NOKIA

7210 SERVICE ACCESS SWITCH

7210 SAS OS Interface Configuration Guide
7210 SAS-D,
7210 SAS-E,
7210 SAS-K2F2T1C
7210 SAS-K2F4T6C
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Preface

About This Guide

This guide describes system concepts and provides configuration examples to provision logical IOM cards and MDAs, and Ethernet ports on 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C platforms.

On 7210 SAS devices, not all the CLI commands are supported on all the platforms and in all the modes. In most cases, the CLI commands explicitly mention the list of supported platforms in this guide. In a few cases, it is implied and easy to know the CLIs not supported on a particular platform.

NOTES:

- 7210 SAS-K5 stands for 7210 SAS-K 2F2T1C and 7210 SAS-K12 stands for 7210 SAS-K 2F4T6C platforms.
- 7210 SAS-E, 7210 SAS-D, and 7210 SAS-K 2F2T1C operate in access-uplink mode by default. There is no need of an explicit user configuration needed for this.
  7210 SAS-K 2F4T6C operates in Access-uplink mode and Network mode. There is no explicit BOF configuration required for it.

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
- MDA and port configuration
- QoS policies

- Services

List of Technical Publications

The 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C OS documentation set is composed of the following books:

- 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C OS Basic System Configuration Guide

  This guide describes basic system configurations and operations.
- 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C OS System Management Guide

  This guide describes system security and access configurations as well as event logging and accounting logs.
- 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C OS Interface Configuration Guide

  This guide describes card, Media Dependent Adapter (MDA), link aggregation group (LAG) and port provisioning.
- 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C OS Router Configuration Guide

  This guide describes logical IP routing interfaces and associated attributes such as an IP address, port, as well as IP and MAC-based filtering.
- 7210 SAS-K2F4T6C OS MPLS Guide

  This guide describes how to configure Multi-protocol Label Switching (MPLS) and Label Distribution Protocol (LDP).
- 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C OS OS Services Guide

  This guide describes how to configure service parameters such as customer information and user services.
- 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C 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-D and 7210 SAS-E OS OS Quality of Service Guide

  This guide describes how to configure Quality of Service (QoS) policy management.
- 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C Quality of Service Guide

  This guide describes how to configure Quality of Service (QoS) policy management.
- 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C7210 OS Routing Protocols Guide

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

GETTING STARTED

In This Chapter

This chapter provides process flow information to configure cards and ports.

Nokia 7210 SAS D, E, K 2F2T1C and K 2F4T6C-Series Switch Configuration Process

Table 1 lists the tasks necessary to provision and ports.

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

Table 1: Configuration Process

Area	Task	Chapter
Provisioning	Chassis slots and cards	Chassis Slots and Cards on page 16
	Ports	Ports on page 22
Reference	List of IEEE, IETF, and other proprietary entities.	Nokia Standards and Protocol Support on page 243

In This Chapter

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 on page 16
  - Chassis Slots and Cards on page 16
  - Digital Diagnostics Monitoring on page 18
  - Ports on page 22
    - Port Types on page 22
  - LAG on page 33
    - Multi-Chassis LAG on page 47
    - 802.1x Network Access Control on page 48
  - MTU Configuration Guidelines on page 56
  - on page 60
- Configuration Notes on page 189

Configuration Overview

NOTE: This document uses the term pre-provisioning in the context of preparing or pre-configuring entities such as chassis slots, 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 7210 SAS-E, 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C and the variants are platforms with a fixed port configuration, and no expansion slots. 7210 software inherits the concept of CPM, IOM and MDA from 7x50 to represent the hardware logically. These are fixed and are not removable. The software creates 2 logical cards, to represent the CPM and IOM and these are pre-provisioned on boot-up. The IOM card, is modelled with a single MDA, a logical entity to represent the fixed ports on the system. This MDA is auto-provisioned on boot-up and user does not need to provision them. Ports and interfaces can also be pre-provisioned.

