7210 SAS M 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 7210 SAS-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 7210 SAS M OS documentation set is composed of the following books:

- 7210 SAS M OS Basic System Configuration Guide

  This guide describes basic system configurations and operations.

- 7210 SAS M OS System Management Guide

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

- 7210 SAS M OS Interface Configuration Guide

  This guide describes card, Media Dependent Adapter (MDA), and port provisioning.

- 7210 SAS M OS 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.

- 7210 SAS M OS Services Guide

  This guide describes how to configure service parameters such as customer information and user services.

- 7210 SAS M OS OAM and Diagnostic Guide

  This guide describes how to configure features such as service mirroring and Operations, Administration and Management (OAM) tools.

- 7210 SAS M OS Quality of Service Guide

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

- 7210 SAS M OS MPLS Guide

  This guide describes how to configure Multiprotocol Label Switching (MPLS) and Label Distribution Protocol (LDP).

- 7210 SAS M OS Routing Protocols Guide

  This guide provides an overview of routing concepts and provides configuration examples for RIP, OSPF, IS-IS and route policies.

Technical Support

If you purchased a service agreement for your 7210 SAS M-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 and ports.

Alcatel-Lucent 7210 SAS M-Series Router Configuration Process

Table 1 lists the tasks necessary to provision input/output control modules (IOMs), also referred to as cards, 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 14
	MDAs	MDAs on page 14
	Ports	Ports on page 15
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support on page 139

7210 SAS-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*.

The chassis slot is auto-provisioned at boot time with the appropriate line card type and MDA type.

The following sections are discussed.

Chassis Slots and Cards

The MDA type is auto-provisioned at boot time.

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.

Ports

Port Types

The Alcatel-Lucent 7210 SAS routers support the following port types:

- Ethernet — Supported Ethernet port types include:
  - → Fast Ethernet
  - → Gigabit

  7210 SAS M ports must be configured as either access or network. The default is network.
  - → Access ports — Configured for customer facing traffic on which services are configured. If a Service Access Port (SAP) is to be configured on the port, it must be configured as an access port. When a port is configured for access mode, the appropriate encapsulation type must be configured to distinguish the services on the port. Once a port has been configured for access mode, one or more services can be configured on the port depending on the encapsulation value.

Port Features

- LAG on page 16
- 802.1x Network Access Control on page 24

LAG

Based on the IEEE 802.3ad standard, Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two network devices, depending on the number of links installed (from 1 to 4). 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 802.3ad 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 (0-3), 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 four physical links. The threshold is set to two and dynamic costing is not configured. If the operational links is equal to or drops below two, the link is regarded as operationally down until the number of operational links is two 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:

- A maximum of 12 LAGs, 4 ports in each, can be configured on a 7210 SAS M.
- Ports can be added or removed from the LAG while the LAG and its ports (other than the port being removed) remain operational. When ports to and/or from the LAG are added or removed, the hashing algorithm is adjusted for the new port count.
- **show** commands display physical port statistics on a port-by-port basis or the entire LAG can be displayed.
- LAG is supported on Ethernet ports.
- Ports of a particular LAG can be of different types but they must be the same speed and duplex. To guarantee the same port speed is used for all ports in a LAG, autonegotiation must be disabled or in limited mode to ensure only a specific speed is advertised.

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

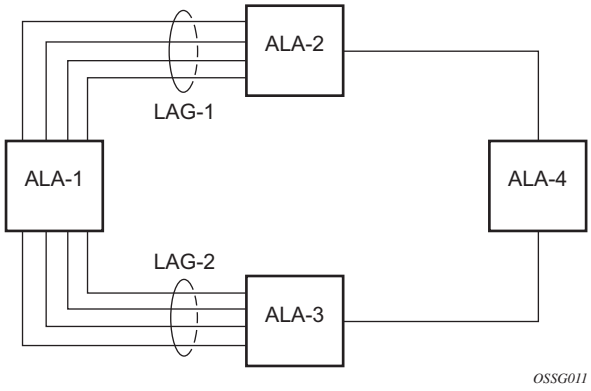

Figure 1: LAG Configuration

LAG 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 7210 SAS M currently only supports Link Aggregation Groups and supports up to four ports per LAG.

To avoid out-of-sequence packets the algorithm for selecting the next hop in LAG must be deterministic. The algorithm performs at line rate and is executed in the 7210 SAS M Network Processor Array (NPA) when the packet ingresses the IOM, after determining that the next hop is a LAG.

Depending on the type of traffic that needs to be distributed into a 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 traffic. This is hashed based on IP source and destination addresses, TCP or UDP source and destination port information in the hash algorithm, or the MAC source and destination addresses for non-IP traffic.
- 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, TCP or UDP source port and destination port. 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 7210 SAS M router uses the IP SA/DA and TCP/UDP port information.
- MPLS switched traffic at an LSR is based on the whole label stack (up to two labels). Note that the EXP/TTL information in each label is not included in the hash algorithm.
- VLL traffic from a service access point is sprayed similar to that in a VPLS service.

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. For more information about QoS policies and LAG interaction refer to LAG and QoS Policies on page 21.

LAG and QoS Policies

In the 7210 SAS M, an ingress QoS policy is applied to the aggregate traffic that enters the traffic through all the ports of the system. For example, if an ingress policy is configured with a policier of PIR 100Mb, for a SAP configured on a LAG with two ports, then the policer limits the traffic entering the system through the two ports to a maximum of 100Mb.

In the 7210 SAS M, egress QoS policy shaper parameters are applied to all the ports that are members of the LAG (all ports get the full SLA). For example, if an egress policy is configured with a policer of PIR 100Mb, each port would get a PIR of 100 Mb. The advantage of this method over a scheme where the PIR is divided equally among all the member ports of the LAG, is that a single flow can consume the entire SLA. The disadvantage is that the overall SLA can be exceeded if the flows span multiple 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 7210 SAS 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 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 802.3ad standard so interoperability is ensured.

LAG Subgroups

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 7210 SAS 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).

802.1x Network Access Control

The Alcatel-Lucent 7210 SAS 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 7210 SAS 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

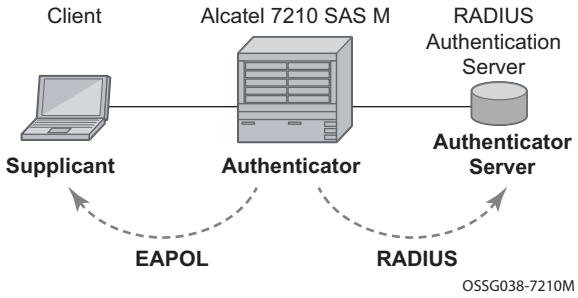

Figure 2: 802.1x Architecture

The IEEE 802.1x standard defines three participants in an authentication conversation (see Figure 2).

- 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.

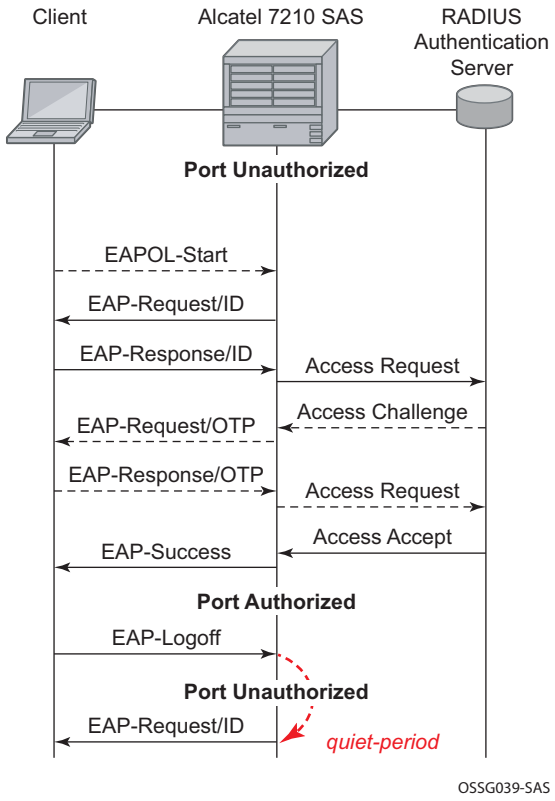

Figure 3: 802.1x Authentication Scenario

The messages involved in the authentication procedure are illustrated in Figure 3.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 4 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.

