/100 Ethernet TX
1/1/10   None  Up       0     10/100 Ethernet TX
1/1/11   None  Up       0     10/100 Ethernet TX
1/1/12   None  Up       0     10/100 Ethernet TX
1/1/13   None  Up       0     10/100 Ethernet TX
1/1/14   None  Up       0     10/100 Ethernet TX
1/1/15   None  Up       0     10/100 Ethernet TX
1/1/16   None  Up       0     10/100 Ethernet TX
1/1/17   None  Up       0     10/100 Ethernet TX
...
===============================================================================
*A:Dut-C#


*A:Dut-C# show elmi uni 1/1/5
===============================================================================
Uni-N Detailed Information
===============================================================================
Uni Mode      : Uni-N                  Link Status         : Up
Uni Identifier: UNI115
T391          : 10 seconds             T392                : 15 seconds
N393          : 4                      UniType             : Bundling
Rx Enq. Time  : 02/18/2010 17:11:44    Tx Status Time      : 02/18/2010 17:11:44
Rx Enq Msg    : 24                     Tx Status Msg       : 24
Rx Check Time : 02/18/2010 17:12:34   Tx Check Time       : 02/18/2010 17:12:34
Rx Inv. SeqNum: 0                     Tx Async Status Msg : 0
Enq Timeouts  : 0                     Discard Msg         : 0
===============================================================================
*A:Dut-C#
```

eth-tunnel

Syntax **eth-tunnel**

Context show

Description This command displays Ethernet tunnel information.

Sample

```
*A:PE-E# show eth-tunnel
===============================================================================
Ethernet Tunnel Groups
===============================================================================
Tunnel Admin  Oper   Protection    Active Paths
ID     State  State  Type           1  2  3  4  5  6  7  8
-------------------------------------------------------------------------------
1      Up     Up     g.8031-1to1     x  2
2      Up     Up     g.8031-1to1     1  x
===============================================================================
*A:PE-E#
*A:PE-E# show eth-tunnel aps
===============================================================================
Ethernet Tunnel APS Groups
===============================================================================
Tunnel Admin  Oper   Working Path           Path   Active Rx PDU
ID     State  State  Protecting Path        State  Path   Tx PDU
-------------------------------------------------------------------------------
1      Up     Up     1 - 1/1/2 1            Down   No     BF010100 (  SF)
                     2 - 2/1/2 1            Up     Yes    BF010100 (  SF)
2      Up     Up     1 - 2/1/2 2            Up     Yes    0F000000 (  NR)
                     2 - 1/1/2 2            Down   No     EF000000 (SF-P)
===============================================================================
*A:PE-E#

*A:PE-E# show eth-tunnel 1
===============================================================================
Ethernet Tunnel Group 1 Information
===============================================================================
Description        : Eth Tunnel
IfIndex            : 1476395009
Admin State        : Up                   Oper State       : Up
Protection Type    : G.8031-1to1          Max Revert Time  :    1 seconds
MAC Address        : 00:1a:f0:44:d2:03    Time to Revert   : N/A
                                          Hold Down Time   :    0 centiseconds
-------------------------------------------------------------------------------
Ethernet Tunnel Group APS Information
-------------------------------------------------------------------------------
APS PDU Rx         : BF010100 (  SF)    Switchover Time  : 05/28/2009 10:10:17
APS PDU Tx         : BF010100 (  SF)
Defect Status      :
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Ethernet Tunnel Group Path Summary
-------------------------------------------------------------------------------
Path ID   Member   Control-Tag Precedence      Admin/Oper      Active  Mgmt
-------------------------------------------------------------------------------
   1      1/1/2    1           primary            Up/Down      No      Yes
   2      2/1/2    1           secondary          Up/Up        Yes     No
===============================================================================
*A:PE-E#

*A:PE-E# show eth-tunnel 1 path 1
===============================================================================
```

```
Ethernet Tunnel Group 1 Path Information
===============================================================================
Description        : (Not Specified)
Member             : 1/1/2              Control-Tag      : 1
Admin State        : Up                 Oper State       : Down
-------------------------------------------------------------------------------
Ethernet Tunnel Group Path APS Information
-------------------------------------------------------------------------------
Active Count       : 2                  Active Time      : 0d 00:12:09
-------------------------------------------------------------------------------
Eth-Cfm Configuration Information
-------------------------------------------------------------------------------
Md-index           : 1                  Direction        : Down
Ma-index           : 1                  Admin            : Enabled
MepId              : 1                  CCM-Enable       : Enabled
LowestDefectPri    : macRemErrXcon      HighestDefect    : defRemoteCCM
Defect Flags       : bDefRemoteCCM
Mac Address        : 00:16:4d:c0:c1:ca  ControlMep       : True
===============================================================================
*A:PE-E#

*A:PE-E# show eth-tunnel 1 path 1 detail
===============================================================================
Ethernet Tunnel Group 1 Detailed Path Information
===============================================================================
Description        : (Not Specified)
Member             : 1/1/2              Control-Tag      : 1
Admin State        : Up                 Oper State       : Down
-------------------------------------------------------------------------------
Ethernet Tunnel Group Path APS Information
-------------------------------------------------------------------------------
Active Count       : 2                  Active Time      : 0d 00:12:09
-------------------------------------------------------------------------------
Eth-Cfm Configuration Information
-------------------------------------------------------------------------------
Md-index           : 1                  Direction        : Down
Ma-index           : 1                  Admin            : Enabled
MepId              : 1                  CCM-Enable       : Enabled
LowestDefectPri    : macRemErrXcon      HighestDefect    : defRemoteCCM
Defect Flags       : bDefRemoteCCM
Mac Address        : 00:16:4d:c0:c1:ca  ControlMep       : True
CcmLtmPriority     : 7
CcmTx              : 0                  CcmSequenceErr   : 0
Eth-Ais:           : Disabled
Eth-Tst:           : Disabled
LbRxReply          : 0                  LbRxBadOrder     : 0
LbRxBadMsdu        : 0                  LbTxReply        : 0
LbNextSequence     : 1                  LtNextSequence   : 1
LtRxUnexplained    : 0
===============================================================================
*A:PE-E#
```

interface-group-handler

Syntax **interface-group-handler** [*igh-id*]

Context show

Description This command displays Interface Group Handler (IGH) information.

If no command line options are specified, a summary listing of all IGHs is displayed.

Parameters *igh-id* — Displays information only on the specified IGH ID.

Sample

```
A:ALU-27# show interface-group-handler
===============================================================================
Interface Group Handler Summary Information
===============================================================================
IGH Index Admin     Number of Threshold
          State     Members
-------------------------------------------------------------------------------
1         Up        4         4
2         Up        2         2
===============================================================================
A:ALU-27#

A:ALU-27#show interface-group-handler 2
===============================================================================
Interface Group Handler 2 Information
===============================================================================
Admin Status       : Up
Threshold          : 2                 Last Change      : 02/02/2010 18:10:04
-------------------------------------------------------------------------------
Interface Group Handler Protocol Information
-------------------------------------------------------------------------------
Protocol Oper Status  Active Links                          Up Time
-------------------------------------------------------------------------------
ipcp     up           2                                     0d 00:15:04
ipv6cp   none         0                                             N/A
mplscp   waiting      0                                             N/A
osicp    none         0                                             N/A
-------------------------------------------------------------------------------
Port 1/5/2.2 Information
-------------------------------------------------------------------------------
Protocol Oper Status                                       Up Time
-------------------------------------------------------------------------------
ipcp     up                                                0d 00:15:05
ipv6cp   none                                                      N/A
mplscp   running                                                   N/A
osicp    none                                                      N/A
-------------------------------------------------------------------------------
Port 1/5/2.3 Information
-------------------------------------------------------------------------------
Protocol Oper Status                                       Up Time
-------------------------------------------------------------------------------
ipcp     up                                                0d 00:15:05
ipv6cp   none                                                      N/A
mplscp   running                                                   N/A
osicp    none                                                      N/A
===============================================================================
A:ALU-27#
```

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 7750 SR-c4 — 1, 3 7750 SR-c12 — 1, 3, 5, 7, 9, 11

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.
`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:7750-3# show mcm
==========================================================================
MCM Summary
==========================================================================
Slot Mcm  Provisioned          Equipped             Admin    Operational
          Mcm-type             Mcm-type             State    State
--------------------------------------------------------------------------
1    1    mcm-xp               mcm-xp               up       up
     3                         mcm-xp               up       unprovisioned
==========================================================================
```

```
A:7750-3#

A:7750-3# show mcm 1
==========================================================================
MCM 1/1
==========================================================================
Slot Mcm  Provisioned          Equipped             Admin    Operational
          Mcm-type             Mcm-type             State    State
--------------------------------------------------------------------------
1    1    mcm-xp               mcm-xp               up       up
==========================================================================
MCM 1/3
==========================================================================
Slot Mcm  Provisioned          Equipped             Admin    Operational
          Mcm-type             Mcm-type             State    State
--------------------------------------------------------------------------
     3                         mcm-xp               up       unprovisioned
==========================================================================
A:7750-3#
```

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 — 10

mda — The MDA number in the slot for which to display MDA information.

Values 1, 2
7750 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.

Label	Description (Continued)
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:ALA-1# show mda
===========================================================================
MDA Summary
===========================================================================
Slot Mda  Provisioned          Equipped             Admin    Operational
          Mda-type             Mda-type             State    State
---------------------------------------------------------------------------
1    1    m1-oc192             m1-oc192             up       up
     2    m1-10gb              m1-10gb              up       up
===========================================================================
A:ALA-1#
```

MDA Detailed Output — The following table describes detailed MDA output fields.

Label	Description
Slot	The chassis slot number.
Slot	The MDA slot number.
Provisioned Provisioned-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.

Label	Description (Continued)
`Number of ports equipped`	The number of ports that are actually equipped on the MDA.
`Transmit timing selected`	Indicates the source for the timing used by the MDA.
`Sync interface timing status`	Indicates whether the MDA has qualified one of the timing signals from the CPMs.
`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 port that can exist on the 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.
`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

```
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 (on a 7750 SR-c12/c4 system).

```
A:7750-3# 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
===========================================================================
7750A:SR-7/Dut-C# show mda 5/1 detail (channelized)
===========================================================================
MDA 5/1 detail
===========================================================================
Slot Mda  Provisioned          Equipped             Admin    Operational
          Mda-type             Mda-type             State    State
---------------------------------------------------------------------------
5    1    m1-choc12-sfp        m1-choc12-sfp        up       up

MDA Specific Data
    Maximum port count            : 1
    Number of ports equipped      : 1
    Transmit timing selected      : CPM Card A
    Sync interface timing status  : Qualified
    Network ingress queue policy  : default
    Capabilities                  : Sonet, TDM, PPP, FR
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS3
    Max number of channels        : 512
    Channels in use               : 0

Hardware Data
    Part number                   : 3HE00193AAAA01
    CLEI code                     :
    Serial number                 : NS042510655
    Manufacture date              : 07072004
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Time of last boot             : 2007/04/11 12:51:48
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:1a:7c:6f
===========================================================================
A:SR-7/Dut-C#
```

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.

Values access-ingress, access-egress

service *service-id* **—** Displays pool information for the specified service.

Values 1 — 2147483647

queue-group *queue-group-name* **—** Display information for the specified queue group.

direction — Specifies to display information for the ingress or egress direction.