Chassis Slots and Cards

- The 7210 SAS-E supports the following:
  - 12 x 10/100/1000 SFP ports
  - One Ethernet out of band management port
  - One management console port
  - 12 x 10/100/1000 BASE-T ports
- The 7210 SAS-D supports the following:
  - 6 x 10/100/1000 SFP ports
  - 4 x 10/100/1000 BASE-T ports
  - One management console port
- The 7210 SAS-K2F2T1C supports the following:
  - 2 x 10/100/1000 Base-T fixed copper ports
  - One management console port

- The 7210 SAS-K2F4T6C supports the following:
  - 2 x 100/1000 SFP ports
  - 4 x 10/100/1000 Base-T fixed copper ports
  - 6 Combo port (100/1000SFP or 10/100/1000 Base-T)
  - One management console port.

Digital Diagnostics Monitoring

Some Nokia SFPs, XFPs, and the MSA DWDM transponder have Digital Diagnostics Monitoring (DDM) capability where the transceiver module maintains information about its working status in device registers including:

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

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

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

The Tx and Rx power displayed in the DDM output are average optical power in dBm.

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

The following are potential uses of the DDM data:

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

Supported real-time DDM features are summarized in Table 2.

Table 2: Real-Time DDM Information

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

The factory-programmed DDM alarms and warnings that are supported are summarized in Table 3.

Table 3: DDM Alarms and Warnings

Parameter	SFP/XFP Units	SFP	XFP	Required?	MSA DWDM
Temperature - High Alarm - Low Alarm - High Warning - Low Warning	C	Yes	Yes	Yes	Yes
Supply Voltage - High Alarm - Low Alarm - High Warning - Low Warning	µV	Yes	Yes	Yes	No
TX Bias Current - High Alarm - Low Alarm - High Warning - Low Warning	µA	Yes	Yes	Yes	Yes
TX Output Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes	Yes
RX Optical Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes	Yes
AUX1 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes	No
AUX2 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes	No

Nokia SFPs and XFPs

The availability of the DDM real-time information and warning/alarm status is based on the transceiver. It may or may not indicate that DDM is supported. Although some Nokia SFPs support DDM, initial releases of 7210 SAS does not support DDM. Please contact Nokia representatives for information on the software release in which DDM functionality is supported. Non-DDM and DDM-supported SFPs are distinguished by a specific ICS value.

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

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

Statistics Collection

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

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

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

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

Ports

Port Types

Nokia routers support the following port types:

- Ethernet — Supported Ethernet port types include:
  - Fast Ethernet (10/100BASE-T, 100Mbps SFP)
  - Gigabit Ethernet (1GbE SFP, 1000BASE-T)

A brief description of different modes is as follows:

Port Modes

In 7210 SAS devices, port must be configured as either access, access uplink or network. The following paragraphs explain the significance of the different port modes and the support available on different platforms. Supported port modes on different 7210 platforms is listed in **Table 5** below.

- 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.
- Access-uplink ports — Access-uplink ports are used to provide native Ethernet connectivity in service provider transport or infrastructure network. This can be achieved by configuring port mode as access uplink. With this option, the encap-type can be configured to only qinq. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access uplink port to allow the operator to differentiate multiple services being carried over a single access uplink port.This is the default mode when a node is operating in access-uplink mode.(applicable only to 7210 SAS-K 2F4T6C)
- Network ports (applicable only to 7210 SAS-K2F4T6C)— Configured for network facing traffic. These ports participate in the service provider transport or infrastructure network. Dot1q is supported on network ports.

•

The following port modes are supported on each of the 7210 SAS platforms:

Table 4: 7210 SAS Platforms supporting port modes

Port Mode Platforms	Access	Network	Hybrid	Access-uplink
7210 SAS-E	Yes	No	No	Yes
7210 SAS-D	Yes	No	No	Yes
7210 SAS-K 2F2T1C	Yes	No	No	Yes
7210 SAS-K 2F4T6C	Yes	Yes	No	Yes

Port Dot1q VLAN Etype on 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C

7210 supports an option to allow the user to use a different dot1q VLAN Ethernet Type (Etype). It allows for interoperability with third-party switches that use some pre-standard (other than 0x8100) dot1q VLAN Etype.