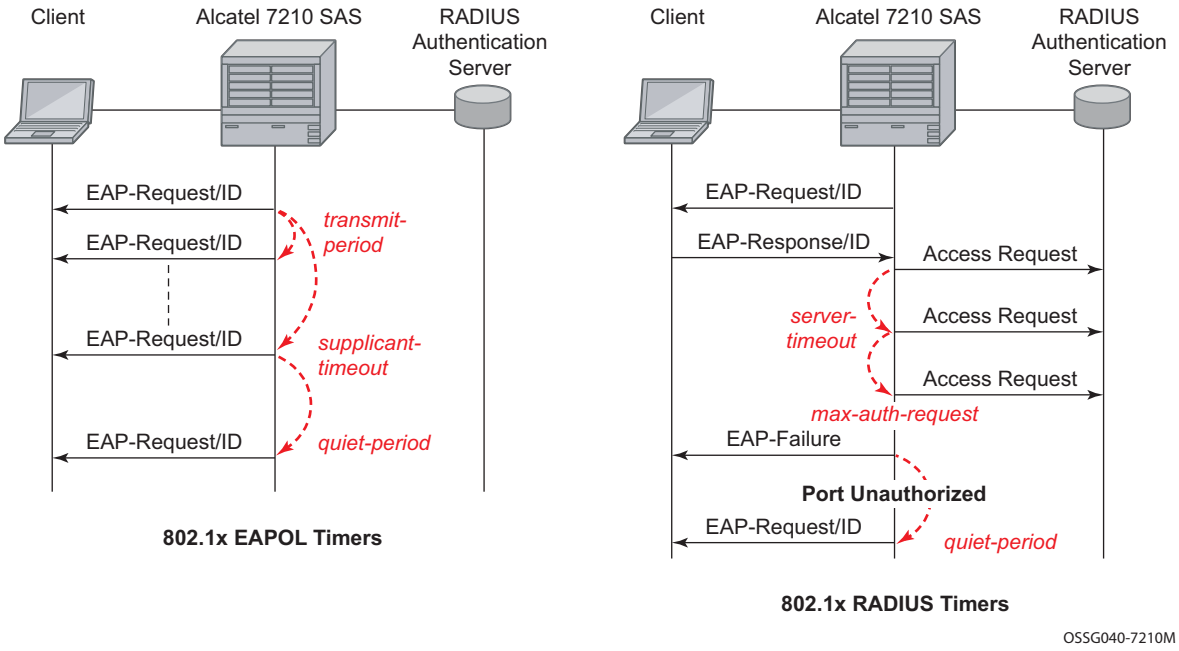

Figure 4: 802.1x EAPOL Timers (left) and RADIUS Timers (right)

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.

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.
- Generation of dying gasp message on network ports on power failure.
- EFM OAMPDU tunneling.
- High resolution timer for EFM OAM in 500ms 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.

The 7210 does not generate EFM OAM PDUs with these flags except for the dying gasp flag. However, it supports processing of these flags in EFM OAM PDUs received from the peer.

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.

802.3ah OAM PDU Tunneling for Epipe Service

The 7210 SAS 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

- The 7210 SAS M must contend with MTU limitations at many service points. The physical (access and network) port, service, and SDP MTU values must be individually defined.
- 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 2 displays the default MTU values which are dependent upon the (sub-) port type, mode, and encapsulation.

Table 2: 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*

*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.

Deploying Preprovisioned Components

Appropriate MDAs are auto-provisioned in 7210 SAS M. User is not required to provisions the slots or MDA.

Configuration Notes

The following information describes provisioning caveats:

- Ports can be provisioned without configuration of slot, card and MDA since these components are auto-provisioned.

Configuring Physical Ports with CLI

This section provides information to configure ports.

Topics in this section include:

Preprovisioning Guidelines

7210 SAS M provides a console port to connect terminals to the device. The Ethernet management port is not supported.

Configure parameters from a system console connected to a 7210 SAS M console port, using Telnet to access a 7210 SAS remotely or SSH to open a secure shell connection.

Preprovisioning a Port

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 41.

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

    Accounting policies can only be associated with network ports 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 41.

Once ports are preprovisioned, Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two nodes. Up to four links can be grouped. All physical links in a given LAG combine to form one logical connection. A LAG also provides redundancy in case one or more links that participate in the LAG fail. For command syntax, see Configuring LAG Parameters on page 43.

Basic Configuration

Note that cards and MDAs required for operation of the system are auto-provisioned.

The most basic configuration must have the following:

Common Configuration Tasks

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

Configuring Ports

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:

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:

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 LAG Parameters

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

- A maximum of four 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 1/1/2
     port 1/1/3
     dynamic-cost
     port-threshold 2 action down
----------------------------------------------
A:ALA-A>config>lag#
```

Service Management Tasks

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

- Modifying a Card Type on page 45
- Deleting a Card on page 46
- Deleting Port Parameters on page 47

To change an MDA type already provisioned for a specific slot/card, first you must shut down the slot/MDA/port configuration and then delete the MDA from the configuration. Modify and delete operations can be performed only on the MDAs that are not auto equipped or auto provisioned.Use the following CLI syntax to modify an MDA:

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

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

Modifying a Card Type

The modify operation cannot be performed on an IOM card that is auto equipped and auto provisioned during bootup and is fixed.

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

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

Deleting a Card

The delete operation cannot be performed on an IOM card that is auto equipped and auto provisioned during bootup and is fixed.

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

CLI Syntax:
```
config> card slot-number
        card-type card-type
        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
```

Card, MDA, and Port Command Reference

Command Hierarchies

Card and MDA Configuration Commands

Hardware Commands

config
- [**no**] **card** *slot-number*
  - **card-type** *card-type*
  -
    - [**no**] **shutdown**
  - [**no**] **mda** *mda-slot*
    - **mda-type** *mda-type*
    - **no mda-type**
    - [**no**] **shutdown**
  - [**no**] **shutdown**

Port Configuration Commands

config
- **port**
- **no port**
  - **access**
    - **egress**
      - [**no**] **pool** [*name*]
        - **slope-policy** *name*
        - **no slope-policy**
  - **description** *long-description-string*
  - **no description**
  - **network**
    - **egress**
      - [**no**] **pool** [*name*]
  - [**no**] **shutdown**
  - **split-horizon-group** **g***roup-name*
  - **no split-horizon-group**

Ethernet Commands

config
- [**no**] **port** {*port-id*}
  - **ethernet**
    - **access**
      - **egress**
        - **accounting-policy** *acct-policy-id*
        - **no accounting-policy**
        - [**no**] **collect-stats**
        - **qos** *policy-id*
        - **no qos**
    - **autonegotiate** [**limited**]
    - [**no**] **autonegotiate**
    - **dot1x**
      - **max-auth-req** *max-auth-request*
      - **port-control** {**auto** | **force-auth** | **force-unauth**}
      - **quiet-period** *seconds*
      - **radius-plcy** *name*
      - **re-auth-period** *seconds*
      - [**no**] **re-authentication**
      - **server-timeout** *seconds*
      - **no server-timeout**
      - **supplicant-timeout** *seconds*
      - **no supplicant-timeout**
      - **transmit-period** *seconds*
      - **no transmit-period**
    - **down-when-looped**
      - **keep-alive** *timer*
      - **no keep-alive**
      - **retry-timeout** *timer*
      - **no retry-timeout**
      - [**no**] **shutdown**
    - **duplex** {**full** | **half**}
    - **efm-oam**
      - [**no**] **accept-remote-loopback**
      - **mode** {**active** | **passive**}
      - [**no**] **shutdown**
      - [**no**] **transmit-interval** *interval* [**multiplier** *multiplier*]
      - [**no**] **tunneling**
    - **egress-scheduler-policy** *port-scheduler-policy-name*
    - **no egress-scheduler-policy**
    - **encap-type** {**dot1q** | **null**}
    - **no encap-type**
    - **hold-time** {[**up** *hold-time up*] [**down** *hold-time down*]}
    - **no hold-time**
    - **mac** *ieee-address*
    - **no mac**
    - **mode** {**access**}
    - **no mode**
    - **mtu** *mtu-bytes*
    - **no mtu**
    - [**no**] **report-alarm** [**signal-fail**] (**7210 SAS MX**)
    - **speed** {**10** | **100** | **1000**}

LAG Commands

config
- — [**no**] **lag** [*lag-id*]
  - — **description** *long-description-string*
  - — **no description**
  - — **encap-type** {**dot1q** | **null**}
  - — **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**
  - — **no mode**
  - — **port** *port-id* [*port-id* …up to 4 total] [**priority** *priority*] [**sub-group** *sub-group-id*]
  - — **no port** *port-id* [*port-id* …up to 4 total]
  - — **selection-criteria** [**highest-count** | **highest-weight**] [**slave-to-partner**]
  - — **no selection-criteria**
  - — [**no**] **shutdown**

Split Horizon Group Commands

config
- — [**no**] **split-horizon-group** **g***roup-name*

Show Commands

show
- — **chassis** [**environment**] [**power-supply**]
- — **card** [*slot-number*] [**detail**]
- — **card state**
- — **pools** *mda-id*[/*port*]
- — **lag** [*lag-id*] [**detail**] [**statistics**]
- — **lag** *lag-id* **associations**
- — **port** *port-id* [**count**] [**detail**]
- — **port** *port-id* **description**
- — **port** *port-id* **associations**
- — **port** *port-id* **dot1x** [**detail**]
- — **port** *port-id* **ethernet** [**efm-oam** | **detail**]

Monitor Commands

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

Clear Commands

clear
- — **card** *slot-number*
- — **lag** *lag-id* **statistics**
- — **mda** *mda-id* [**statistics**]
- — **port** *port-id* **statistics**

Debug Commands

debug
- — **lag** [**lag-id** *lag-id* **port** *port-id*] [**all**]
- — **lag** [**lag-id** *lag-id* **port** *port-id*] [**sm**] [**pkt**] [**cfg**] [**red**] [**iom-upd**] [**port-state**] [**timers**] [**sel-logic**]
- — **no lag** [**lag-id** *lag-id*]

Configuration Commands

Generic Commands

description

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

Context config>port
config>lag

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

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

Default No description is associated with the configuration context.

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

shutdown

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

Context config>card
config>card>mda
config>port
config>port>ethernet
config>lag

config>port>ethernet>efm-oam

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**.

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

Syntax **card** *slot-number*

Context config

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

The **no** form of this command cannot be used on fixed IOM and MDA cards that are auto equipped and auto provisioned.

Default The IOM card is equipped and provisioned for slot 1.

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

card-type

Syntax **card-type** *card-type*

Context config>card

Description This mandatory command adds a 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 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.

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.

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

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

The **no** form of this command cannot be used as the IOM card is fixed.

Default The IOM card is equipped and preprovisioned for slot 1.

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

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. Fixed ports on the panel of the chassis belong to MDA 1. Cards inserted in expansion slots are numbered 2 and 3.

Values 1, 2

Values 1, 2, 3

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 twothree 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.

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

MDA 1 does not need to be configured as is provisioned automatically during bootup.

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. A fixed MDA that is auto equipped and auto provisioned cannot be deleted. An error message is shown in case the **no** form of command is performed on fixed MDAs.

Default MDA 1 is equipped and provisioned by default during bootup.

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

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.

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.

network

Syntax **network**

Context config>card>mda
config>port

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

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.

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.

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>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>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.

qos

Syntax **qos** *policy-id*
no qos

Context config>port>ethernet>access>egress

Description This command associates a QoS policy to the port.

Parameters *policy-id* — Specifies an existing QoS policy to be assigned to the port.

Values 1 — 65535

General Port Commands

port

Syntax **port** *port-id*
no port *port-id*

Context config

Description This command enables access to the context to configure ports. 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.

egress-scheduler-policy

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

Context config>port>ethernet

Description This command enables the provisioning of an existing port-scheduler-policy to a port or channel.

The default scheduling done for a port is strict scheduling. When a port-scheduler-policy is applied to the port, the scheduling behavior changes to the one specified in the policy (Strict, RR, WRR, WDRR, WRR/WDRR + Strict).

The **no** form of the command removes the policy from the port and makes the scheduling scheme of the port to strict.

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.

mode

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

Context config>port>ethernet

Description This command configures an Ethernet port for **access** or **network** mode operation.

An **access** port is used for customer facing traffic on which services are configured. A Service Access Point (SAP) can only be configured on an access port. When a port is configured for access mode, the appropriate **encap-type** must be specified to distinguish the services on the port. Once an Ethernet port has been configured for access mode, multiple services can be configured on the Ethernet port .

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. 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 or a SONET path has been configured for access mode, multiple services can be configured on the Ethernet port or SONET path.

A network port or channel participates in the service provider transport or infrastructure network when a network mode is selected. When the **network** option is configured, the **encap-type** cannot be configured for the port/channel.

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

Default **network** — Configures the Ethernet port for transport network use.

Parameters **network —** Configures the Ethernet port as service access.

network — Configures the Ethernet port for transport network use.

mac

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

Context config>port>ethernet
config>lag
config>eth-tunnel

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

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

Description This command configures the maximum payload MTU size for an Ethernet port port. 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.

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
10/100 or 100FX Ethernet	Network	null	1514
10/100 or 100FX Ethernet	Network	dot1q	1518

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

Values 512 — 9212

	Range
config>port>ethernet	512 — 9212

queue-policy

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

Context config>card>mda>network>ingress

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.

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.

access

Syntax **access**

Context config>port>ethernet

Description This command configures Ethernet access port parameters.

egress

Syntax **egress**

Context config>port>ethernet>access

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.

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.

7210 SAS 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.

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

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

encap-type

Syntax **encap-type** {**dot1q** | **null**}
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.

hold-time

Syntax **hold-time** {[**up** *hold-time up*] [**down** *hold-time down*]}
no hold-time

Context config>port>ethernet

Description This command configures port link dampening timers which reduce the number of link transitions reported to upper layer protocols. The **hold-time** value is used to dampen interface transitions.

When an interface transitions from an up state to a down state, it is immediately advertised to the rest of the system if the hold-time down interval is zero, but if the hold-time down interval is greater than zero, interface down transitions are not advertised to upper layers until the hold-time down interval has expired. Likewise, an interface is immediately advertised as up to the rest of the system if the hold-time up interval is zero, but if the hold-time up interval is greater than zero, up transitions are not advertised until the hold-time up interval has expired.

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

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

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

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

Values 0 — 5

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

Values 0 — 5

report-alarm

Syntax [**no**] **report-alarm** [**signal-fail**]

Context config>port>ethernet

Description This command specifies when and if to generate alarms and alarm clear notifications for this 7210 SAS MX port.

Parameters **signal-fail —** Reports an Ethernet signal lost alarm.

speed

Syntax **speed** {**10** | **100** | **1000**}

Context config>port>ethernet

Description This command configures the port speed of a Fast Ethernet port when autonegotiation is disabled. If the port is configured to autonegotiate this parameter is ignored. Speed cannot be configured for ports that are part of a Link Aggregation Group (LAG).

Default **100**

Parameters **10 —** Sets the link to 10 mbps speed.

100 — Sets the link to 100 mbps speed.

1000 — Sets the link to 1000 mbps speed.

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 7210 SAS 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 7210 SAS 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 7210 SAS.

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 7210 SAS 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 7210 SAS waits for the RADIUS server to responds to its access request message. When this timer expires, the 7210 SAS 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 7210 SAS 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 7210 SAS 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

Port Commands

network

Syntax **network**

Context config>port>ethernet

accounting-policy

Syntax **accounting-policy** *policy-id*
no accounting-policy

Context config>port>ethernet>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>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 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

Description This command specifies the existing network queue policy which defines queue parameters such as 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.

It defines the reference **slot/mda cma/port** for the system clock as that of an incoming (optical) line signal. This source serves to drive an external office clock through the BITS/SSU out ports, or just to drive the system clock.

Sonet/SDH	Loop Timed	Default
OC-48	Yes	loop-timed
OC-12	No	node-timed
OC-3	No	node-timed

.

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 4 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 4 links can be supported in a single LAG, up to 12 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.

The system 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 — 12

encap-type

Syntax **encap-type** {**dot1q** | **null**}
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.

hold-time

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

Context config>lag

Description This command specifies the timer, in tenths of seconds, which controls the delay between detecting that a LAG is down (all active ports are down) and reporting it to the higher levels.

A non-zero value can be configured, for example, when active/standby signalling is used in a 1:1 fashion to avoid informing higher levels during the small time interval between detecting that the LAG is down and the time needed to activate the standby link.

Default 0

Parameters **down** *hold-down-time* **—** Specifies the hold-time for event reporting

Values 0 — 2000

lacp

Syntax **lacp** [*mode*] [**administrative-key** *admin-key*]
no lacp

Context config>lag

Description This command specifies the LACP mode for aggregated Ethernet interfaces only. This command enables the LACP protocol. Per the IEEE 802.3ad standard, the Link Aggregation Control Protocol (LACP) provides a standardized means for exchanging information between Partner Systems on a link to allow their Link Aggregation Control instances to reach agreement on the identity of the Link Aggregation Group to which the link belongs, move the link to that Link Aggregation Group, and enable its transmission and reception functions in an orderly manner. LACP can be enabled on a maximum of 12 ports.

Default no lacp

Parameters *mode* — Specifies the mode in which LACP will operate.

Values **passive** — Starts transmitting LACP packets only after receiving packets.
active — Initiates the transmission of LACP packets.

administrative-key *admin-key* **—** Specifies an administrative key value to identify the channel group on each port configured to use LACP. This value should be configured only in exceptional cases. If it is not specified, a random key is assigned.

Values 1 — 65535

lacp-xmit-interval

Syntax **lacp-xmit-interval** {**slow** | **fast**}

Context config>lag

Description This command sepcifies the interval signaled to the peer and tells the peer at which rate it should transmit.

Default fast

Parameters **slow —** Transmits packets every 30 seconds.

fast — Transmits packets every second.

lacp-xmit-stdby

Syntax [**no**] **lacp-xmit-stdby**

Context config>lag

Description This command enables LACP message transmission on standby links.

The **no** form of this command disables LACP message transmission. This command should be disabled for compatibility when using active/standby groups. This forces a timeout of the standby links by the peer. Use the **no** form if the peer does not implement the correct behavior regarding the lacp sync bit.

Default lacp-xmit-stdby

mode

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

Context config>lag

Description This command configures the mode of the Link Aggregation Group (LAG).

Parameters **access —** Configures the mode as access for the LAG.

network — Configures the mode as network for the LAG.

port

Syntax **port** *port-id* [*port-id …*up to 4 total] [**priority** *priority*] [**subgroup** *sub-group-id*]
no port *port-id* [*port-id …*up to 4 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 4 (space separated) ports can be added or removed from the LAG link assuming the maximum of 4 ports is not exceeded.

All ports, when added to a LAG, must share the same characteristics (speed, duplex, etc.). An error message will be displayed when adding ports that do not share the same characteristics. Hold-timers must be 0. Ports that are part of a LAG must be configured with autonegotiate limited or disabled.

The **no** form of this command removes ports from the LAG.

Default No ports are defined as members of a LAG.

Parameters *port-id* — The port ID configured or displayed in the *slot/mda/port* format.

priority *priority* — Port priority used by LACP. The port priority is also used to determine the primary port. The port with the highest priority is the primary port. In the event of a tie, the smallest port ID becomes the primary port.

Values 1 — 65535

subgroup *sub-group-id* **—** This parameter identifies a LAG subgroup. When using subgroups in a LAG, they should only be configured on one side of the LAG, not both. Only having one side perform the active/standby selection will guarantee a consistent selection and fast convergence. The active/standby selection will be signalled through LACP to the other side. The hold time should be configured when using subgroups to prevent the LAG going down when switching between active and standby links in case no links are usable for a short time, especially in case a subgroup consists of one member.

Values 1 — 2 identifies a LAG subgroup.

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 — 3

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.

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.

split-horizon-group

Syntax **split-horizon-group** *group-name*
no split-horizon-group

Context config>lag
config>port

Description This command associates a split horizon group to which this port or LAG belongs. For LAGs, all the member ports of the LAG are added to the split horizon group. The split-horizon-group must be configured in the **config** context.

The **no** form of this command removes the port or all member ports of the LAG from the split horizon group.

Configuring or removing the association of the port requires the following conditions to be satisfied:

- There are no applications associated with the port/lag (like SAPs on the port, etc.).
- The port or LAG should be administratively shutdown.
- The port should not be part of a LAG.
- To change split horizon group of a port or LAG, the old split horizon group should be first removed from the port or LAG, and then the new split horizon group can be configured.

The **no** form of this command removes the port or all member ports of the LAG from the split horizon group.

Parameters *group-name* — Specifies the name of the split horizon group up to 32 characters in length. The string must be composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

split-horizon-group

Syntax [**no**] **split-horizon-group** *name-string*

Context config

Description This command creates a split horizon group to be applied on ports and LAGs.

The **no** form of the command removes the split horizon group. The user can remove a split horizon group only when there are no ports or LAGs associated with this split horizon group.

Default none

Parameters *name-string* — Creates the name of the split horizon group up to 32 characters in length. The string must be composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

Values

Show Commands

Hardware Commands

chassis

Syntax **chassis** [**environment**] [**power-supply**]

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.

Output **Chassis Output —** The following table describes chassis output fields.

Label	Description
Name	The system name for the router.
Type	Displays the 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 slot(s) and the CPM slots.
Number of ports	The total number of ports currently installed in this chassis. This count does not include the Ethernet ports on the CPMs that are used for management access.

Label	Description (Continued)
Critical LED state	The current state of the Critical LED in this chassis.
Major LED state	The current state of the Major LED in this chassis.
Minor LED state	The current state of the Minor LED in this chassis.
Base MAC address	The base chassis Ethernet MAC address.
Admin chassis mode	The configured chassis mode.
Oper chassis mode	The current chassis mode.
Part number	The CPM's part number.
CLEI code	The code used to identify the router.
Serial number	The CPM'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.
Number of power supplies	The number of power supplies installed in the chassis.

Label	Description (Continued)
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