Values ingress, egress

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.
`Resv CBS`	Specifies the percentage of pool size reserved for CBS.
`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.

Label	Description (Continued)
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
```

megapools

Syntax **megapools** *slot-number*
megapools *slot-number* **fp** *forwarding-plane* [**service-id** *service-id*] [**queue-group** *queue-group-name*] [**ingress | egress**]

Context show

Description This command displays megapool information. A megapool is a mechanism the IOM-3 flexpath traffic manager uses to allow oversubscription of buffer pools. Every buffer pool is created in the context of a megapool.

By default, all buffer pools are associated with a single megapool and the pools are not oversubscribed. When WRED queue support is enabled on the IOM, three megapools are used.

- The original megapool services the default and named pools.
- The second megapool services the system internal use pools.
- The third megapool is used by the buffer pools used by the WRED queues.

The traffic manager buffers are allocated to the three megapools without oversubscription. The WRED queue pools are allowed to oversubscribe their megapool, but the megapool protects the pools associated with the other megapools from buffer starvation that could be caused by that oversubscription.

Parameters *slot-number* — Displays information for the specified card slot.

fp-number — The fp-number parameter is optional following the **fp** command. If omitted, the system assumes forwarding plane number 1.

queue-group *queue-group-name* **—** Displays information for the specified port queue group name.

ingress — Displays ingress queue group information.

egress — Displays egress queue group information.

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 — 128

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 of the APS group.
`Switching-arch`	The architecture of the APS group.

Label	Description (Continued)
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:

```
*A:Dut-A# 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     Up     Up     N/A     1/5/1     1/9/5     1/5/1     PC-Tx: No-Req
===============================================================================
*A:Dut-A#


*A:Dut-A# show aps aps-1 detail
===============================================================================
APS Group: aps-1
===============================================================================
Description        : APS Group
Group Id           : 1                     Active Circuit       : 1/5/1
Admin Status       : Up                    Oper Status          : Up
Working Circuit    : 1/5/1                 Protection Circuit   : 1/9/5
Switching-mode     : Uni-1plus1            Switching-arch       : 1+1(sig,data)
Revertive-mode     : Non-revertive         Revert-time (min)    :
Rx K1/K2 byte      : 0x00/0x00 (No-Req on Protect)
Tx K1/K2 byte      : 0x00/0x00 (No-Req on Protect)
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
APS SF Hold Time   : 6000 msec             APS SD Hold Time     : 9000 msec
Mode mismatch Cnt  : 0                     Channel mismatch Cnt : 0
PSB failure Cnt    : 0                     FEPL failure Cnt     : 0
-------------------------------------------------------------------------------
 APS Working Circuit - 1/5/1
-------------------------------------------------------------------------------
Admin Status       : Up                    Oper Status          : Up
```

```
Current APS Status : OK                     No. of Switchovers   : 0
Last Switchover    : None                   Switchover seconds   : 0
Signal Degrade Cnt : 1                      Signal Failure Cnt   : 1
Last Switch Cmd    : No Cmd                 Last Exercise Result : Unknown
Tx L-AIS           : None
-------------------------------------------------------------------------------
 APS Protection Circuit - 1/9/5
-------------------------------------------------------------------------------
Admin Status       : Up                     Oper Status          : Up
Current APS Status : OK                     No. of Switchovers   : 0
Last Switchover    : None                   Switchover seconds   : 0
Signal Degrade Cnt : 1                      Signal Failure Cnt   : 1
Last Switch Cmd    : No Cmd                 Last Exercise Result : Unknown
Tx L-AIS           : None
===============================================================================
*A:Dut-A#
```

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      3/1/1     3/1/2      3/1/1      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   : 2/2/2
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 - 2/2/2
-------------------------------------------------------------------------------
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* **atm connections**
port *port-id* **atm ilmi**
port *port-id* **atm port-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**]
port *port-id* **cisco-hdlc**
port *port-id* **ppp** [**detail**]
port *port-id* **queue-group** [**ingress|egress**] [**queue-group-name**] [**access|network**] [{**statistics|associations**}]
port *port-id* **mlfr-link** [**detail**]**port** *port-id* **otu** [**detail**]
port *port-id* **frame-relay** [**detail**]
port aps [**detail**]
port cem
port *port-id* **ethernet** [**efm-oam | detail**]
port *port-id* **dot1x** [**detail**]
port *port-id* **vport** [*vport-name*] **associations**

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 — 64

ccag-id	*slot/mda/path-id*[*cc-type*]	
	path-id	a, b
	cc-type	.sap-net, .net-sap

MDA Values 7750 SR-12, 7750 SR-7, 7750 SR-1: 1, 2
7750 SR-c12: 1, 3, 5, 7, 9, 11
7750 SR-c4: 1, 3

CMA Values 7750 SR-c12: 1 — 12, 7750 SR-c4: 1 — 4

Slot Values 7750 SR-12: 1 — 10
7750 SR-7: 1 — 5
7750 SR-1: 1
7750 SR-c12/4: 1

Port Values 1 — 60 (depending on the MDA type)

Values (for channelized MDAs):

CHOC12-SFP:	slot/mda/port. [1..4] . [1..3] . [1..28] . [..24]
	For example, 7/2/1.1.1.28.24
CHOC3-SFP:	slot/mda/port. [1..3] . [1..28] . [..24]
	For example, 7/2/1.1.28.24
DS3:	slot/mda/port. [1..28] . [..24]
	For example, 7/1/1.1.1

aps — Displays ports on APS groups.

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.

mlfr-link — Displays link-based MLFR information for the port.

detail — Provides detailed information.

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.

Output **Port Output —** The following tables describe port output fields:

- General Port Output Fields on page 507
- Entering port ranges on page 509
- Specific Port Output Fields on page 509
- Detailed Port Output Fields on page 516
- Ethernet Output Fields on page 522
- Ethernet-Like Medium Statistics Output Fields on page 525
- Port Associations Output Fields on page 532
- Port Frame Relay Output Fields on page 533
- PPP Output Fields on page 373

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.

Label	Description (Continued)
	`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.
`Oper MTU`	The negotiated size of the largest packet which can be sent on the port 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:ALU-211# show port 1/1/2
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
```

```
Interface          : 1/1/2                           Oper Speed       : 100 mbps
Link-level         : Ethernet                        Config Speed     : 100 mbps
Admin State        : up                              Oper Duplex      : full
Oper State         : up - Active in LAG 10           Config Duplex    : full
Physical Link      : Yes                             MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 35717120                        Hold time up     : 0 seconds
Last State Change  : 12/16/2008 19:31:40             Hold time down   : 0 seconds
Last Cleared Time  : 12/16/2008 19:31:48
.....
===============================================================================
*A:ALU-211#


*A:ALU-211# show port 1/1/2
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
Interface          : 1/1/2                           Oper Speed       : 100 mbps
Link-level         : Ethernet                        Config Speed     : 100 mbps
Admin State        : up                              Oper Duplex      : full
Oper State         : down - Standby in LAG 10        Config Duplex    : full
Physical Link      : Yes                             MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 35717120                        Hold time up     : 0 seconds
Last State Change  : 12/16/2008 18:28:52             Hold time down   : 0 seconds
Last Cleared Time  : 12/16/2008 18:28:51
...
===============================================================================
*A:ALU-211#
```

Entering port ranges:

```
*A:ALU-1# configure port 1/1/[1..3] shut
*A:ALU-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:ALU-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.

Label	Description (Continued)
`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.
	Additionally, the *lag-id* of the LAG it belongs to in addition to the status of the LAG member (active or standby) is specified.
`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.
`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`	Displays 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.

Label	Description (Continued)
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 IOM 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.
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.
OTU	OTU encapsulation status.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.

Label	Description (Continued)
`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.
	`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.

Label	Description (Continued)
`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 IOM 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 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.

Label	Description (Continued)
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.
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.

Label	Description (Continued)
`Unknown Proto Discards Input/ Output`	For packet-oriented interfaces, the number of packets received through 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.
`Sync. Status Msg`	Whether synchronization status messages are enabled or disabled.
`Tx DUS/DNU`	Whether the QL value is forcibly set to QL-DUS/QL-DNU.
`Rx Quality Level`	Indicates which QL value has been received from the interface.
`Tx Quality Level`	Indicates which QL value is being transmitted out of the interface.
`SSM Code Type`	Indicates the SSM code type in use on the port.

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.
`Access Egr. Qos`	Specifies the access egress policy or that the default policy 1 is in use.
`Egr. Sched. Pol`	Specifies the port scheduler policy or that the default policy default is in use.
`Encap Type`	`Null` — Ingress frames will not use any tags or labels to delineate a service.

Label	Description (Continued)
	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 IOM 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.

Label	Description (Continued)
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.
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 through 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.

Label	Description (Continued)
`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.
`Rx S1 Byte`	Displays the received S1 byte and its decoded QL value.
`Tx S1 Byte`	Displays the transmitted S1 byte and its decoded QL value.
`Tx DUS/DNU`	Displays whether the QL value is forcibly set to QL-DUS/QL-DNU.

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
Single Fiber Mode  : No                         Clock Mode       :synchronous
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

Sync. Status Msg.  : Enabled                    Rx Quality Level : 0xa(eec2)
Tx DUS/DNU         : Disabled                   Tx Quality Level : 0xa(eec2)
SSM Code Type      : sonet

Configured Address : 00:21:05:7e:b1:48

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-Gi Ethernet SFP
Interface         : 1/1/1                        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

Sync. Status Msg.  : Enabled                     Rx Quality Level : 0xa(eec2)
Tx DUS/DNU         : Disabled                    Tx Quality Level : 0xa(eec2)
SSM Code Type      : sonet

Configured Address : 00:21:05:7e:b1:48
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#
```

```
*A:Bennet-Dut-A# show port 1/1/2 vport "vp1"
========================================================================
Ethernet port 1/1/2 Access Egress vport
========================================================================
VPort Name    : vp1
Description   : (Not Specified)
Sched Policy  : psp

Host-Matches
------------------------------------------------------------------------
Dest: dslam1
------------------------------------------------------------------------
========================================================================
*A:Bennet-Dut-A#
```

```
*A:Bennet-Dut-A# show port 1/1/2 vport "vp1" associations
========================================================================
Ethernet port 1/1/2 Access Egress vport
========================================================================
------------------------------------------------------------------------
VPort "vp1"
------------------------------------------------------------------------
svc-id : 1
 sap   : 1/1/2:1
 subscr: s1
 ip    : 1.1.1.2
 mac   : 00:00:00:00:00:01  pppoe-sid: N/A
========================================================================
*A:Bennet-Dut-A
```

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.
`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).