Configuration guidelines for Dot1q-Etype for 7210 SAS-D

The following are the configuration guidelines for Dot1q-Etype configured for dot1q encap port on 7210 SAS-D:

- Dot1q-Etype configuration is supported for all ports - Access, Access-uplink and Network ports.
- Dot1q-preserve SAPs cannot be configured on dot1q encap ports configured to use ether type other than 0x8100.
- Priority tagged packet received with Etype 0x8100 on a dot1q port configured with Etype 0x9100 are classified as priority tagged packet and mapped to a dot1q :0 SAP (if configured) and the priority tag is removed.
- Priority tagged packets received with Etype 0x6666 (any value other than 0x8100) on a dot1q port configured with Etype 0x9100 is classified as null-tagged packet and mapped to a dot1q :0 SAP (if configured) and the priority tag is retained and forwarded.

- The dot1q-Etype is modified only for the dot1q encap port (access/hybrid port). The dot1q-Etype cannot be modified on Network ports.
- During the non-default dot1q-rvpls and qinq-rvpls, the extra tagged packets is dropped even for an 0x8100 packets on an RVPLS SAP, this is applicable only for network mode (and not access-uplink mode).

Ethernet Combo Port on 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C

The 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C supports a combo port. The combo port provides two physical interface options to the user. One option is to configure it as a SFP port allowing for fiber based connectivity and speeds of 100/1000 with the advantages of using suitable optics for longer reach. Second option is to configure it as a fixed copper port which provides cheaper connectivity for shorter reach. The SFP port support 100/1000 speeds and the copper port can support 10/100/1000Mbps speed. The combo port can be configured either as a SFP port or a copper port. In other words, both the interfaces cannot be used simultaneously. The user is provided with an option to configure the connection type of combo port to be either SFP or copper.

- 7210 SAS-K2F2T1C provide one combo port;
- 7210 SAS-K2F4T6C provides 6 Combo ports.

Link Layer Discovery Protocol (LLDP)

The IEEE 802.1ab Link Layer Discovery Protocol (LLDP) standard defines protocol and management elements suitable for advertising information to stations attached to the same IEEE 802 LAN. The protocol facilitates the identification of stations connected by IEEE 802 LANs or MANs, their points of interconnection, and access points for management protocols.

The LLDP helps the network operators to discover topology information. This information is used to detect and resolve network problems and inconsistencies in the configuration.

Listed below is the information included in the protocol defined by the IEEE 802.1ab standard:

- Connectivity and management information about the local station to adjacent stations on the same IEEE 802 LAN is advertised.
- Network management information from adjacent stations on the same IEEE 802 LAN is received.
- Operates with all IEEE 802 access protocols and network media.
- Network management information schema and object definitions that suitable for storing connection information about adjacent stations is established.
- Provides compatibility with a number of MIBs. For more information, see Figure 1.