```
*A:MTU-A# show chassis
===============================================================================
Chassis Information
===============================================================================
    Name                          : MTU-A
    Type                          : 7210 SAS-M-1
    Location                      :
    Coordinates                   :
    CLLI code                     :
    Number of slots               : 2
    Number of ports               : 24
    Critical LED state            : Off
    Major LED state               : Off
    Minor LED state               : Off
    Over Temperature state        : OK
    Base MAC address              : 00:11:00:22:bc:11

Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 : MTUSN107210
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Time of last boot             : 2001/06/27 11:14:43
    Current alarm state           : alarm cleared
-------------------------------------------------------------------------------
Environment Information
    Number of fan trays           : 1
    Number of fans                : 3
```

```
    Fan tray number               : 1
    Status                        : up
    Speed                         : half speed
-------------------------------------------------------------------------------
Power Supply Information
    Number of power supplies      : 2

    Power supply number           : 1
    Configured power supply type  : ac single
    Status                        : up
    AC power                      : within range

    Power supply number           : 2
    Defaulted power supply type   : none
    Status                        : not equipped
===============================================================================
*A:MTU-A#


*A:MTU-A# show chassis power-supply
===============================================================================
Chassis Information
===============================================================================
Power Supply Information
    Number of power supplies      : 2

    Power supply number           : 1
    Configured power supply type  : ac single
    Status                        : up
    AC power                      : within range

    Power supply number           : 2
    Defaulted power supply type   : none
    Status                        : not equipped
===============================================================================
*A:MTU-A#
```

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.

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:MTU-A# show card
===============================================================================
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-24g             iom-24g             up         up
A         sfm-24g             sfm-24g             up         up/active
===============================================================================
*A:MTU-A#
```

Show Card State Output — The following table describes show card state output fields.

Label	Description
Slot/MDA	The slot number of the card in the chassis.
Provisioned Type	The card type that is configured for the slot.
Equipped Type	The card type that is actually populated in the slot.
Admin State	Up — The card is administratively up.
	Down — The card is administratively down.
Operational State	Up — The card is operationally up.

Label	Description (Continued)
	provisioned — There is no card in the slot but it has been pre-configured.
Num Ports	The number of ports available on the MDA.
Num MDA	The number of MDAs installed.
Comments	Indicates whether the SF/CPM is the active or standby.

```
*A:MTU-A# show card state
===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-24g          iom-24g          up    up                  2
1/1    m24-100fx-1gb-s* m24-100fx-1gb-s* up    up            24
A      sfm-24g          sfm-24g          up    up                        Active
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

Show Card Detail Output — The following table describes detailed card output fields.

Label	Description
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.

Label	Description (Continued)
	Down — The card is operationally down.
Temperature	Internal chassis temperature.
Temperature threshold	The value above which the internal temperature must rise in order to indicate that the temperature is critical.
Software boot version	The version of the boot image.
Software version	The software version number.
Time of last boot	The date and time the most recent boot occurred.
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.