Label	Description (Continued)
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.
`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#

A:ALA-48# show port 1/2/1.sts192
============================================================================
WAN Interface Sublayer Path Info
============================================================================
Oper Status        : up
Signal Label       : 0x1a                    Rx Signal Label      : 0x1a
Trace String       : Alcatel 7750 SR
Rx Trace Str(Hex)  : 89 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Cfg Alarm          : pais plop prdi pplm prei puneq plcd
Alarm Status       :
============================================================================
Port Statistics
============================================================================
                                                   Input
Output
----------------------------------------------------------------------------
Unicast Packets                                367218143
5311
```

```
Multicast Packets                                 0
0
Broadcast Packets                                 0
0
Discards                                          0
0
Unknown Proto Discards                            0
===========================================================================
A:ALA-48#


A:ALA-48# show port 1/2/1.sts192 detail
===========================================================================
WAN Interface Sublayer Path Info
===========================================================================
Oper Status        : up
Signal Label       : 0x1a                  Rx Signal Label      : 0x1a
Trace String       : Alcatel 7750 SR
Rx Trace Str(Hex)  : 89 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Cfg Alarm          : pais plop prdi pplm prei puneq plcd
Alarm Status       :
===========================================
Sonet Path
===========================================
                                 Far End
-------------------------------------------
ES-P                  1              0
SES-P                 1              0
UAS-P                 0              0
CV-P                 10              0
=========================================
=========================================
Transmit:
LOP-P                 :              0
Fifo Error            :             96
Max Packet Error      :              0
Min Packet Error      :              0
LLP Packet Error      :              0
FIFO Underflow Error  :              0

Receive:

LOP-P                 :              0
AIS-P                 :              1
RDI-P                 :              0
PLM-P                 :              0
LCD-P                 :              0
Unequipped            :              0
Remote Error          :              6
Parity Error          :             10
Fifo Error            :              0
Max Pkt Error         :              0
Min Pkt Error         :              0
FCS Error             :              0
Packet Abort Error    :              0
Addr Ctrl Invalid     :              0
===========================================================================
Port Statistics
===========================================================================
```

```
Input
Output
-----------------------------------------------------------------------------
Unicast Packets                                  369758853
5312
Multicast Packets                                        0
0
Broadcast Packets                                        0
0
Discards                                                 0
0
Unknown Proto Discards                                   0
=============================================================================
A:ALA-48#
```

Channelized Port Output — The following table describes channelized port output fields.

Label	Description
`Description`	A text description of the port.
`Interface`	The port ID displayed in the *slot/mda/port* format.
`TimeSlots`	Specifies the DS0 timeslot used in the T1/E1 channel-group.
`Speed`	Indicates the speed of the DS0 channels used in the associated channel-group.
`CRC`	Indicates the precision of the cyclic redundancy check. `16` — A16-bit CRC calculation. `32` — A 32-bit CRC calculation. 32-bit CRC increases the error detection ability, but it also adds some performance overhead.
`Admin Status`	`Up` — The port is administratively up. `Down` — The administratively down.
`Oper Status`	`Up` — The port is operationally up. `Down` — The port is operationally down.
`Last State Change`	Displays the last time the operational status of the port changed state.
`Chan-Grp IfIndex`	Displays the channel group's interface index number which reflects its initialization sequence.
`Configured Mode`	`network` — The port is configured for transport network use. `access` — The port is configured for service access. Channelized ports are always access ports.
`Encap Type`	The type of encapsulation protocol configured on this port's network interface. `bcp-null` — Indicates that BCP is used as the NCP control protocol. `dot1q` — Indicates that ingress frames carry 802.1Q tags where each tag signifies a different service.
`Oper MTU`	The negotiated size of the largest packet which can be sent on the channel, specified in octets. For channels that are used to transmit network datagrams, this is the size of the largest network datagram that can be sent.
`Physical Link`	Indicates whether or not the port has a physical link.
`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.

Sample Output

```
A:ALA-7# show port 7/1/1.ds0grp-1.1
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS3
Interface          : 7/1/1.ds0grp-1.1
TimeSlots          : 1
Speed              : 64                         CRC                  : 16
Admin Status       : up                         Oper status          : down
Last State Change  : 2007/04/11 01:14:37        Chan-Grp IfIndex     : 656441433

Configured mode    : access                     Encap Type           : bcp-null
Admin MTU          : 1522                       Oper MTU             : 1522
Physical Link      : No
===============================================================================
Port Statistics
=======================================================================
                                          Input                 Output
-----------------------------------------------------------------------
Unicast Packets                               0                      0
Multicast Packets                             0                      0
Broadcast Packets                             0                      0
Discards                                      0                      0
Unknown Proto Discards                        0
=======================================================================
A:ALA-7#


A:ALA-7# show port 7/1/1.ds0grp-1.1 detail
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS3
Interface          : 7/1/1.ds0grp-1.1
TimeSlots          : 1
Speed              : 64                         CRC                  : 16
Admin Status       : up                         Oper status          : down
Last State Change  : 04/11/2007 01:14:37        Chan-Grp IfIndex     : 656441433

Configured mode    : access                     Encap Type           : bcp-null
Admin MTU          : 1522                       Oper MTU             : 1522
Physical Link      : No
===============================================================================
Port Statistics
=======================================================================
                                          Input                 Output
-----------------------------------------------------------------------
Unicast Packets                               0                      0
Multicast Packets                             0                      0
Broadcast Packets                             0                      0
Discards                                      0                      0
Unknown Proto Discards                        0
=======================================================================
A:ALA-7#
```

```
ALA-12# show port 7/1/1.1.1
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 3/1/1.1.1
TimeSlots          : 1
Speed              : 64                          CRC                   : 16
Admin Status       : up                          Oper status           : down
Last State Change  : 04/11/2007 06:54:28         Chan-Grp IfIndex      : 589332542

Configured mode    : access                      Encap Type            : bcp-null
Admin MTU          : 1518                        Oper MTU              : 1518
Physical Link      : No                          Bundle Number         : none
Idle Cycle Flags   : flags                       Load-balance-algo     : default
===============================================================================
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
===============================================================================
ALA-12#
A:ALA-48# show port 3/1/3.e3
===============================================================================
TDM Interface
===============================================================================
Description        : E3
Interface          : 3/1/3.e3
Type               : e3                          Framing               : g751
Admin Status       : up                          Oper status           : down
Physical Link      : No                          Clock Source          : loop-timed
Last State Change  : 04/11/2007 06:54:28         Port IfIndex          : 589398019

Configured mode    : access                      Encap Type            : bcp-null
Admin MTU          : 1518                        Oper MTU              : 1518
CRC                : 16                          Channelized           : none
Idle Cycle Flags   : flags                       Loopback              : none
FEAC Loop Respond  : Disabled                    In FEAC Loop          : No
BERT Pattern       : none                        BERT Duration         : N/A
Err Insertion Rate : 0                           Last BERT Synched     : 0 Seconds
BERT Status        : idle                        Last BERT Errors      : 0
                                                 Last BERT Total Bits : 0
Cfg Alarm          : ais los
Alarm Status       :
Subrate Mode       : none

MDL Transmit       : none
-------------------------------------------------------------------------------
```

```
Local MDL Information
-------------------------------------------------------------------------------
EIC                 :                          LIC                 :
FIC                 :                          Unit                :
PFI                 :
Idle Signal Port    :
Test Signal Gen     :
-------------------------------------------------------------------------------
Far End MDL Information
-------------------------------------------------------------------------------
EIC                 :                          LIC                 :
FIC                 :                          Unit                :
PFI                 :
Idle Signal Port    :
Test Signal Gen     :
===============================================================================
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: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.

Sample Output

```
A:ALA-49>config>port# show port 8/1/2 frame-relay
===============================================================================
Frame Relay Info for 8/1/2
===============================================================================
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#
```

OTU Output — The following table describes the OTU output fields.

Label	Description
OTU Status	Status of the OTU (Optical Transport Unit): enabled or disabled. When OTU is enabled, and additional layer of framing encapsulates an MDA's natively programmed mode of operation, 10-Gigabit Ethernet LAN or WAN, adding SONET-Like Framing with FEC (Forward Error Correction). When OTU is disabled, the MDA operates in a 10-Gigabit Ethernet LAN or WAN as per Ethernet provisioning.

Label	Description (Continued)
FEC Mode	Type of FEC (Forward Error Correction) in effect: g709, enhanced or disabled. When g709 is selected, the standard FEC method is used. When enhanced is selected, a proprietary FEC algorithm is used that extends optical reach in long haul applications. When disabled the bytes that are reserved for FEC in the OTU frame are transmitted as zeros and the FEC decoder is bypassed, but OTU framing is still in effect.
Data Rate	This indicates the data rate at which the port is operating. When OTU is encapsulating 10-Gigabit Ethernet WAN, the data rate is 10.709 Gb/s, the G.709 standard OTU2 data rate. When OTU is encapsulating 10-Gigabit Ethernet LAN, the data rate is either 11.049 Gb/s or 11.096 Gb/s, depending on the otu2-lan-data-rate configuration parameter of the port's OTU parameters. These data rates (11.049 Gb/s and 11.096 Gb/s) are considered OTU2e data rates that are non-standard or over-clocked with respect to G.709, but have become widely used in optical networking to transport un-altered 10-Gigabit Ethernet LAN payloads.
Cfg Alarms and Alarm Status	This indicates the alarms that shall be reported when raised or cleared. Alarms that are not in this list will not be reported when they are raised or cleared but will appear in the Alarm Status.
SF/SD Method	This indicates the selected method for declaring the SF (Signal Fail) or SD (Signal Degrade) alarm. When BIP8 is selected, the error rate of SM-BIP8 errors in the OTU frames is used to declare SF or SD (This is very similar to SONET SF/SD which uses a rate of B2 errors). When FEC is selected, the rate of corrected bits is used to declare SF or SD. This effectively indicates that the link would be degraded (SD) or failed (SF) if FEC was disabled and gives the user an early warning that the link is degrading or is about to fail.
SF Threshold	This is the configured error rate threshold at which the SF (Signal Fail) alarm will be raised.
SD Threshold	This is the configured error rate threshold at which the SD (Signal Degrade) alarm will be raised.
SM-TTI Tx (<mode>)	This is the configured SM-TTI (Section Monitor Trail Trace Identifier) to be transmitted by this port in the OTU overhead bytes. The modes are auto, string, or bytes. In the auto and string modes, a printable character string will be displayed. In bytes mode, up to 64 hex bytes will be displayed
SM-TTI Rx	This is the SM-TTI (Section Monitor Trail Trace Identifier received by this port. When the received TTI is a printable string of characters, it will be displayed as a text string. When the received TTI contains one or more non-printable characters, it will be displayed at a sequence of 64 hex bytes. When the received TTI is all zeros, the string “Not Specified” will be displayed.

Label	Description (Continued)
`FEC Corrected 0s`	Displays the number of bits that were received as 0s but corrected to 1s.
`FEC Corrected 1s`	Number of bits that were received as 1s but corrected to 0s.
`FEC Uncorrectable Sub-Rows`	The number of sub-rows that were not corrected because too many errors were detected.
`FEC SES`	The number of severely errored seconds were the number of uncorrectable sub-rows was greater than 15% of the maximum.
`SM BIP8`	The number of detected BIP-8 errors in the section monitor overhead.
`SM BEI`	The number of backward error indications received from the far end in the section monitor overhead.
`SM SES`	Section monitor severely errored seconds where the number of SM-BIP8 was greater than 15% of the maximum.
`PM BIP8`	The number of detected BIP-8 errors in the section monitor overhead.
`PM BEI`	The number of backward error indications received from the far end in the section monitor overhead.
`PM SES`	Section monitor severely errored seconds where the number of SM-BIP8 was greater than 15% of the maximum.