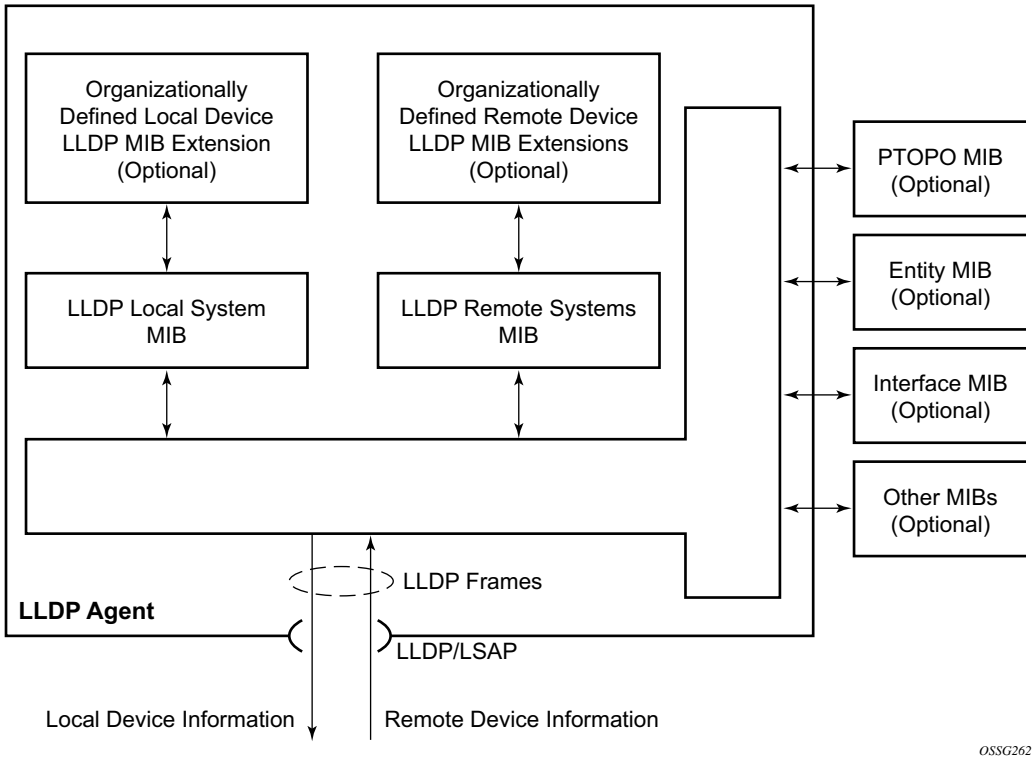

Figure 1: LLDP Internal Architecture for a Network Node

In order to detect and address network problems and inconsistencies in the configuration, the network operators can discover the topology information using LLDP. The Standard-based tools address the complex network scenarios where multiple devices from different vendors are interconnected using Ethernet interfaces.

The example displayed in Figure 2 depicts a MPLS network that uses Ethernet interfaces in the core or as an access/handoff interfaces to connect to different kind of Ethernet enabled devices such as service gateway/routers, QinQ switches DSLAMs or customer equipment.

The topology information of the network in Figure 2 can be discovered if, IEEE 802.1ab LLDP is running on each of the Ethernet interfaces in network.

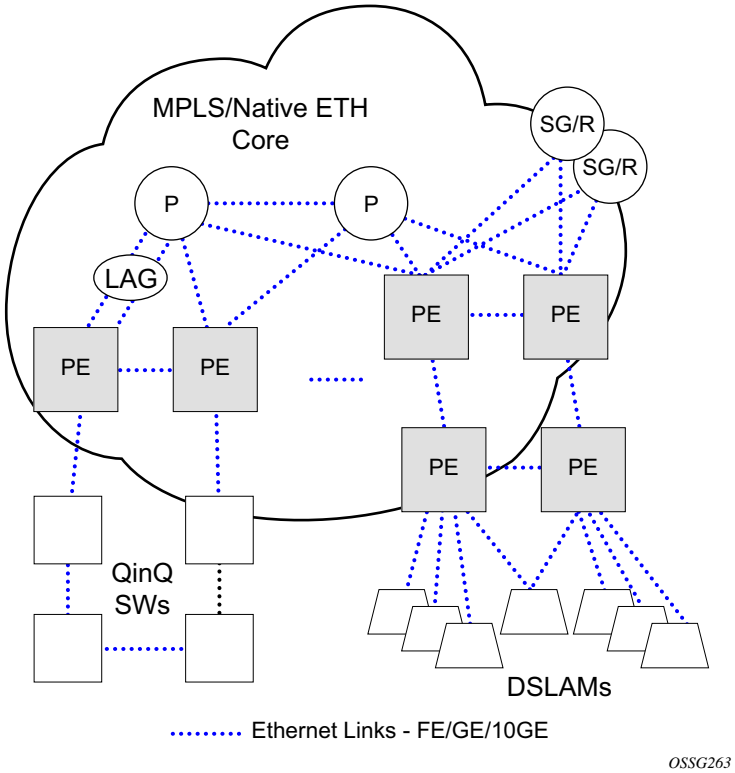

Figure 2: Generic Customer Use Case For LLDP

LLDP Protocol Features

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

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

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

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

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

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

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

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

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

The implementation defaults to setting the port-id field in the LLDP OAMPDU to tx-local. This encodes the port-id field as ifIndex (sub-type 7) of the associated port. This is required to support some releases of SAM. SAM may use the ifIndex value to properly build the Layer Two Topology Network Map. However, this numerical value is difficult to interpret or readily identify the LLDP peer when reading the CLI or MIB value without SAM. Including the port-desc option as part of the tx-tlv configuration allows an ALU remote peer supporting port-desc preferred display logic to display the value in the port description TLV instead of the port-id field value. This does not change the encoding of the port-id field. That value continues to represent the ifIndex. In some environments, it may be important to select the specific port information that is carried in the port-id field. The operator has the ability to control the encoding of the port-id information and the associated subtype using the port-id-subtype option. Three options are supported for the port-idsubtype:

tx-if-alias — Transmit the ifAlias String (subtype 1) that describes the port as stored in the IFMIB, either user configured description or the default entry (ie 10/100/Gig ethernet SFP)

tx-if-name — Transmits the ifName string (subtype 5) that describes the port as stored in the IFMIB, ifName info.

tx-local — The interface ifIndex value (subtype 7)

IPv6 (address subtype 2) and IPv4 (address subtype 1) LLDP System Management addresses are supported.