```
*A:MTU-A# show card detail
===============================================================================
Card 1
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-24g             iom-24g             up         up


IOM Card Specific Data
    Clock source                : none
    Available MDA slots         : 2
    Installed MDAs              : 1

Hardware Data
    Part number                 :
    CLEI code                   :
    Serial number               : MTUSN107210
    Manufacture date            :
    Manufacturing string        :
    Manufacturing deviations    :
    Administrative state        : up
    Operational state           : up
    Temperature                 : 40C
    Temperature threshold       : 50C
    Software boot (rom) version : 7
    Software version            : TiMOS-B-1.1.S29 both/mpc ALCATEL SAS-M 721*
    Time of last boot           : 2001/06/27 11:15:07
    Current alarm state         : alarm cleared
    Base MAC address            : 00:11:00:22:bc:11
    Memory capacity             : 1,024 MB
```

```
===============================================================================
*A:MTU-A#
```

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.

Label	Description (Continued)
Free space	The amount of space remaining on the compact flash card.
Part number	The SF/CPM part number.
CLEI code	The code used to identify the router.
Serial number	The SF/CPM part number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Administrative state	Up – The card is administratively up. Down – The card is administratively down.
Operational state	Up – The card is operationally up. Down – The card is operationally down.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Status	Displays the current status.
Temperature	Internal chassis temperature.
Temperature threshold	The value above which the internal temperature must rise in order to indicate that the temperature is critical.
Software boot version	The version of the boot image.
Memory capacity	The total amount of memory.

Sample Output

```
*A:MTU-A# show card A detail
===============================================================================
Card A
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
A         sfm-24g             sfm-24g             up         up/active


BOF last modified                : N/A
Config file version              : WED JUN 27 11:12:21 2008 UTC
Config file last modified        : 2008/06/27 11:42:06
Config file last saved           : N/A
```

```
M/S clocking ref state            : primary

Flash - cf1:
    Administrative State          : up
    Operational state             : up
    Serial number                 : serial-1
    Firmware revision             : v1.0
    Model number                  : Flash 1
    Size                          : 110,984 KB
    Free space                    : 103,264 KB

Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 : MTUSN107210
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 40C
    Temperature threshold         : 50C
    Software boot (rom) version   : 7
    Software version              : TiMOS-B-1.1.S29 both/mpc ALCATEL SAS-M 721*
    Time of last boot             : 2008/06/27 11:14:43
    Current alarm state           : alarm cleared
    Base MAC address              : 00:11:00:22:bc:11
    Memory capacity               : 1,024 MB
===============================================================================
*A:MTU-A#
```

mda

Syntax **mda** [*slot* [*/mda*]] [**detail**]

Context show

Description This command displays MDA information.

If no command line options are specified, a summary output of all MDAs is displayed in table format.

Parameters *slot* — The slot number for which to display MDA information.

Values 1

mda — The MDA number in the slot for which to display MDA information.

Values 1 — 3

detail — Displays detailed MDA information.

Output **MDA Output —** The following table describes MDA output fields.

Label	Description
Slot	The chassis slot number.
MDA	The MDA slot number.
Provisioned MDA-type	The MDA type provisioned.
Equipped MDA-type	The MDA type actually installed.
Admin State	Up — Administratively up.
	Down — Administratively down.
Ops State	Up — Operationally up.
	Down — Operationally down.

Sample Output

```
*A:MTU-A# show mda
===============================================================================
MDA Summary
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
           Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m24-100fx-1gb-sfp     m24-100fx-1gb-sfp     up        up
===============================================================================
*A:MTU-A#
```

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.

Label	Description (Continued)
	Down — The MDA is operationally down.
Maximum port count	The maximum number of ports that can be equipped on the MDA card.
Number of ports equipped	The number of ports that are actually equipped on the MDA.
Transmit timing selected	The transmit timing method which is presently selected and being used by this MDA.
Sync Interface timing status	Indicates the status of the synchronous equipment timing subsystem.
Network Ingress Queue Policy	Specifies the network queue policy applied to the MDA to define the queueing structure for this object.
Capabilities	Specifies the minimum size of the port that can exist on the MDA.
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

```
*A:MTU-A# show mda 1/1 detail
===============================================================================
```

```
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m24-100fx-1gb-sfp     m24-100fx-1gb-sfp     up        up


MDA Specific Data
    Maximum port count            : 24
    Number of ports equipped      : 24
    Network ingress queue policy  : default
    Capabilities                  : Ethernet

Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 : MTUSN107210
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 40C
    Temperature threshold         : 50C
    Time of last boot             : 2001/06/27 11:15:10
    Current alarm state           : alarm cleared
    Base MAC address              : 00:11:00:22:bc:13
===============================================================================
*A:MTU-A#
```

pools

Syntax **pools** *mda-id* [*/port*] [**access-app** [*pool-name* | **service** *service-id*]] [*access-app* [*pool-name*| **service** *service-id*]]
pools *mda-id* [*/port*] [**network-app** [*[pool-name*]] [*access-uplink-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-AvgThresh-old	Specifies the percentage of the buffer utilized after which the drop probability starts to rise above 0.
Max-Avg	Specifies the percentage of the buffer utilized after which the drop probability is 100 percent. This implies that all packets beyond this point will be dropped.
Time Avg Factor	Specifies the time average factor the weighting between the previous shared buffer average utilization result and the new shared buffer utilization in determining the new shared buffer average utilization.
Actual ResvCBS	Specifies the actual percentage of pool size reserved for CBS.
Admin ResvCBS	Specifies the percentage of pool size reserved for CBS.
PoolSize	Specifies the size in percentage of buffer space. The value '-1' implies that the pool size should be computed as per fair weighting between all other pools.
Pool Total	Displays the total pool size.
Pool Shared	Displays the amount of the pool which is shared.
Pool Resv	Specifies the percentage of reserved pool size.
Pool Total In Use	Displays the total amount of the pool which is in use.
Pool Shared In Use	Displays the amount of the pool which is shared that is in use.

```
*A:MTU-A# show pools 1/1/2 access-egress
===============================================================================
Pool Information
===============================================================================
Port                : 1/1/2
```

```
Application          : Acc-Egr           Pool Name          : default
Resv CBS             : Sum
-------------------------------------------------------------------------------
High Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           70           90          75
Queue2          Down           70           90          75
Queue3          Down           70           90          75
Queue4          Down           70           90          75
Queue5          Down           70           90          75
Queue6          Down           70           90          75
Queue7          Down           70           90          75
Queue8          Down           70           90          75
-------------------------------------------------------------------------------
Low Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           50           75          75
Queue2          Down           50           75          75
Queue3          Down           50           75          75
Queue4          Down           50           75          75
Queue5          Down           50           75          75
Queue6          Down           50           75          75
Queue7          Down           50           75          75
Queue8          Down           50           75          75
-------------------------------------------------------------------------------
Non Tcp Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           50           75          75
Queue2          Down           50           75          75
Queue3          Down           50           75          75
Queue4          Down           50           75          75
Queue5          Down           50           75          75
Queue6          Down           50           75          75
Queue7          Down           50           75          75
Queue8          Down           50           75          75
-------------------------------------------------------------------------------
Time Avg Factor
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Queue Id   Time Avg Factor
-------------------------------------------------------------------------------
Queue1            7
Queue2            7
Queue3            7
Queue4            7
Queue5            7
Queue6            7
Queue7            7
Queue8            7
```

```
MMU Pool Total In Use: 0 KB              MMU Pool Shared In*: 0 KB

Pool Total           : 163 KB
Pool Shared          : 95 KB             Pool Resv          : 68 KB

Pool Total In Use    : 0 KB
Pool Shared In Use   : 0 KB              Pool Resv In Use   : 0 KB

-------------------------------------------------------------------------------
FC-Maps                          ID       CBS (B)     Depth  A.CIR     A.PIR
                                                             O.CIR     O.PIR
-------------------------------------------------------------------------------
be                               1/1/2    8698        0      0         1000000
                                                               0         Max
l2                               1/1/2    8698        0      0         1000000
                                                               0         Max
af                               1/1/2    8698        0      0         1000000
                                                               0         Max
l1                               1/1/2    8698        0      0         1000000
                                                               0         Max
h2                               1/1/2    8698        0      0         1000000
                                                               0         Max
ef                               1/1/2    8698        0      0         1000000
                                                               0         Max
h1                               1/1/2    8698        0      0         1000000
                                                               0         Max
nc                               1/1/2    8698        0      0         1000000
                                                               0         Max
===============================================================================
* indicates that the corresponding row element may have been truncated.