Sample Output

```
A:ALA-49>config>port# show port 3/2/1 otu detail
===============================================================================
OTU Interface
===============================================================================
OTU Status         : Enabled                    FEC Mode         : enhanced
                                                Data Rate        : 11.049 Gb/s
Cfg Alarms         : loc los lof lom otu-ber-sf otu-bdi fec-sf
Alarm Status       :
SF/SD Method       : FEC                        SF Threshold     : 1E-5
                                                SD Threshold     : 1E-7

SM-TTI Tx (auto)   : ALA-49:3/2/1/C17
SM-TTI Rx          : (Not Specified)
===============================================================================
OTU Statistics
===============================================================================
Statistics                                                 Count
-------------------------------------------------------------------------------
FEC Corrected 0s                                                   0
FEC Corrected 1s                                                   0
FEC Unrrectable Sub-rows                                           0
FEC SES                                                            0
SM BIP8                                                            0
SM BEI                                                             0
```

```
PM SES                                                        0
PM BIP8                                                       0
PM BEI                                                        0
PM SES                                                        0
===============================================================================
```

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	Displays 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.
ACFC	Indicates whether Address and Control Field PPP Header Compression is enabled.
PFC	Indicates whether Protocol Field PPP Header Compression is enabled.

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#
```

The following output displays an example of a PPP link inside a multilink-bundle group:

```
*A:top_SR7# show port 3/1/4.1.2.3.1 ppp
===============================================================================
LCP Protocol for 3/1/4.1.2.3.1
===============================================================================
Protocol  State         Last Change         Restart Count   Last Cleared
-------------------------------------------------------------------------------
lcp       opened        05/22/2008 07:46:18         1      05/22/2008 06:28:48
===============================================================================
Keepalive statistics

Request interval   : 4            Threshold exceeded : 0
Drop Count         : 3            In packets         : 46404
Time to link drop  : 00h00m12s    Out packets        : 46404
Last cleared time  : 05/22/2008 06:28:48

PPP Header Compression
 ACFC              : Enabled      PFC                : Enabled
===============================================================================
*A:top_SR7#
```

The following output displays an example of a standalone PPP link:

```
*A:top_SR7# show port 3/1/4.1.2.3.1 ppp
===============================================================================
PPP Protocols for 3/1/4.1.2.3.1
===============================================================================
Protocol  State         Last Change         Restart Count   Last Cleared
-------------------------------------------------------------------------------
lcp       initial       05/24/2008 11:25:23         1      05/22/2008 06:28:48
ipcp      initial       05/22/2008 06:28:48         0      05/22/2008 06:28:48
mplscp    initial       05/22/2008 06:28:48         0      05/22/2008 06:28:48
bcp       initial       05/22/2008 06:28:48         0      05/22/2008 06:28:48
osicp     initial       05/22/2008 06:28:48         0      05/22/2008 06:28:48
ipv6cp    initial       05/22/2008 06:28:48         0      05/22/2008 06:28:48
===============================================================================
PPP Statistics
===============================================================================
Local Mac address  : 00:16:4d:8f:d3:57  Remote Mac address :
Local Magic Number : 0x0                Remote Magic Number: 0x0
Local IPv4 address : 0.0.0.0            Remote IPv4 address: 0.0.0.0
Local IPv6 address : ::
Remote IPv6 address: ::

Line Monitor Method: keepalive

Keepalive statistics

Request interval   : 4            Threshold exceeded : 0
Drop Count         : 3            In packets         : 46418
Time to link drop  : 00h00m12s    Out packets        : 46418
Last cleared time  : 05/22/2008 06:28:48

PPP Header Compression
 ACFC              : Enabled      PFC                : Enabled
===============================================================================
*A:top_SR7#
```

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

Label	Description (Continued)
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.
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.
HEC Errors (Fixed)	Indicates the number of fixed HEC errors on this interface.

Sample Output

```
A:ALA-2934 show mda 7/2 detail (ATM MDA)
```

```
===============================================================================
MDA 7/2 detail
===============================================================================
Slot Mda  Provisioned          Equipped             Admin    Operational
          Mda-type             Mda-type             State    State
-------------------------------------------------------------------------------
7    2    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             : 2007/08/23 13:46:57
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:4a:34:90
===============================================================================
A:ALA-2934#
ALA-1# show port 9/1/2 atm
==============================================================================
ATM Info for 9/1/2
==============================================================================
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
========================================================================
ALA-1#
```

```
*A:ALA-48# show port 3/2/1 atm detail
===============================================================================
ATM Info for 3/2/1
===============================================================================
Cell Mode            : UNI                Mapping            : Direct
Configured VCs       : 0                  Configured VPs     : 0
Configured VTs       : 0                  Configured IFCs    : 0
Configured minimum VPI: 0
Last Unknown VPI/VCI  : none
===============================================================================
TC Sublayer Information
===============================================================================
TC Alarm State       : LCD Failure        Number OCD Events  : 0
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 : 599041 kbps
Shaped Bandwidth   : 0 kbps
================================================================================
ATM Statistics
================================================================================
                                                   Input              Output
--------------------------------------------------------------------------------
Octets                                                 0                   0
Cells                                                  0                   0
Unknown VPI/VCI Cells                                  0
================================================================================
AAL-5 Packet Statistics
================================================================================
                                                   Input              Output
--------------------------------------------------------------------------------
Packets                                                0                   0
Dropped Packets                                        0                   0
CRC-32 Errors                                          0
================================================================================
*A:ALA-48#
B:Dut-D# show port 2/2/1.1.1.1 atm
===============================================================================
ATM Info for 2/2/1.1.1.1
===============================================================================
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 2/2/1.1.1.1 atm detail
==============================================================================
ATM Info for 2/2/1.1.1.1
==============================================================================
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 2/2/1.1.1.1 atm connections
================================================================
ATM Connections, Port 2/2/1.1.1.1
================================================================
           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#
```

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.
`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

```
ALA-1# show port 9/1/2 atm pvc
================================================================
ATM Endpoints, Port 9/1/2
================================================================
VPI/VCI    Owner  Type     Ing.TD  Egr.TD  Adm  OAM        Opr
----------------------------------------------------------------
0/500      SAP    PVC      5       3       up   ETE-AIS    dn
================================================================
ALA-1#
```

```
B:Dut-D# show port 2/2/1.1.1.1 atm pvc 0/100
===============================================================================
ATM PVC
===============================================================================
Port Id            : 2/2/1.1.1.1         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       : 06/15/2007 22:09:11 ILMI Vpi/Vci Range : n/a
===============================================================================
B:Dut-D#


A:ALA-228#
===============================================================================
ATM PVC
===============================================================================
Port Id            : 3/1/4.1.1.1         VPI/VCI            : 0/100
Admin State        : up                  Oper state         : down
OAM State          : ETE-AIS             Encap Type         : n/a
Owner              : SAP                 AAL Type           : n/a
Endpoint Type      : PVC                 Cast Type          : P2P
Ing. Td Idx        : 1                   Egr. Td Idx        : 1
Last Changed       : 02/26/2007 14:16:29 ILMI Vpi/Vci Range : n/a
===============================================================================
A:ALA-228#
```

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
`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.

Label	Description (Continued)
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

```
ALA-1# show port 9/1/2 atm pvc 0/500 detail
==============================================================================
ATM Endpoint
==============================================================================
Port Id           : 9/1/2              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      : 02/14/2007 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#


A:ALA-228# show port 2/2/1.1.1.1 atm pvc 0/100 detail
==============================================================================
ATM PVC
==============================================================================
Port Id            : 2/2/1.1.1.1         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       : 06/15/2007 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
===============================================================================
A:ALA-228#
```

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.
`Tagged Cells`	Displays the number of cells that have been demoted from CLP0 to CLP1.

Sample Output

```
A:SR1_5>config>service# show port 1/2/2 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       : 04/02/2007 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#
```

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    adaptive     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    loop-timed   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#
```

lldp

Syntax **lldp** [**nearest-bridge**|**nearest-non-tpmr**|**nearest-customer**] [**remote-info**] [**detail**]

Context show>port>ethernet

Description This command displays Link Layer Discovery Protocol (LLDP) information.

Parameters **nearest-bridge —** Displays nearest bridge information.

nearest-non-tpmr — Displays nearest Two-Port MAC Relay (TPMR) information.

nearest-customer — Displays nearest customer information.

remote-info — Displays remote information on the bridge MAC.

detail — Shows detailed information.

Sample Output

```
A:testSr1# show port 1/2/2 ethernet lldp
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/2/2 Bridge nearest-bridge
-------------------------------------------------------------------------------
Admin State          : txAndRx        Notifications          : Disabled
Transmit TLVs        : portDesc sysCap

Management Address Transmit Configuration:
Index 1 (system)     : Enabled        Address                : 10.20.30.40

Port 1/2/2 Bridge nearest-non-tpmr
-------------------------------------------------------------------------------
Admin State          : disabled       Notifications          : Disabled
Transmit TLVs        : None

Management Address Transmit Configuration:
Index 1 (system)     : Disabled       Address                : 10.20.30.40

Port 1/2/2 Bridge nearest-customer
-------------------------------------------------------------------------------
Admin State          : disabled       Notifications          : Disabled
Transmit TLVs        : None

Management Address Transmit Configuration:
Index 1 (system)     : Disabled       Address                : 10.20.30.40
===============================================================================
A:testSr1#


A:testSr1# show port 1/2/2 ethernet lldp nearest-bridge detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/2/2 Bridge nearest-bridge
-------------------------------------------------------------------------------
Admin State          : txAndRx        Notifications          : Disabled
Transmit TLVs        : portDesc sysCap

Management Address Transmit Configuration:
Index 1 (system)     : Enabled        Address                : 10.20.30.40

Port LLDP Stats:
Tx Frames            : 13             Tx Length Err Frames   : 0
Rx Frames            : 0              Rx Frame Discard       : 0
Rx Frame Errors      : 0              Rx TLV Discard         : 0
```

```
Rx TLV Unknown        : 0              Rx Ageouts           : 0
===============================================================================
A:testSr1#


A:testSr1# show port 1/2/2 ethernet lldp nearest-bridge remote-info detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/2/2 Bridge nearest-bridge Remote Peer Information
-------------------------------------------------------------------------------
Remote Peer Index 2 at timestamp 12/02/2008 16:08:14:
Supported Caps        : (Not Specified)
Enabled Caps          : (Not Specified)
Chassis Id Subtype    : 4 (macAddress)
Chassis Id            : ac:fa:ff:00:00:00
PortId Subtype        : 7 (local)
Port Id               : 37814272
Port Description      : n/a
System Name           : n/a
System Description    : n/a

Remote Peer Index 2 management addresses at time 12/02/2008 16:08:14:
No remote management addresses found
===============================================================================
A:testSr1#
```

port-tree

Syntax **port-tree** *port-id*

Context show

Description This command displays the tree for SONET/SDH or TDM ports/channels.

Parameters *port-id* — Specifies the physical port ID.