LLDP Tunneling for Epipe Service

Customers who subscribe to Epipe service consider the Epipe as a wire, and run LLDP between their devices which are located at each end of the Epipe. To facilitate this, the 7210 devices support tunneling of LLDP frames that use the nearest bridge destination MAC address.

If enabled using the command *tunnel-nearest-bridge-dest-mac,* all frames received with the matching LLDP destination mac address are forwarded transparently to the remote end of the Epipe service. To forward these frames transparently, the port on which tunneling is enabled must be configured with NULL SAP and the NULL SAP must be configured in an Epipe service. Tunneling is not supported for any other port encapsulation or other services.

Additionally, before enabling tunneling, admin status for LLDP dest-mac nearest-bridge must be set to disabled or Tx only, using the command admin-status available under configure> port> ethernet> lldp> destmac-nearest-bridge. If *admin-status* for dest-mac nearest-bridge is set to receive and process nearest-bridge LLDPDUs (that is, if either rx or tx-rx is set) then it overrides the *tunnel-nearest-bridge-dest-mac* command.

The following table lists the behavior for LLDP with different values set in use for admin-status and when tunneling is enabled or disabled:

NOTE: Transparent forwarding of LLDP frames can be achieved using the standard defined mechanism when using the either nearest-non-tmpr or the nearest-customer as the destination MAC address in the LLDP frames. It is recommended that the customers use these MAC address where possible to conform to standards. This command allows legacy LLDP implementations that do not support these additional destinations MAC addresses to tunnel LLDP frames that use the nearest-bridge destination MAC address.

Port loop-back for Ethernet ports

NOTE: Supported only on 7210 SAS-D and 7210 SAS-E. 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C supports SAP loop-back with mac-swap and port loop-back without MAC swap. It does not support port loop-back with MAC swap.

7210 devices support port loop-back for ethernet ports. There are two flavors of port loop-back commands - port loop-back without mac-swap and port loop-back with mac-swap. Both these commands are helpful for testing the service configuration and measuring performance parameters such as throughput, delay, and jitter on service turn-up. Typically, a third-party external test device is used to inject packets at desired rate into the service at a central office location.

The following sections describe the port loop-back functionality.

Port loop-back without MAC swap

When the Port loop-back command is enabled, the system enables PHY/MAC loop-back on the specified port. All the packets are sent out the port configured for loop-back and received back by the system. On ingress to the system after the loop-back, the node processes the packets as per the service configuration for the SAP.

This is recommended for use with only Epipe services. This command affects all the services configured on the port, therefore the user is advised to ensure all the configuration guidelines mentioned for this feature in the command description are followed.

Port loop-back with MAC swap

The 7210 SAS provides port loop back support with MAC swap. When the Port loop-back command is enabled, the system enables PHY/MAC loop-back on the specified port. All the packets are sent out the port configured for loop-back and received back by the system. On ingress to the system after the loop-back, the node swaps the MAC addresses for the specified SAP and the service. It only processes packets that match the specified source MAC address and destination MAC address, while dropping packets that do not match. It processes these packets as per the service configuration for the SAP.

This is recommended for use with only VPLS and Epipe services. This command affects all the services configured on the port, therefore the user is advised to ensure all the configuration guidelines mentioned for this feature in the command description are followed.

Per SAP loop-back with mac-swap

NOTE: Supported only on 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C. It is not supported on 7210 SAS-D and 7210 SAS-E.

The 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C provides per SAP loop-back support with MAC swap. When the SAP loop-back command is enabled, all the packets are sent out the SAP configured with loop-back are looped back at the egress of the SAP back into the ingress of the SAP. The node swaps the MAC addresses before the packet hits the ingress of the SAP. After it is received back at SAP ingress, it processes these packets as per the service configuration for the SAP. Only traffic sent out of the test SAP is looped back. In other words, it does not affect other SAPs and services configured on the same port. It is supported for use with both VPLS and Epipe services.