*A:MTU-A# show pools 1/1/1 network-egress
===============================================================================
Pool Information
===============================================================================
Port                 : 1/1/1 (lag-1)
Application          : Net-Egr           Pool Name          : default
Resv CBS             : Sum
-------------------------------------------------------------------------------
High Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           70           90          75
Queue2          Down           70           90          75
Queue3          Down           70           90          75
Queue4          Down           70           90          75
Queue5          Down           70           90          75
Queue6          Down           70           90          75
Queue7          Down           70           90          75
Queue8          Down           70           90          75
-------------------------------------------------------------------------------
Low Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           50           75          75
```

```
Queue2          Down            50           75          75
Queue3          Down            50           75          75
Queue4          Down            50           75          75
Queue5          Down            50           75          75
Queue6          Down            50           75          75
Queue7          Down            50           75          75
Queue8          Down            50           75          75
-------------------------------------------------------------------------------
Non Tcp Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down            50           75          75
Queue2          Down            50           75          75
Queue3          Down            50           75          75
Queue4          Down            50           75          75
Queue5          Down            50           75          75
Queue6          Down            50           75          75
Queue7          Down            50           75          75
Queue8          Down            50           75          75
-------------------------------------------------------------------------------
Time Avg Factor
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Queue Id   Time Avg Factor
-------------------------------------------------------------------------------
Queue1             7
Queue2             7
Queue3             7
Queue4             7
Queue5             7
Queue6             7
Queue7             7
Queue8             7

MMU Pool Total In Use: 0 KB              MMU Pool Shared In*: 0 KB

Pool Total           : 163 KB
Pool Shared          : 95 KB             Pool Resv          : 68 KB

Pool Total In Use    : 0 KB
Pool Shared In Use   : 0 KB              Pool Resv In Use   : 0 KB

-------------------------------------------------------------------------------
FC-Maps                          ID       CBS (B)     Depth  A.CIR     A.PIR
                                                             O.CIR     O.PIR
-------------------------------------------------------------------------------
be                               1/1/1    8698        0      0         1000000
                                                               0         Max
l2                               1/1/1    8698        0      250000    1000000
                                                               250000    Max
af                               1/1/1    8698        0      250000    1000000
                                                               250000    Max
l1                               1/1/1    8698        0      250000    1000000
                                                               250000    Max
h2                               1/1/1    8698        0      1000000   1000000
                                                               Max       Max
ef                               1/1/1    8698        0      1000000   1000000
```

```
                                                                 Max       Max
h1                              1/1/1    8698        0       100000    1000000
                                                                 100000    Max
nc                              1/1/1    8698        0       100000    1000000
                                                                 100000    Max
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:MTU-A#
```

Port Show Commands

port

Syntax **port** *port-id* [**count**] [**detail**]
port *port-id* **description**
port *port-id* **associations**
port *port-id* **dot1x** [**detail**]
port *port-id* **ethernet** [**efm-oam** | **detail**]

Context show

Description This command displays port information.

If no command line options are specified, the command port displays summary information for all ports on provisioned MDAs.

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

Syntax port-id *slot*[/*mda*[/*port*]]

MDA Values 1, 2, 3

Slot Values 1

Port Values 1 — 24 (depending on the MDA type)

associations — Displays a list of current router interfaces to which the port is associated.

description — Displays port description strings.

dot1x — Displays information.about 802.1x status and statistics.

ethernet — Displays ethernet port information.

efm-oam — Displays EFM OAM information.

detail — Displays detailed information about the Ethernet port.

Output **Port Output —** The following tables describe port output fields:

- General Port Output Fields on page 106
- Entering port ranges on page 107
- Specific Port Output Fields on page 108
- Detailed Port Output Fields on page 114
- Ethernet Output Fields on page 121
- Ethernet-Like Medium Statistics Output Fields on page 124
- Port Associations Output Fields on page 124

Label	Description
Port ID	The port ID configured or displayed in the *slot/mda/port* format.
Admin State	Up — The administrative state is up.
	Down — The administrative state is down.
Phy Link	Yes — A physical link is present.
	No — A physical link is not present.
Port State	Up — The port is physically present and has physical link present.
	Down — The port is physically present but does not have a link.
	Ghost — A port that is not physically present.
	None — The port is in its initial creation state or about to be deleted.
	Link Up — A port that is physically present and has physical link present.
	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 specified in octets.
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.

Label	Description (Continued)
	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:MTU-A# 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       Up    Yes  Up      1578 1578    1 netw dotq xcme   MDI GIGE-SX
1/1/2       Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-LX  1*
1/1/3       Up    Yes  Up      1578 1578    - netw null xcme   MDX GIGE-T
1/1/4       Up    No   Down    1518 1518    - accs dotq xcme   GIGE-LX  10KM
1/1/5       Up    No   Down    1514 1514    - netw null xcme   GIGE-T
1/1/6       Up    No   Down    1578 1578    - netw null xcme   GIGE-T
1/1/7       Up    Yes  Up      1578 1578    - netw null xcme   MDX GIGE-T
1/1/8       Up    Yes  Up      1578 1578    - netw null xcme   MDI GIGE-T
1/1/9       Up    Yes  Up      1518 1518    - accs dotq xcme   MDX GIGE-T
1/1/10      Up    No   Down    1514 1514    - accs null xcme   GIGE-T
1/1/11      Up    Yes  Link Up 1578 1578    - netw null xcme   MDI GIGE-T
1/1/12      Up    No   Down    1514 1514    - accs null xcme
1/1/13      Up    Yes  Up      1514 1514    - netw null xcme   MDX GIGE-T
1/1/14      Up    No   Down    1578 1578    - netw null xcme   GIGE-T
1/1/15      Up    Yes  Up      1518 1518    - netw dotq xcme   MDI GIGE-T
1/1/16      Up    Yes  Up      1578 1578    1 netw dotq xcme   MDI GIGE-SX
1/1/17      Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-SX
1/1/18      Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-SX
1/1/19      Up    No   Down    1578 1578    - netw null xcme
1/1/20      Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-SX
1/1/21      Up    Yes  Up      1514 1514    3 accs null xcme   MDI GIGE-T
1/1/22      Up    Yes  Up      1514 1514    3 accs null xcme   MDX GIGE-T
1/1/23      Up    Yes  Up      1578 1578    - netw null xcme   MDI GIGE-SX
1/1/24      Up    Yes  Up      1578 1578    - netw null xcme   MDX GIGE-T
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:MTU-A#
```

Entering port ranges:

```
*A:ALU-1# configure port 1/1/[1..3] shut
*A:MTU-A# 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       Up    Yes  Up      1578 1578    1 netw dotq xcme   MDI GIGE-SX
```

```
1/1/2       Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-LX  1*
1/1/3       Up    Yes  Up      1578 1578    - netw null xcme   MDX GIGE-T
1/1/4       Up    No   Down    1518 1518    - accs dotq xcme   GIGE-LX  10KM
1/1/5       Up    No   Down    1514 1514    - netw null xcme   GIGE-T
1/1/6       Up    No   Down    1578 1578    - netw null xcme   GIGE-T
1/1/7       Up    Yes  Up      1578 1578    - netw null xcme   MDX GIGE-T
1/1/8       Up    Yes  Up      1578 1578    - netw null xcme   MDI GIGE-T
1/1/9       Up    Yes  Up      1518 1518    - accs dotq xcme   MDX GIGE-T
1/1/10      Up    No   Down    1514 1514    - accs null xcme   GIGE-T
1/1/11      Up    Yes  Link Up 1578 1578    - netw null xcme   MDI GIGE-T
1/1/12      Up    No   Down    1514 1514    - accs null xcme
1/1/13      Up    Yes  Up      1514 1514    - netw null xcme   MDX GIGE-T
1/1/14      Up    No   Down    1578 1578    - netw null xcme   GIGE-T
1/1/15      Up    Yes  Up      1518 1518    - netw dotq xcme   MDI GIGE-T
1/1/16      Up    Yes  Up      1578 1578    1 netw dotq xcme   MDI GIGE-SX
1/1/17      Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-SX
1/1/18      Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-SX
1/1/19      Up    No   Down    1578 1578    - netw null xcme
1/1/20      Up    Yes  Up      1514 1514    - accs null xcme   MDI GIGE-SX
1/1/21      Up    Yes  Up      1514 1514    3 accs null xcme   MDI GIGE-T
1/1/22      Up    Yes  Up      1514 1514    3 accs null xcme   MDX GIGE-T
1/1/23      Up    Yes  Up      1578 1578    - netw null xcme   MDI GIGE-SX
1/1/24      Up    Yes  Up      1578 1578    - netw null xcme   MDX GIGE-T
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:MTU-A#
```

Specific Port Output — The following table describes port output fields for a specific port.