Syntax

port-id	*slot*[/*mda*[/*port*]] or *slot*/*mda*/*port*[.*channel*]
aps-id	aps-*group-id*[.*channel*] aps keyword group-id 1 — 64
ccag-id	*slot/mda/path-id*[*cc-type*] path-id a, b cc-type .sap-net, .net-sap

MDA Values 7750 SR-12, 7750 SR-7, 7750 SR-1: 1, 2
7750 SR-c12: 1, 3, 5, 7, 9, 11
7750 SR-c4: 1— 4

CMA Values 7750 SR-c12: 1 — 12

Slot Values 7750 SR-12: 1 — 10
7750 SR-7: 1 — 5

7750 SR-1: 1
7750 SR-c12/4: 1

Port Values 1 — 60 (depending on the MDA type)

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 7/1/1
    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-lag

Syntax **mac-lag peer** *ip-address* [**lag** *lag-id*]
mac-lag [**peer** *ip-address* [**lag** *lag-id*]] **statistics**

Context show>redundancy>multi-chassis

Description This command displays multi-chassis LAG information.

Sample

```
*A:Dut-B# show redundancy multi-chassis mc-lag peer 10.20.1.2
===============================================================================
Multi-Chassis MC-Lag Peer 10.20.1.2
===============================================================================
Last State chg : 05/17/2009 19:31:58
Admin State : Up Oper State : Up
KeepAlive : 5 deci-seconds Hold On Ngbr Failure : 2
-------------------------------------------------------------------------------
Lag Id Lacp Remote Source Oper System Id Sys Last State Changed
Key Lag Id MacLSB MacLSB Prio
-------------------------------------------------------------------------------
1 40000 1 Lacp 9c:40 00:02:80:01:00:01 100 05/17/2009 19:31:56

*A:Dut-B# /tools dump redundancy src-bmac-lsb
Src-bmac-lsb: 1025 (04-01) User: B-Vpls - 1 service(s)
Services affected:
B-Vpls: 1
B-Vpls: 2
```

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.
	`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.

Label	Description (Continued)
`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.

Sample Output

```
*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 Authen-tication	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.

Label	Description (Continued)
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.
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. **Sample Output**

```
A:SR-12# show system  switch-fabric high-bandwidth-multicast
===============================================================================
Switch Fabric
===============================================================================
Slot/Mda    Min Fwd Cap  Max Fwd Cap  Hi-Bw-Mcast    Mcast Hi  Mcast Low Group
-------------------------------------------------------------------------------
 3/1        100%         100%         Yes            #15#      #1#       1
 4/1        100%         100%         No             3         4         0
 4/2        100%         100%         No             1         2         0
 8/1        100%         100%         Yes            #15#      #1#       2
 A          100%         100%         No             0         0         0
 B          100%         100%         No             0         0         0
===============================================================================
A:SR-12#
```

Multilink Bundle Commands

multilink-bundle

Syntax **multilink-bundle** [*bundle-id* **|** *slot/mda* **| type** {**mlppp | ima-grp | mlfr**}] [**detail**]
multilink-bundle {*bundle-id* **|** *slot/mda*} [**ppp | ima | mlfr**]
multilink-bundle *bundle-id* **relations**
multilink-bundle *bundle-id* **ppp** [**multiclass**]**multilink-bundle** *bundle-id* **mlfr** [**frame-relay** [**detail**]]

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, mlfr 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, MLFR 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-r-slot/mda.bundle-num (Creates an MLFR 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.

mlfr — Displays bundle MLFR information, or used to display MLFR-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.
`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.

Label	Description (Continued)
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.
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.

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-44-cpm2# show multilink-bundle detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-ppp-1/1.1   Type               : mlppp
Admin Status       : up                 Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 572522497
Total Links        : 3                  Active Links       : 0
Red Diff Delay     : 0                  Yellow Diff Delay  : 0
Red Diff Delay Act : none               MRRU               : 1524
Short Sequence     : true               Oper MRRU          : 1524
Oper MTU           : 1526               Fragment Threshold : 128 bytes
```

```
Up Time             : N/A                Bandwidth          : 0 KBit
PPP Input Discards : 0                   Primary Member Port: 1/1/1.1.1.1.1.1
Mode                : access
Interleave-Frag     : false
-------------------------------------------------------------------------------
Member Port Id              #TS   Admin  Oper  Act  Down Reason       Up Time
-------------------------------------------------------------------------------
1/1/1.1.1.1.1.1             12     up     up   no    oper down          N/A
1/1/1.1.1.1.1.2             12     up     up   no    oper down          N/A
1/1/1.1.1.1.1.3             12     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-44-cpm2#


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
nown Proto Discards                                 0
===============================================================================
A:timetra-sim110#

*A:Cpm-A>config>port#  show multilink-bundle

===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
------------------------------------------------------------------------------
bundle-fr-1/1.1      mlfr    Down      Down      Ghost     1      0/0
------------------------------------------------------------------------Bundles : 1
===============================================================================
Bundle Summary
===============================================================================
Bundle               Type    Admin     Oper      Port      Min    Total/
Id                           State     State     State     Links  Active Links
------------------------------------------------------------------------------
bundle-fr-1/1.1      mlfr    Down      Down      Ghost     1      0/0
------------------------------------------------------------------------------
Bundles : 1
==============================================================================
*A:Cpm-A> show multilink-bundle bundle-fr-1/1.1 detail
 ===============================================================================
```

```
Bundle bundle-fr-1/1.1 Detail
===============================================================================
Description        : MultiLink Bundle
Bundle Id          : bundle-fr-1/1.1    Type               : mlfr
Admin Status       : down               Oper Status        : down
Minimum Links      : 1                  Bundle IfIndex     : 572530689
Total Links        : 0                  Active Links       : 0
Red Diff Delay     : 0                  Yellow Diff Delay  : 0
Red Diff Delay Act : none               MRRU               : N/A
Short Sequence     : N/A                Oper MRRU          : N/A
Oper MTU           : 0                  Fragment Threshold : 128 bytes
Up Time            : N/A                Bandwidth          : 0 KBit
PPP Input Discards : N/A                Primary Member Port: None
Mode               : access
Interleave-Frag    : N/A

===============================================================================
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:Cpm-A> show multilink-bundle bundle-fr-1/1.1 mlfr frame-relay

===============================================================================
Frame Relay Info for bundle-fr-1/1.1
===============================================================================
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
=======================================================================
Service Access Points(SAP)
=======================================================================
Service Id         : 39
SAP                : 1/1/2.3.5.2.2:18         Encap             : frRel
Description        : Default sap description for service id 39
Admin State        : Up                       Oper State        : Up
Flags              : None
```

```
Multi Svc Site     : None
Last Status Change : 12/02/2008 20:48:17
Last Mgmt Change   : 12/02/2008 20:46:38
Sub Type           : regular
Split Horizon Group: (Not Specified)

Admin MTU          : 4474                       Oper MTU          : 4474
Ingr IP Fltr-Id    : n/a                        Egr IP Fltr-Id    : n/a
Ingr Mac Fltr-Id   : n/a                        Egr Mac Fltr-Id   : n/a
Ingr IPv6 Fltr-Id  : n/a                        Egr IPv6 Fltr-Id  : n/a
tod-suite          : None                       qinq-pbit-marking : both
Ing Agg Rate Limit : max                        Egr Agg Rate Limit: max
Endpoint           : N/A

FRF-12             : Disabled
Acct. Pol          : None                       Collect Stats     : Disabled

-------------------------------------------------------------------------

FRF12 on channel where sap resides:

=========================================================================
Service Access Points(SAP)
=========================================================================
Service Id         : 1
SAP                : 1/1/1.3.7.4.1:16           Encap             : frRel
Description        : sap-1-88.10.131.1
Admin State        : Up                         Oper State        : Up
Flags              : None
Multi Svc Site     : None
Last Status Change : 12/02/2008 20:48:15
Last Mgmt Change   : 12/02/2008 20:46:36
Sub Type           : regular
Split Horizon Group: (Not Specified)
Admin MTU          : 9194                       Oper MTU          : 9194
Ingr IP Fltr-Id    : n/a                        Egr IP Fltr-Id    : n/a
Ingr Mac Fltr-Id   : n/a                        Egr Mac Fltr-Id   : n/a
Ingr IPv6 Fltr-Id  : n/a                        Egr IPv6 Fltr-Id  : n/a
tod-suite          : None                       qinq-pbit-marking : both
Ing Agg Rate Limit : max                        Egr Agg Rate Limit: max

FRF-12 (I/F)       : Enabled
Scheduling Class   : 0
Acct. Pol          : None                       Collect Stats     : Disabled
Anti Spoofing      : None                       Avl Static Hosts  : 0
                                                Tot Static Hosts  : 0
Calling-Station-Id : n/a
Application Profile: None
-------------------------------------------------------------------------

FRF12 ETE on sap capable of supporting it:

===============================================================================
Service Access Points(SAP)
==============================================================================
Service Id         : 1
SAP                : 1/1/1.1:16                 Encap             : frRel
Description        : (Not Specified)
Admin State        : Up                         Oper State        : Up
```

```
Flags              : None
Multi Svc Site     : None
Last Status Change : 12/02/2008 20:48:12
Last Mgmt Change   : 12/02/2008 20:46:36
Sub Type           : regular
Split Horizon Group: (Not Specified)

Admin MTU          : 9194                     Oper MTU           : 9194
Ingr IP Fltr-Id    : n/a                      Egr IP Fltr-Id     : n/a
Ingr Mac Fltr-Id   : n/a                      Egr Mac Fltr-Id    : n/a
Ingr IPv6 Fltr-Id  : n/a                      Egr IPv6 Fltr-Id   : n/a
tod-suite          : None                     qinq-pbit-marking : both
Ing Agg Rate Limit : max                      Egr Agg Rate Limit: max

FRF-12 (ETE)       : Enabled                  Ete-Frag-Threshold: 128
Scheduling Class   : 3
Acct. Pol          : None                     Collect Stats      :
Disabled
Anti Spoofing      : None                     Avl Static Hosts  : 0
                                              Tot Static Hosts  : 0
Calling-Station-Id : n/a
Application Profile: None
 ---------------------------------------------------------------------------
```

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.

Label	Description
`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-1/1.2 relations
===============================================================================
Bundle Relationship
===============================================================================
Bundle         Admin   Oper    Working            Protect            Active
Id             State   State   Bundle Id          Bundle Id          Bundle
-------------------------------------------------------------------------------
bpgrp-ima-1    Down    Down    bundle-ima-1/1.1   bundle-ima-1/1.2   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.

Label	Description (Continued)
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 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         1000010000000 5000      5000000
===============================================================================
```

ppp

Syntax **ppp** [**multiclass**]

Context show>multilink-bundle

Description This command enables the context to display PPP group data.

MDA Values 1, 2

multiclass
Specifies to display multi-class MLPPP information.

Sample Output

```
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#


*A:mlppp_top# show multilink-bundle bundle-ppp-1/1.1 ppp multiclass
===============================================================================
MLPPP Per Class Traffic Statistics for bundle-ppp-1/1.1
===============================================================================
                                                    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#
```

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) 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.
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-1/1.1 ima atm
==============================================================================
ATM Info for bundle-ima-1/1.1
==============================================================================
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
===============================================================================
```

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.

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`	`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-1/1.1 ima atm connections
================================================================
ATM Connections, Port bundle-ima-1/1.1
================================================================
           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.

Label	Description (Continued)
`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-1/1.1 ima atm port-connection
==============================================================================
ATM Port Connection
==============================================================================
Port Id              : bundle-ima-1/1.1
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	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.
Type	Identifies the system entity that owns a specific ATM connection.
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-1/1.1 ima atm pvc
=================================================================
ATM PVCs, Port bundle-ima-1/1.1
=================================================================
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-1/1.1 ima atm pvc detail
=================================================================
ATM PVCs, Port bundle-ima-1/1.1
=================================================================
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 — Displays 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.