LAG

Based on the IEEE 802.3ax standard (formerly 802.3ad), Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two network devices, depending on the number of links installed. 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 Nokia routers is based on the type of traffic transported to ensure that all traffic in a flow remains in sequence while providing effective load sharing across the links in the LAG.

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

LAG Features

Hardware capabilities:

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

Software capabilities:

- Conforms to the IEEE LAG implementation.

Configuring LAGs

LAG configuration guidelines include:

- Ports can be added or removed from the LAG while the LAG and its ports (other than the port being removed) remain operational. When ports to and/or from the LAG are added or removed, the hashing algorithm is adjusted for the new port count.
- The **show** commands display physical port statistics on a port-by-port basis or the entire LAG can be displayed.
- On 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C, a single set of counters is used to account for the traffic received on the LAG.
- 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, auto-negotiation must be disabled or in limited mode to ensure only a specific speed is advertised.

Figure 3 Displays traffic routed between ALA-1 and ALA-2 as a LAG consisting of four ports.

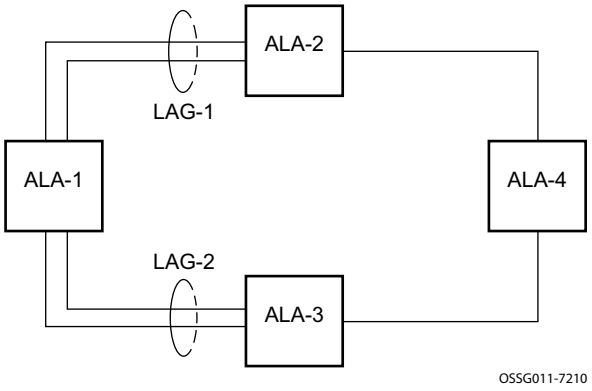

Figure 3: LAG Configuration

LAG and QoS Policies on 7210 SAS-D and 7210 SAS-E

In the 7210 SAS-D and 7210 SAS-Ean ingress QoS policy is applied to the aggregate traffic that is received on all the member ports of the LAG. For example, if an ingress policy is configured with a policer of PIR 100Mbps, for a SAP configured on a LAG with two ports, then the policer limits the traffic received through the two ports to a maximum of 100Mbps.

In the 7210 SAS-D and 7210 SAS-E, an egress QoS policy 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 queue shaper rate of PIR 100Mbps, and applied to an access-uplink or access LAG configured with two port members, then each port would send out 100 Mbps of traffic for a total of 200Mbps of traffic out of the LAG. 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 use the entire SLA. The disadvantage is that, the overall SLA can be exceeded if the flows span multiple ports.

LAG and QoS policies on 7210 SAS-K2F2T1C and K2F4T6C

On 7210 SAS-K2F2T1C and 7210 SAS-K2F4T6C, an ingress QoS policy is applied to the aggregate traffic that is received through all the member ports of the LAG and mapped to that service entity (for example: access-uplink port). For example, if an ingress policy is configured with a queue shaper rate of PIR 100Mbps for an access-uplink LAG configured with two ports, then the queue shaper limits the traffic received through the two ports to a maximum of 100Mbps.

On 7210 SAS-K2F2T1C and 7210 SAS-K2F4T6C, an egress QoS policy 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 queue shaper rate of PIR 100Mbps, and applied to an access-uplink LAG configured with two port members, then each port can send out 100 Mbps of traffic for a total of 200Mbps of traffic out of the LAG (assuming flows are distributed among the 2 ports). 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 use 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.

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

LAG 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 Link Aggregation (LAG) one of the methods is applied. The Nokia implementation supports per flow hashing used to achieve uniform loadspreading and per service hashing designed to provide consistent per service forwarding. Depending on the type of traffic that needs to be distributed into a LAG, different variables are used as input to the hashing algorithm.

The tables below provides the packet fields used for hashing for different services and different traffic types for different platforms.