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.
Speed	The speed of the interface.
Link-level	Ethernet — The port is configured as Ethernet.
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.

Label	Description (Continued)
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.
Configured Mode	network – The port is configured for transport network use. access – The port is configured for service access.
Dot1Q Ethertype	Indicates the Ethertype expected when the port's encapsulation type is Dot1Q.
QinQ Ethertype	Indicates the Ethertype expected when the port's encapsulation type is QinQ.
Net. Egr. Queue Pol	Specifies the network egress queue policy or that the default policy is used.
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. 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.

Label	Description (Continued)
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 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 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.
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.

Label	Description (Continued)
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 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.

Label	Description (Continued)
	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.
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 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.

Label	Description (Continued)
Multicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Broadcast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Discards Input/ Output	The number of inbound packets chosen to be discarded to possibly free up buffer space.
Unknown Proto Discards Input/ Output	For packet-oriented interfaces, the number of packets received via the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
Errors	This field displays the number of cells discarded due to uncorrectable HEC errors. Errors do not show up in the raw cell counts.

Detailed Port Output — The following table describes detailed port output fields.

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.
Speed	The speed of the interface.
Link-level	Ethernet – The port is configured as Ethernet.
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 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 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 via the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
LLF Admin State	Displays the Link Loss Forwarding administrative state.
LLF Oper State	Displays the Link Loss Forwarding operational state.

Sample Output

```
*A:MTU-A# show port 1/1/1
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                       Oper Speed       : 1 Gbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1578
IfIndex            : 35684352                    Hold time up     : 0 seconds
Last State Change  : 06/27/2001 11:15:22         Hold time down   : 0 seconds
Last Cleared Time  : 06/27/2001 11:14:44

Configured Mode    : network                     Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Net. Egr. Queue Pol: default                     Access Egr. Qos *: n/a
Egr. Sched. Pol    : default                     Network Qos Pol  : n/a
Auto-negotiate     : limited                     MDI/MDX          : MDI
Accounting Policy  : None                        Collect-stats    : Disabled

Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120

Configured Address : 00:11:00:22:bc:13
Hardware Address   : 00:11:00:22:bc:13
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALA  IPUIAELDAB2
TX Laser Wavelength: 850 nm                      Diag Capable     : yes
Connector Code     : LC                          Vendor OUI       : 00:90:65
Manufacture date   : 2008/09/29                  Media            : Ethernet
Serial Number      : PEC5184
Part Number        : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;
===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                          1556859                1766709
Packets                                           18523                   5849
Errors                                                0                      0
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                    3324                   5847
Multicast Packets                                 15199                      0
```

```
Broadcast Packets                                  0                    2
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:MTU-A#


*A:MTU-A# show port 1/1/1 detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                       Oper Speed       : 1 Gbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1578
IfIndex            : 35684352                    Hold time up     : 0 seconds
Last State Change  : 06/27/2001 11:15:22         Hold time down   : 0 seconds
Last Cleared Time  : 06/27/2001 11:14:44

Configured Mode    : network                     Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Net. Egr. Queue Pol: default                     Access Egr. Qos *: n/a
Egr. Sched. Pol    : default                     Network Qos Pol  : n/a
Auto-negotiate     : limited                     MDI/MDX          : MDI
Accounting Policy  : None                        Collect-stats    : Disabled

Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120

Configured Address : 00:11:00:22:bc:13
Hardware Address   : 00:11:00:22:bc:13
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALA  IPUIAELDAB2
TX Laser Wavelength: 850 nm                      Diag Capable     : yes
Connector Code     : LC                          Vendor OUI       : 00:90:65
Manufacture date   : 2008/09/29                  Media            : Ethernet
Serial Number      : PEC5184
Part Number        : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;
===============================================================================
Traffic Statistics
===============================================================================
```

```
                                                    Input                  Output
-------------------------------------------------------------------------------
Octets                                           1625057                 1843692
Packets                                            19334                    6105
Errors                                                 0                       0
===============================================================================
Ethernet Statistics
===============================================================================
Broadcast Pckts  :                   2  Drop Events      :                   0
Multicast Pckts  :               15863  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :             3468749
Packets                         :               25439
Packets of 64 Octets            :               25370
Packets of 65 to 127 Octets     :                4987
Packets of 128 to 255 Octets    :               10937
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
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Port Statistics
===============================================================================
                                                    Input                  Output
-------------------------------------------------------------------------------
Unicast Packets                                     3471                    6103
Multicast Packets                                  15863                       0
Broadcast Packets                                      0                       2
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
===============================================================================
Total Egress Packet Drops :        0
===============================================================================
Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
                        Packets                 Octets
-------------------------------------------------------------------------------
Egress Queue  1 (be)
Fwd Stats             :          4                       360
Drop Stats            :          0                       0
Egress Queue  2 (l2)
Fwd Stats             :          0                       0
Drop Stats            :          0                       0
```

```
Egress Queue  3 (af)
Fwd Stats            :          0                      0
Drop Stats           :          0                      0
Egress Queue  4 (l1)
Fwd Stats            :          0                      0
Drop Stats           :          0                      0
Egress Queue  5 (h2)
Fwd Stats            :          0                      0
Drop Stats           :          0                      0
Egress Queue  6 (ef)
Fwd Stats            :          0                      0
Drop Stats           :          0                      0
Egress Queue  7 (h1)
Fwd Stats            :          0                      0
Drop Stats           :          0                      0
Egress Queue  8 (nc)
Fwd Stats            :          1172                   97420
Drop Stats           :          0                      0
===============================================================================
*A:MTU-A#
*A:MTU-A# show port 1/1/1
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                       Oper Speed       : 1 Gbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1578
IfIndex            : 35684352                    Hold time up     : 0 seconds
Last State Change  : 06/27/2001 11:15:22         Hold time down   : 0 seconds
Last Cleared Time  : 06/27/2001 11:14:44

Configured Mode    : network                     Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Net. Egr. Queue Pol: default                     Access Egr. Qos *: n/a
Egr. Sched. Pol    : default                     Network Qos Pol  : n/a
Auto-negotiate     : limited                     MDI/MDX          : MDI
Accounting Policy  : None                        Collect-stats    : Disabled

Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120

Configured Address : 00:11:00:22:bc:13
Hardware Address   : 00:11:00:22:bc:13
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALA  IPUIAELDAB2
TX Laser Wavelength: 850 nm                      Diag Capable     : yes
Connector Code     : LC                          Vendor OUI       : 00:90:65
Manufacture date   : 2008/09/29                  Media            : Ethernet
Serial Number      : PEC5184
Part Number        : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
```

```
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Octets                                            1556859               1766709
Packets                                             18523                  5849
Errors                                                  0                     0
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Port Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                      3324                  5847
Multicast Packets                                   15199                     0
Broadcast Packets                                       0                     2
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:MTU-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.

Label	Description (Continued)
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).
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 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  :                   2  Drop Events      :                   0
Multicast Pckts  :               15863  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :             3468749
Packets                         :               25439
Packets of 64 Octets            :               25370
Packets of 65 to 127 Octets     :                4987
Packets of 128 to 255 Octets    :               10937
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
===============================================================================
```

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.

Sample Output

```
===============================================================================
A:ALA-48#

===============================================================================
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:MTU-A#
```

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:MTU-A>config# show port 1/1/23 associations
===============================================================================
Interface Table
===============================================================================
```

```
Router/ServiceId                Name                            Encap Val
-------------------------------------------------------------------------------
Router: Base                    one                             0
-------------------------------------------------------------------------------
Interfaces
===============================================================================
*A:MTU-A>config#
```

Syntax port-id *slot*[/*mda*[/*port*]]

MDA Values 1, 2, 3

Port Values 1 — 60 (depending on the MDA type)

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 — 12

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 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
A:ALA-48# show lag
```

```
===============================================================================
Lag Data
===============================================================================
Lag-id          Adm     Opr     Port-Threshold   Up-Link-Count   MC Act/Stdby
-------------------------------------------------------------------------------
1                 up      up      0                2               N/A
2                 up      up      0                2               N/A
3                 up      up      0                2               N/A
4                 up      up     0                2               N/A
5                 up      up      0                2               N/A
6                 up      up      0                2               N/A
-------------------------------------------------------------------------------
Total Lag-ids: 6       Single Chassis: 6        MC Act: 0       MC Stdby: 0
===============================================================================
A:ALA-48#
```

Detailed LAG Output — The following table describes detailed LAG output fields.