Label	Description
`VPI`	Displays the VPI 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.
`Eng.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.
`OAM`	Indicates the OAM operational status of ATM connections.
`Opr`	`Up` — The bundle is operationally up.
	`Down` — The bundle is operationally down.

Sample Output

```
A:ima2# show multilink-bundle bundle-ima-1/1.1 ima atm pvp
================================================================
ATM PVPs, Port bundle-ima-1/1.1
================================================================
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.

Label	Description
VPI Range	Displays the VPI range:
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.

Sample Output

```
A:ima2# show multilink-bundle bundle-ima-1/1.1 ima atm pvt
================================================================
ATM PVTs, Port bundle-ima-1/1.1
================================================================
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 — 200 (7750 SR-1: 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.
Number of sub-groups	Total subgroups in LAG.

Label	Description (Continued)
`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.
`Sub-group`	Displays the member subgroup where the member port belongs to.

Label	Description (Continued)
Priority	Displays the member port priority.

```
*A:Dut-B# show lag 10 detail
===============================================================================
LAG Details
===============================================================================
Description : N/A
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id : 10 Mode : access
Adm : up Opr : up
Thres. Exceeded Cnt : 1 Port Threshold : 0
Thres. Last Cleared : 05/17/2009 19:33:00 Threshold Action : down
Dynamic Cost : false Encap Type : qinq
Configured Address : 00:03:fa:8d:45:d2 Lag-IfIndex : 1342177290
Hardware Address : 00:03:fa:8d:45:d2 Adapt Qos : distribute
Hold-time Down : 0.0 sec Port Type : standard
Per FP Ing Queuing : disabled
LACP : enabled Mode : active
LACP Transmit Intvl : fast LACP xmit stdby : enabled
Selection Criteria : highest-count Slave-to-partner : disabled
Number of sub-groups: 1 Forced : -
System Id : 00:03:fa:8d:44:88 System Priority : 32768
Admin Key : 32777 Oper Key : 40009
Prtr System Id : 00:03:fa:13:6f:a7 Prtr System Priority : 32768
Prtr Oper Key : 32777
MC Peer Address : 10.20.1.2 MC Peer Lag-id : 10
MC System Id : 00:02:80:01:00:0a MC System Priority : 100
MC Admin Key : 40009 MC Active/Standby : active
MC Lacp ID in use : true MC extended timeout : false
MC Selection Logic : peer decided
MC Config Mismatch : no mismatch
Source BMAC LSB : use-lacp-key Oper Src BMAC LSB : 9c:49
-------------------------------------------------------------------------------
Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio
-------------------------------------------------------------------------------
1/1/10 up active up yes 1 - 32768
-------------------------------------------------------------------------------
Port-id Role Exp Def Dist Col Syn Aggr Timeout Activity
-------------------------------------------------------------------------------
1/1/10 actor No No Yes Yes Yes Yes Yes Yes
1/1/10 partner No No Yes Yes Yes Yes Yes Yes
===============================================================================
*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 — 64 (16 for 7750 SR-c12/4)
		bundle ID	bundle-*type-slot/mda.bundle-num*	
			bpgrp-*type-bpgrp-num*	
			bundle	keyword
			bundle-num	1 — 128 (16 for 7750 SR-c12/4)
			type	ima, 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 2/1/4 interval 3 repeat 3 absolute
===============================================================================
Monitor statistics for Port 2/1/4
===============================================================================
                                             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 2/1/4 interval 3 repeat 3 rate
===============================================================================
Monitor statistics for Port 2/1/4
===============================================================================
                                             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#
```

```
===============================================================================
*A:Cpm-A> monitor port bundle-fr-1/1.1
===============================================================================
Monitor statistics for Port bundle-fr-1/1.1
===============================================================================
Input                Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
--------------------------------------------------------------------------------
Octets                                                      0                       0
Packets                                                     0                       0
Errors                                                      0                       0
```

port

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 9/1/1 atm interval 3 repeat 2 absolute
===============================================================================
Monitor ATM statistics for Port 9/1/1
===============================================================================
                                                      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* **soft**

Context clear

Description This command reinitializes the card in the specified slot.

Parameters *slot-number* — Clears information for the specified card slot.

Values SR-1, SR-c12/4: no cards can be cleared in this chassis type
SR-7: 1 - 6
SR-12: 1 - 10

soft — Issues a soft reset of the I/O module (IOM).

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 — 200 (7750 SR-1, SR-c12/4: 1 — 64)

statistics — Specifies to clear statistics for the specified LAG ID.

mda

Syntax **mda** *mda-id* [**statistics**]

Context clear

Description This command reinitializes the specified MDA in a particular slot.

Parameters *mda-id* — Clears the specified slot and MDA/CMA.

Values 1, 2

statistics — Clears statistics for the specified MDA.

port

Syntax **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**
port *port-id* **queue-group** *queue-group-name* [**access** | **network**] {**ingress** | **egress**} [**access|network**] [{**statistics|associations**}]
port *port-id* **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 — 64 (16 for 7750 SR-c12/4)	
bundle-type-slot/mda.bundle-num			
	bundle	keyword	
	type	ima, ppp	
	bundle-num	1 — 336	
bpgrp-id	bpgrp-<type>-<bpgrp-num>		
		bpgrp	keyword
		type	ima, ppp
		bpgrp-num	1 — 2000 (256 for 7750 SR-c12/4)

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 - 10

mda — The MDA number.

Default All MDAs.

Values 1, 2

7750 SR-c12: 1, 3, 5, 7, 9, 117750 SR-c12: 1-12**pvc —** Clears PVC statistics.

port-connection — Clears port-connection statistics.

queue-group *queue-group-name* **—** Clears the specified port queue group name. It uniquely identifies a port ingress queue group in the managed system.

ingress — Clears ingress queue group information.

egress — Clears egress queue group information

Tools Commands

aps

Syntax **aps** *aps-id* [**clear**]
aps mc-aps-signaling [**clear**]
aps mc-aps-ppp [**clear**]

Context tools>dump>aps

Description This command displays Automated Protection Switching (APS) information.

Parameters **clear —** Removes all Automated Protection Switching (APS) operational commands.

mc-aps-signaling — Displays multi-chassis APS signaling information.

mc-aps-ppp — Displays multi-chassis APS PPP information.

Sample Output

```
*A:AS_SR7_2# tools dump aps aps-33

GrpId = 33, state = Running, mode:cfg/oper = Bi-directional/Bi-directional
   revert = 0, workPort: N/A, protPort: 2/1/1, activePort: working
   rxK1 = 0x0 (No-Req on Protect), physRxK1 = 0x0, rxK2 = 0x5
   txK1 = 0x0 (No-Req on Protect), physTxK1 = 0x0, txK2 = 0x5
   K1ReqToBeTxed = 0x0, K1ChanToBeTxed = 0x0, lastRxReq = 0xc
   MC-APS Nbr = 100.100.100.1 (Up), advIntvl = 10, hold = 30
   workPort: status = OK, Tx-Lais = None, sdCnt = 1, sfCnt = 1
     numSwitched = 1, switchSecs = 0, lastSwitched = 07/25/2007 08:00:12
     disCntTime = , alarms = , switchCmd = No Cmd
   protPort: status = OK, Tx-Lais = None, sdCnt = 1,  sfCnt = 0
     numSwitched = 1, switchSecs = 0, lastSwitched = 07/25/2007 08:03:39
     disCntTime = , alarms = ,  switchCmd = No Cmd
   GrpStatus: OK, mmCnt = 1, cmCnt = 1, psbfCnt = 1, feplfCnt = 2
   LocalSwitchCmd: priority = No-Req, portNum = 0
   RemoteSwitchCmd: priority = No-Req, portNum = 0
   Running Timers = mcAdvIntvl mcHold
   processFlag =  apsFailures = , sonet = Y
   DebugInfo: dmEv = 0, dmClrEv = 0, amEv = 1, amClrEv = 1
     cmEv = 1, cmClrEv = 1, psbfEv = 1, psbfClrEv = 1
     feplfEv = 2, feplfClrEv = 2, wtrEv = 0, psbfDetectEv = 0
     wSdEv = 1, wSfEv = 2, pSdEv = 1, pSfEv = 1
     portStatusEv = 8, rxK1Ev = 9, txLaisEv = 2, lastEvName = FeplClr
     CtlUpEv = 3, CtlDnEv = 2, wAct = 0, wDeAct = 0
Seq      Event  TxK1/K2 RxK1/K2  Dir    Active         Time
===     ======= ======= ======= =====   ======  ================
000     ProtAdd 0xc005  0x0000  Tx-->     Work  497 02:18:10.590
001     RxKByte 0xc005  0x6dea  Rx<--     Work  497 02:20:14.820
002     RxKByte 0xc005  0xc005  Rx<--     Work  497 02:21:30.970
003     RxKByte 0xc005  0x2005  Rx<--     Work  497 02:21:36.530
004      pSFClr 0x0005  0x2005  Tx-->     Work  497 02:21:40.590
005     RxKByte 0x0005  0x0005  Rx<--     Work  497 02:21:40.600
```

```
006     RxKByte 0x0005  0xc115  Rx<--     Work  497 02:25:22.840
007     RxKByte 0x2115  0xc115  Tx-->     Prot  497 02:25:22.840
008     RxKByte 0x2115  0xa115  Rx<--     Prot  000 00:00:47.070
009     RxKByte 0x2115  0x1115  Rx<--     Prot  000 00:00:47.560
010     RxKByte 0x2115  0xc005  Rx<--     Prot  000 00:00:57.010
011     RxKByte 0x2005  0xc005  Tx-->     Work  000 00:00:57.010
012     RxKByte 0x2005  0x0005  Rx<--     Work  000 00:01:06.170
013     RxKByte 0x0005  0x0005  Tx-->     Work  000 00:01:06.170
```

Sample Output

```
:AS_SR7_1# tools dump aps mc-aps-ppp

 pppmMcsModStarted = Yes
 pppmMcsDbgDoSync = Yes
 pppmMcsApsGrpHaAuditDone = Yes
 pppmMcsPostHaSyncedApsGrpId = 47
 pppmMcsMcApsChanCnt = 1280

 pppmMcsDbgRxPktCnt = 2560
 pppmMcsDbgRxPktNotProcessedCnt = 0
 pppmMcsDbgRxPktInvalidCnt = 0
 pppmMcsDbgInconsistentRxPktDropCnt = 0
 pppmMcsDbgInconsistentTxPktDropCnt = 1176
 pppmMcsDbgTxPktNotSentCnt = 0
 pppmMcsDbgTxPktSentCnt = 25
 pppmMcsDbgEvtDropCnt = 0
 pppmMcsDbgMemAllocErrCnt = 0
 pppmMcsDbgReTxCnt = 0
 pppmMcsDbgReTxExpCnt = 0
 pppmMcsDbgReReqCnt = 0

 pppmMcsStateAckQueueCnt (curr/peek) = 0/130
 pppmMcsStateReqQueueCnt (curr/peek) = 0/1280
 pppmMcsStateReReqQueueCnt (curr/peek) = 0/256
 pppmMcsStateTxQueueCnt (curr/peek) = 0/512
 pppmMcsStateReTxQueueCnt (curr/peek) = 0/130

 MC-APS Peer Info :
 --------------------

   Grp 13 Addr 100.100.100.2 - Up
   Grp 20 Addr 100.100.100.2 - Up
   Grp 35 Addr 100.100.100.2 - Up
   Grp 43 Addr 100.100.100.2 - Up
   Grp 47 Addr 100.100.100.2 - Up

 Number of pppmMcs Evt Msgs dispatched:
   ctl_link_state : 0
   ctl_link_up_tmr : 0
   ctl_link_down_tmr : 0
   ha_audit_done : 0
```

Sample Output

```
*A:eth_aps_sr7# tools dump aps mc-aps-signaling

 MC-APS Control Debug Counters :
 ------------------------------
 Ctl Pkt Rx = 0
 Invalid Rx Ctl Pkt = 0
 Incompatible Rx Ctl Pkt = 0
 Nbr not Rx Ctl Pkt = 0
 Invalid Rx Ctl Pkt Tlv = 0
 Ctl Pkt Rx-ed before HaReady = 0
 Not sent Tx Ctl Pkt = 0

 MC-APS-LAG Debug Counters :
 --------------------------
 Ctl Pkt Rx from IOM        = 0

 Not processed Rx Ctl Pkt   = 0
 Invalid Rx Ctl Pkt         = 0
 Incompatible Rx Ctl Pkt    = 0
 Rx Ctl Pkt queueing failed = 0

 Ctl Pkt Tx (direct)        = 0
 Ctl Pkt Tx (UDP socket)    = 0
 Not sent Tx Ctl Pkt        = 0

 Route Update               = 0
 Matched Route Update       = 0

 Msg Buf Alloc Failed       = 0

 MC-APS-LAG NbrRoute Entries :
 ------------------------------
 NbrAddr 1.1.1.1 NextHopAddr ::
   EgressIfIndex =  0
   EgressPortId =  Unknown
   app refCnt  =  1
   refCntTotal =  1
```

aps

Syntax **aps**

Context tools>perform

Description This command enables the context to perform Automated Protection Switching (APS) operations.

clear

Syntax **clear** *aps-id* {**protect | working**}

Context tools>perform>aps
tools>dump>aps

Description This command removes all Automated Protection Switching (APS) operational commands.

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command clears a physical port that is acting as the protection circuit for the APS group.

working — This command clears a physical port that is acting as the working circuit for this APS group.

exercise

Syntax **exercise** *aps-id* {**protect | working**}

Context tools>perform
tools>dump>aps

Description This command performs an exercise request on the protection or working circuit.

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command performs an exercise request on the port that is acting as the protection circuit for the APS group.

working — This command performs an exercise request on the port that is acting as the working circuit for this APS group.

force

Syntax **force** *aps-id* {**protect** | **working**}

Context tools>perform
tools>dump>aps

Description This command forces a switch to either the protect or working circuit

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command clears a physical port that is acting as the protection circuit for the APS group.

working — This command clears a physical port that is acting as the working circuit for this APS group.

lockout

Syntax **lockout** *aps-id*

Context tools>perform
tools>dump>aps

Description This command locks out the protection circuit.

Parameters *aps-id* — Automated Protection Switching ID

Values 1 — 64

request

Syntax **request** *aps-id* {**protect** | **working**}

Context tools>perform
tools>dump>aps

Description This command requests a manual switch to protection or working circuit.

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command requests a manual switch to a port that is acting as the protection circuit for the APS group.

working — This command requests a manual switch to a port that is acting as the working circuit for this APS group.

eth-tunnel

Syntax **eth-tunnel** *tunnel-index* [**clear**]

Context tools>dump

Description This command displays Ethernet tunnel information.

Sample Output

```
*A:PE-E# tools dump eth-tunnel 1

TunnelId 1 (Up/Up), Port eth-tunnel-1 (Up/Up): type g8031-1to1
 NumMems 2/2, Up/Dn 0/0, active 0x1, present 0x3 baseMemPort 1/1/2
  memId 1 (P), port 1/1/2 (Up), tag 1.0(Up) status (Up/Up)
    ccCnt-sf/ok 1/1 idx 0 tunId 1
  memId 2 (S), port 2/1/2 (Up), tag 1.0(Up) status (Up/Up)
    ccCnt-sf/ok 0/0 idx 1 tunId 1

  TunId = 1, state = Running, Active =  Work, Now = 000 00:16:48.140
   revert = 1, ReqState = NR-NULL, Pdu(Tx/Rx): 0x0f0000/0x0f0000
   Defects =
   Running Timers = PduReTx
    Work MemId = 1 (1/1/2:1.0), state = Ok, cc = 000 00:16:23.510U
      ActiveCnt = 4, ActiveSeconds = 791
    Protect MemId = 2 (2/1/2:1.0), state = Ok, cc = 000 00:09:47.560U
      ActiveCnt = 3, ActiveSeconds = 308
   DbgCnts: swoEv = 2, wMemSts = 2, pMemSts =  0
      rxPdu (valid/Invalid) = 4/0, wSfClr = 1, pSfClr = 0, wtrExp =  1
      cm = 0, cmClr = 0, pm = 0, pmClr = 0, nr = 0, nrClr = 0
  Seq  Event     TxPdu          RxPdu       Dir    Act          Time
  ===  ========  ============  ============  =====  ====  ================
  000   wMemSts  0xbf0101 wSF  0x0f0000  NR  Tx-->  Prot  000 00:16:12.450
  001     RxPdu  0xbf0101 wSF  0x0f0101  NR  Rx<--  Prot  000 00:16:12.450
  002     RxPdu  0xbf0101 wSF  0xbf0101 wSF  Rx<--  Prot  000 00:16:12.480
  003     RxPdu  0xbf0101 wSF  0x0f0101  NR  Rx<--  Prot  000 00:16:24.890
  004    wSFClr  0x5f0101 WTR  0x0f0101  NR  Tx-->  Prot  000 00:16:25.030
  005       WTR  0x0f0000  NR  0x0f0101  NR  Tx-->  Work  000 00:16:26.630
  006     RxPdu  0x0f0000  NR  0x0f0000  NR  Rx<--  Work  000 00:16:26.630
*A:PE-E#
```

frame-relay

Syntax **frame-relay** *port-id*

Context This command displays frame-relay information.

Parameters *port-id* — Specifies the physical port ID.

Syntax: *slot/mda/port*[.*channel*]

Sample Output

```
tools dump frame-relay bundle-fr-1/1.1

MLFR info for bundle-fr-1/1.1:
    expectedBundleIdStr : "7750-bundle-fr-1/1.1"
    bundleId            : 1
    active/configured   : 4/4
    adminEnabled        : 1
    ddDebDownCnt        : 10
    ddMaxForBundle      : 0
    fwdId               : 0
    linkDebugMask       : 0


-------- Member Information ---------

1/1/1.1.1.1                 PortId = 0x22208056
    Internal ID              : bundle 1, link 1
    Link protocol state      : Up
    Diff delay state         : Yellow
    ddRedCnt                 : 0
    ddYellowCnt              : 11
    Smoothed diff delay      : 20 ms.
    Historical RTT           : 22788, 22756, 22752 us.
    Rx LinkId                : "1/1/1.1.1.1"
    WARNING                  : dbgDelay=20 ms
    LIP CTL Messages         : Tx: 136         Rx: 135
    Hello Messages           : Tx: 121         Rx: 12
    Hello Ack Messages       : Tx: 12          Rx: 121
    AddLink Messages         : Tx: 2           Rx: 1
    AddLinkAck Messages      : Tx: 1           Rx: 1
    AddLinkRej Messages      : Tx: 0           Rx: 0
1/1/1.1.2.1                 PortId = 0x22208077
    Internal ID              : bundle 1, link 2
    Link protocol state      : Up
    Diff delay state         : OK
    Smoothed diff delay      : 0 ms.
    Historical RTT           : 2271, 2304, 2309 us.
    Rx LinkId                : "1/1/1.1.2.1"
    LIP CTL Messages         : Tx: 136         Rx: 135
    Hello Messages           : Tx: 121         Rx: 12
    Hello Ack Messages       : Tx: 12          Rx: 121
    AddLink Messages         : Tx: 2           Rx: 1
    AddLinkAck Messages      : Tx: 1           Rx: 1
    AddLinkRej Messages      : Tx: 0           Rx: 0
1/1/1.1.3.1                 PortId = 0x22208098
    Internal ID              : bundle 1, link 4
    Link protocol state      : Up
    Diff delay state         : OK
    Smoothed diff delay      : 0 ms.
    Historical RTT           : 2218, 2223, 2359 us.
    Rx LinkId                : "1/1/1.1.3.1"
    LIP CTL Messages         : Tx: 14          Rx: 13
    Hello Messages           : Tx: 8           Rx: 1
    Hello Ack Messages       : Tx: 1           Rx: 8
    AddLink Messages         : Tx: 3           Rx: 1
    AddLinkAck Messages      : Tx: 1           Rx: 2
    AddLinkRej Messages      : Tx: 0           Rx: 0
1/1/1.1.4.1                 PortId = 0x222080b9
    Internal ID              : bundle 1, link 3
```

```
Link protocol state      : Up
Diff delay state         : OK
Smoothed diff delay      : 0 ms.
Historical RTT           : 2248, 2242, 2309 us.
Rx LinkId                : "1/1/1.1.4.1"
LIP CTL Messages         : Tx: 14          Rx: 13
Hello Messages           : Tx: 8           Rx: 1
Hello Ack Messages       : Tx: 1           Rx: 8
AddLink Messages         : Tx: 3           Rx: 1
AddLinkAck Messages      : Tx: 1           Rx: 2
AddLinkRej Messages      : Tx: 0           Rx: 0
```

lag

Syntax **lag lag-id** *lag-id*

Context tools>dump

Description This command dumps LAG information.

Parameters *lag-id* — Specifies the LAG ID.

Values 1..200

map-to-phy-port

Syntax **map-to-phy-port** {**ccag** *ccag-id* **|** **lag** *lag-id* **|** **eth-tunnel** *tunnel-index*} {**isid** *isid* [**end-isid** *isid*] **|** **service** *service-id* **|** *svc-name* [**end-service** *service-id* **|** *svc-name*]} [**summary**]

Context tools>dump

Description This command provides the ability to respond to a query to provide the link in a LAG/Ethernet tunnel (loadsharing protection mode)/CCAG that is currently assigned to a given service-id or ISID.

Parameters *lag-id* — Specifies the LAG ID.

Values 1..200

isid — Specifies the ISID.

Values 0..16777215

service-id — Specifies the service ID.

Values 1..2147483648, 64 char max

tunnel-index — Specifies the tunnel index.

Values 1..1024

ccag-id — Specifies the CCAG ID.

Values 1..8

ppp

Syntax **ppp** *port-id*

Context tools>dump

Description This command displays PPP information for a port.

Parameters *port-id* — Specifies the physical port ID.