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.
System ID	System ID used by actor in LACP messages.
Admin Key	Configured LAG key.

Label	Description (Continued)
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.
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.
Priority	Displays the member port priority.

Sample Output

```
*A:dut-c# show lag 1 detail
===============================================================================
LAG Details
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 1                     Mode                 : access
Adm                 : up                    Opr                  : up
Thres. Exceeded Cnt : 5428                  Port Threshold       : 0
Thres. Last Cleared : 05/18/2009 11:57:56   Threshold Action     : down
Dynamic Cost        : false                 Encap Type           : dot1q
Configured Address  : 00:ab:00:5a:01:1c     Lag-IfIndex          : 1342177281
Hardware Address    : 00:ab:00:5a:01:1c
Hold-time Down      : 0.0 sec               Uplink               : No
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:ab:00:5a:01:01     System Priority      : 32768
Admin Key           : 32768                 Oper Key             : 32768
Prtr System Id      : 00:9a:9a:ba:ba:60     Prtr System Priority : 32768
Prtr Oper Key       : 32768
-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced   Prio
-------------------------------------------------------------------------------
1/1/3          up     active    up     yes       1             -        32768
1/1/4          up     active    up               1             -        32768
-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
-------------------------------------------------------------------------------
1/1/3          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/3          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/4          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/4          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
===============================================================================
*A:dut-c#
```

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 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 The following example displays LAG output

```
*A:dut-c# show lag 2 detail
===============================================================================
LAG Details
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 2                     Mode                 : network
Adm                 : up                    Opr                  : up
Thres. Exceeded Cnt : 85                    Port Threshold       : 0
Thres. Last Cleared : 05/17/2009 07:56:24   Threshold Action     : down
Dynamic Cost        : false                 Encap Type           : null
Configured Address  : 00:ab:00:5a:01:1d     Lag-IfIndex          : 1342177282
Hardware Address    : 00:ab:00:5a:01:1d
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:ab:00:5a:01:01     System Priority      : 32768
Admin Key           : 32769                 Oper Key             : 32769
Prtr System Id      : 00:9a:9a:ba:ba:60     Prtr System Priority : 32768
Prtr Oper Key       : 32769

-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced   Prio
-------------------------------------------------------------------------------
1/1/5          up     active    up     yes       1             -        32768
1/1/6          up     active    up               1             -        32768

-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
```

```
-------------------------------------------------------------------------------
1/1/5          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/5          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/6          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/6          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
===============================================================================
*A:dut-c#
```

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.

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

interval *seconds* **—** Configures the interval for each display in seconds.

Default 10 seconds

Values 3 — 60

repeat *repeat* **—** Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

Sample Output

```
A:ALA-12>monitor# port /1/4 interval 3 repeat 3 absolute
===============================================================================
Monitor statistics for Port /1/4
===============================================================================
                                                Input                  Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
```

```
-------------------------------------------------------------------------------
Octets                                          0                           0
Packets                                        39                         175
Errors                                          0                           0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                          0                           0
Packets                                        39                         175
Errors                                          0                           0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                          0                           0
Packets                                        39                         175
Errors                                          0                           0
-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                          0                           0
Packets                                        39                         175
Errors                                          0                           0
===============================================================================
A:ALA-12>monitor#

A:ALA-12>monitor# port /1/4 interval 3 repeat 3 rate
===============================================================================
Monitor statistics for Port /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#
```

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 1

lag

Syntax **lag** *lag-id* **statistics**

Context clear

Description This command clears statistics for the specified LAG ID.

Parameters *lag-id* — The LAG ID to clear statistics.

Values 1 — 12

statistics — Specifies to clear statistics for the specified LAG ID.

mda

Syntax **mda** *mda-id*

Context clear

Description This command reinitializes the specified MDA in a particular slot.

Parameters *mda-id* — Clears the specified slot and MDA.

Values mda-id: slot/mda
slot: 1
mda: 1, 2

port

Syntax **port** *port-id* **statistics**

Context clear

Description This command clears port statistics for the specified port(s).

Parameters *port-id* — The port identifier.

statistics — Specifies that port statistics will be cleared.

slot — The slot number.

Values 1

mda — The MDA number.

Default All MDAs.

Values 1, 2

Debug Commands

lag

Syntax **lag** [**lag-id** *lag-id* [**port** *port-id*]] [**all**]
lag [**lag-id** *lag-id* [**port** *port-id*]] [**sm**] [**pkt**] [**cfg**] [**red**] [**iom-upd**] [**port-state**] [**timers**] [**sel-logic**]
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*

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.

Standards and Protocol Support

Standards Compliance

IEEE 802.1d Bridging
IEEE 802.1p/Q VLAN Tagging
IEEE 802.1w Rapid Spanning Tree Protocol
IEEE 802.1x Port Based Network Access Control
IEEE 802.1ad Provider Bridges
IEEE 802.1ag Service Layer OAM
IEEE 802.3ah Ethernet in the First Mile
IEEE 802.3 10BaseT
IEEE 802.3ad Link Aggregation
IEEE 802.3ah Ethernet OAM
IEEE 802.3u 100BaseTX
IEEE 802.3z 1000BaseSX/LX

Protocol Support

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 1519 CIDR
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

RADIUS

RFC 2865 Remote Authentication Dial In User Service
RFC 2866 RADIUS Accounting

SSH

draft-ietf-secsh-architecture.txt SSH 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

NETWORK MANAGEMENT

ITU-T X.721: Information technology-OSI-Structure of Management Information
ITU-T X.734: Information technology-OSI-Systems Management: Event Report Management Function
M.3100/3120 Equipment and Connection Models
TMF 509/613 Network Connectivity Model
RFC 1157 SNMPv1
RFC 1215 A Convention for Defining Traps for use with the SNMP
RFC 1907 SNMPv2-MIB
RFC 2011 IP-MIB
RFC 2012 TCP-MIB
RFC 2013 UDP-MIB
RFC 2096 IP-FORWARD-MIB
RFC 2138 RADIUS
RFC 2571 SNMP-FRAMEWORKMIB
RFC 2572 SNMP-MPD-MIB
RFC 2573 SNMP-TARGET-&-NOTIFICATION-MIB
RFC 2574 SNMP-USER-BASED-SMMIB
RFC 2575 SNMP-VIEW-BASEDACM-MIB
RFC 2576 SNMP-COMMUNITY-MIB
RFC 2665 EtherLike-MIB
RFC 2819 RMON-MIB
RFC 2863 IF-MIB
RFC 2864 INVERTED-STACK-MIB
RFC 3014 NOTIFICATION-LOGMIB
RFC 3164 Syslog
RFC 3273 HCRMON-MIB
RFC 3411 An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks
RFC 3412 - Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
RFC 3413 - Simple Network Management Protocol (SNMP) Applications
RFC 3414 - User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
RFC 3418 - SNMP MIB
draft-ietf-disman-alarm-mib-04.txt
IANA-IFType-MIB
IEEE8023-LAG-MIB

PROPRIETARY MIBs

TIMETRA-CHASSIS-MIB.mib
TIMETRA-CLEAR-MIB.mib
TIMETRA-DOT3-OAM-MIB.mib
TIMETRA-FILTER-MIB.mib
TIMETRA-GLOBAL-MIB.mib
TIMETRA-IEEE8021-CFM-MIB.mib
TIMETRA-LAG-MIB.mib
TIMETRA-LOG-MIB.mib
TIMETRA-MIRROR-MIB.mib
TIMETRA-NTP-MIB.mib
TIMETRA-OAM-TEST-MIB.mib
TIMETRA-PORT-MIB.mib
TIMETRA-QOS-MIB.mib
TIMETRA-SAS-GLOBAL-MIB.mib
TIMETRA-SAS-PORT-MIB.mib
TIMETRA-SAS-QOS-MIB.mib
TIMETRA-SAS-SYSTEM-MIB.mib
TIMETRA-SCHEDULER-MIB.mib
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TIMETRA-SERV-MIB.mib
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