Syntax: *slot/mda/port*[.*channel*]

Sample Output

```
*A:sr7# tools dump ppp aps-1.1.1.1
===============================================================================
Id              : aps-1.1.1.1        ppp unit       : 40
member of       : bpgrp-ppp-1
===============================================================================
looped back     : no                 dbgMask        : 0x0
-------------------------------------------------------------------------------
LCP
-------------------------------------------------------------------------------
phase           : NETWORK            state          : OPENED
passive         : off                silent         : off
restart         : on

mru             : 1500               mtu            : 1502
ack'd peer mru  : 1500
got local mrru  : 1524
local magic     : 0x0                peer magic     : 0x0

keepalive       : on                 echo num       : 2
echo timer      : on                 echos fail     : 3
echo intv       : 10                 echos pend     : 0

options      mru      asyncMap upap     chap     magic    pfc
we negotiate Yes       No       No       No       No      Yes
peer ack'd   Yes       No       No       No       No       No
we allow     Yes       No       No       No       No      Yes
we ack'd     Yes       No       No       No       No       No

options      acfc     lqr      mrru     shortSeq endPoint mlhdrfmt
we negotiate Yes       No      Yes       No      Yes       No
peer ack'd    No       No      Yes       No      Yes       No
we allow     Yes       No      Yes      Yes      Yes       No
we ack'd      No       No      Yes       No      Yes       No
===============================================================================
*A:sr7#
```

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* — Specifies the instance ID.

Values 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* — Specifies an existing bundle ID.

Values **bundle-ima**-*slot/mda.bundle-num*

bundle-num — Specifies the bundle number.

Values 1 — 256

Debug Commands

lmi (frame-relay)

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 (atm)

Syntax [**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 no ilmi 1/2/2
A:CHRISILMI# debug atm ilmi 1/2/4

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*]

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"
```

frf16

Syntax [**no**] **frf16** *port-id*

Context debug>frame-relay

Description This command enables tracing of all FRF16 compliant MLFR link integrity protocol messages in both the receive and transmit directions on a specific member link of an MLFR bundle. The **no** form of the command turns off MLFR debugging.

Parameters *port-id* — Specifies the port ID of the FRF16 bundle member link.

Syntax: *slot/mda/port*[.*channel*]

Sample Output

```
1 2009/02/18 10:39:42.74 UTC MINOR: DEBUG #2001 Base MLFR
"MLFR: [_LIP_ParseRxFrame]
RxMsg <bundle-fr-1/1.1:1/1/1.0x56> <state-0: Up>
<MsgType-5:HelloAck>
     <ie-03:      MagicNum>,<len 06>, <27002>
     <ie-05:     TimeStamp>,<len 06>, <0x4b1c4558>"

2 2009/02/18 10:39:43.73 UTC MINOR: DEBUG #2001 Base MLFR
"MLFR: [_LIP_TxFrame]
TxMsg <bundle-fr-1/1.1:1/1/1.0x56> <state-0: Up>
<MsgType-4:Hello>
     <ie-03:      MagicNum>,<len 06>, <31104>
     <ie-05:     TimeStamp>,<len 06>, <0x5d804569>"

3 2009/02/18 10:39:43.73 UTC MINOR: DEBUG #2001 Base MLFR
"MLFR: [_LIP_ParseRxFrame]
RxMsg <bundle-fr-1/1.1:1/1/1.0x56> <state-0: Up>
<MsgType-5:HelloAck>
     <ie-03:      MagicNum>,<len 06>, <27002>
     <ie-05:     TimeStamp>,<len 06>, <0x5d804569>"
```

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 — 64
bundle ID bundle-*type-slot/mda*.*bundle-num*
bpgrp-*type-bpgrp-num*
bundle keyword
bundle-num 1 — 256 (16 for 7750 SR-c12/4)
type ppp

Standards and Protocol Support

Standards Compliance

IEEE 802.1ab-REV/D3 Station and Media Access Control Connectivity Discovery
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 802.1ad Provider Bridges
IEEE 802.1ah Provider Backbone Bridges
IEEE 802.1ag Service Layer OAM
IEEE 802.3ah Ethernet in the First Mile
IEEE 802.1ak Multiple MAC Registration Protocol
IEEE 802.3 10BaseT
IEEE 802.3ax 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
ITU-T Y.1731 OAM functions and mechanisms for Ethernet based networks
ITU-T G.8031 Ethernet linear protection switching

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 Version 2
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 2918 Route Refresh Capability for BGP-4
RFC 3107 Carrying Label Information in BGP-4
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 4456 BGP Route Reflection: Alternative to Full-mesh IBGP (previously RFC 1966 & 2796)
RFC 4724 Graceful Restart Mechanism for BGP — GR helper
RFC 4760 Multi-protocol Extensions for BGP
RFC 4893 BGP Support for Four-octet AS Number Space
RFC 5065 Confederations for BGP (obsoletes 3065)

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
RFC 5283 LDP extension for Inter-Area LSP
draft-jork-ldp-igp-sync-03

IPSec

RFC 2401 Security Architecture for the Internet Protocol
RFC 2409 The Internet Key Exchange (IKE)
RFC 3706 IKE Dead Peer Detection
RFC 3947 Negotiation of NAT-Traversal in the IKE
RFC 3948 UDP Encapsulation of IPsec ESP Packets
draft-ietf-ipsec-isakmp-xauth-06.txt — Extended Authentication within ISAKMP/Oakley (XAUTH)
draft-ietf-ipsec-isakmp-modecfg-05.txt — The ISAKMP Configuration Method

IPv6

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 4552 Authentication/Confidentiality for OSPFv3
RFC 4659 BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN
RFC 5072 IP Version 6 over PPP
RFC 5095 Deprecation of Type 0 Routing Headers in IPv6
draft-ietf-isis-ipv6-05
draft-ietf-isis-wg-multi-topology-xx.txt

Multicast

RFC 1112 Host Extensions for IP Multicasting (Snooping)
RFC 2236 Internet Group Management Protocol, (Snooping)
RFC 3376 Internet Group Management Protocol, Version 3 (Snooping)
RFC 2362 Protocol Independent Multicast-Sparse Mode (PIMSM)
RFC 3618 Multicast Source Discovery Protocol (MSDP)
RFC 3446 Anycast Rendevous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)
RFC 4601 Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)
RFC 4604 Using IGMPv3 and MLDv2 for Source-Specific Multicast
RFC 4607 Source-Specific Multicast for IP
RFC 4608 Source-Specific Protocol Independent Multicast in 232/8
RFC 4610 Anycast-RP Using Protocol Independent Multicast (PIM)
draft-ietf-pim-sm-bsr-06.txt
draft-rosen-vpn-mcast-08.txt
draft-ietf-mboned-msdp-mib-01.txt
draft-ietf-l3vpn-2547bis-mcast-07: Multicast in MPLS/BGP IP VPNs
draft-ietf-l3vpn-2547bis-mcast-bgp-05: BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs
RFC 3956: Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address

MPLS

RFC 3031 MPLS Architecture
RFC 3032 MPLS Label Stack
Encoding (REV3443))
RFC 4379 Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures
RFC 4182 Removing a Restriction on the use of MPLS Explicit NULL
RFC 5332 MPLS Multicast Encapsulations

RIP

RFC 1058 RIP Version 1
RFC 2082 RIP-2 MD5 Authentication
RFC 2453 RIP Version 2

RSVP-TE

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 3564 Requirements for Diff-Serv-aware TE
RFC 4090 Fast reroute Extensions to RSVP-TE for LSP Tunnels
RFC 4124 Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering
RFC 4125 Maximum Allocation Bandwidth Constraints Model for Diffserv-aware MPLS Traffic Engineering
RFC 4875 Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs)
draft-ietf-mpls-soft-preemption-14 MPLS Traffic Engineering Soft Preemption
draft-ietf-ccamp-mpls-graceful-shutdown-06 Graceful Shutdown in GMPLS Traffic Engineering Networks
draft-ietf-mpls-p2mp-lsp-ping-06 Graceful Shutdown in GMPLS Traffic Engineering Networks

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

TCP/IP

RFC 768 UDP
RFC 1350 The TFTP Protocol (Rev.
RFC 791 IP
RFC 792 ICMP

RFC 793 TCP
RFC 826 ARP
RFC 854 Telnet
RFC 951 BootP (rev)
RFC 1519 CIDR
RFC 1542 Clarifications and Extensions for the Bootstrap Protocol
RFC 1812 Requirements for IPv4 Routers
RFC 2347 TFTP option Extension
RFC 2328 TFTP Blocksize Option
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-05.txt Bidirectional Forwarding Detection
draft-ietf-bfd-v4v6-1hop-06.txt BFD IPv4 and IPv6 (Single Hop)
draft-ietf-bfd-multihop-06.txt BFD for Multihop Paths

VRRP

RFC 2787 Definitions of Managed Objects for the Virtual Router Redundancy Protocol
RFC 3768 Virtual Router Redundancy Protocol
draft-ietf-vrrp-unified-spec-02: Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6

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 1877 PPP Internet Protocol Control Protocol Extensions for Name Server Addresses
RFC 1989 PPP Link Quality Monitoring
RFC 1990 The PPP Multilink Protocol (MP)
RFC 1994 PPP Challenge Handshake Authentication Protocol (CHAP)
RFC 2516 A Method for Transmitting PPP Over EthernetRFC 2615 PPP over SONET/SDH
RFC 2686 The Multi-Class Extension to Multi-Link PPP

Frame Relay

FRF.1.2 - PVC User-to-Network Interface (UNI) Implementation Agreement
FRF.5 - Frame Relay/ATM PVC Network Interworking Implementation
ANSI T1.617 Annex D, DSS1 — Signalling Specification For Frame Relay Bearer Service.
FRF2.2 -PVC Network-to- Network Interface (NNI) Implementation Agreement.
FRF.12 Frame Relay Fragmentation Implementation Agreement
FRF.16.1 Multilink Frame Relay UNI/ NNI Implementation Agreement
ITU-T Q.933 Annex A-Additional procedures for Permanent Virtual Connection (PVC) status management

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
AF-PHY-0086.001,Inverse Multiplexing for ATM (IMA) Specification Version 1.1

DHCP

RFC 2131 Dynamic Host Configuration Protocol (REV)
RFC 3046 DHCP Relay Agent Information Option (Option 82)
RFC 1534 Interoperation between DHCP and BOOTP

VPLS

RFC 4762 Virtual Private LAN Services Using LDP
draft-ietf-l2vpn-vpls-mcast-reqts-04
draft-ietf-l2vpn-signaling-08

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):A Control Channel for Pseudowires

draft-ietf-l2vpn-vpws-iw-oam-02.txt

draft-ietf-pwe3-oam-msg-map-05-txt

draft-ietf-l2vpn-arp-mediation-04.txt

draft-ietf-pwe3-ms-pw-arch-05.txt

draft-ietf-pwe3-segmented-pw-11.txt

draft-hart-pwe3-segmented-pw-vccv-02.txt

draft-muley-dutta-pwe3-redundancy-bit-02.txt

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

RFC 5287 Control Protocol Extensions for the Setup of Time-Division Multiplexing (TDM) Pseudowires in MPLS Networks

SONET/SDH

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

RADIUS

RFC 2865 Remote Authentication Dial In User Service

RFC 2866 RADIUS Accounting

SSH

draft-ietf-secsh-architecture.txtSSH Protocol Architecture

draft-ietf-secsh-userauth.txt SSH Authentication Protocol

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

TACACS+

draft-grant-tacacs-02.txt

Timing

GR-253-CORE SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000

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