4. LAG Hashing Fields used for 7210 SAS-E

Table 5: LAG Hashing mechanism for services configured on 7210 SAS-E devices

Services and Traffic Direction	Packet fields used for Hashing for different traffic types
VPLS service: SAP to SAP	IP traffic (Learnt): Source and Destination IP, Source and Destination L4 ports. IP traffic (Unlearnt): Source and Destination MAC. PBB traffic(Learnt): BDA, BSA,VLAN PBB traffic(Unlearnt): BDA, BSA MPLS traffic (Learnt): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet). MPLS Label Stack (Two labels deep), VLAN. MPLS traffic (Unlearnt): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet). Non-IP traffic (Learnt): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearnt): Source and Destination MAC
Epipe service: SAP to SAP	IP traffic: Source and Destination MAC PBB traffic: BDA, BSA MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet) Non-IP traffic: Source and Destination MAC
IES service (IPv4): IES SAP to IES SAP	IPv4 unicast traffic: Source and Destination IP, Source and Destination L4 ports.

NOTES for 7210 SAS-E:

1. The term ‘Learnt’ mentioned corresponds to Destination MAC.
2. Source/Destination MAC refer to ‘Customer Source/Destination MACs’ unless otherwise specified.
3. VLAN ID is considered for Learnt - PBB, MPLS, Non-IP traffic in VPLS service only for traffic ingressing at dot1q, Q.*, Q1.Q2 SAPs.
4. Only outer VLAN tag is used for hashing.

LAG Hashing Fields used for 7210 SAS-D

Table 6: LAG Hashing mechanism for services configured on 7210 SAS-D devices

Services and Traffic Direction	Packet fields used for Hashing for different traffic types
VPLS service: SAP to SAP	IP traffic (Learnt): Source and Destination IP, Source and Destination L4 ports. IP traffic (Unlearnt): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic (Learnt): BDA, BSA, VLAN PBB traffic (Unlearnt): BDA, BSA, ISID, Ingress Port-Id Non-IP traffic (Learnt): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearnt): Source and Destination MAC, EtherType, Ingress Port-Id, VLAN
Epipe service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id Non-IP traffic: Source and Destination MAC, EtherType, Ingress Port-Id, VLAN
IES service (IPv4): IES SAP to IES SAP	IPv4 unicast traffic: Source and Destination IP, Source and Destination L4 ports.

NOTES for 7210 SAS-D:

1. The term ‘Learnt’ mentioned corresponds to Destination MAC.
2. Source/Destination MAC refer to ‘Customer Source/Destination MACs’ unless otherwise specified.
3. VLAN ID is considered for Learnt PBB, Learnt Non-IP traffic in VPLS service only for traffic ingressing at dot1q, Q.*, Q1.Q2 SAPs.
4. Only outer VLAN tag is used for hashing.

LAG Hashing Fields used for 7210 SAS-K 2F2T1C

Table 7: LAG Hashing mechanism for services configured on 7210 SAS-K 2F2T1C devices

Service and Traffic direction	Packet fields used for Hashing for different traffic types
VPLS service: SAP to SAP	IP traffic (Learnt and Unlearnt): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, Outer VLAN, IP Protocol PBB traffic (Learnt and Unlearnt): BDA, BSA, Ingress Port-Id, Outer and Inner VLANs MPLS traffic (Learnt and Unlearnt): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), Ingress Port-Id, Outer and Inner VLANs Non-IP traffic (Learnt and Unlearnt): Source and Destination MAC, Ingress Port-Id, Outer and Inner VLANs
Epipe service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, Outer VLAN, IP Protocol PBB traffic: BDA, BSA, Ingress Port-Id, Outer and Inner VLANs MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), Ingress Port-Id, Outer and Inner VLANs Non-IP traffic: Source and Destination MAC, Ingress Port-Id, Outer and Inner VLANs

NOTES for 7210 SAS-K 2F2T1C:

1. ‘Learnt’ wherever mentioned corresponds to Destination MAC.
2. Source/Destination MAC refer to ‘Customer Source/Destination MACs’ unless otherwise specified.

LAG Hashing Fields used for 7210 SAS-K 2F4T6C

Table 8: LAG Hashing mechanism for services configured on 7210 SAS-K 2F4T6C devices

Service and Traffic direction	Packet fields used for Hashing for different traffic types
VPLS service: SAP to SAP	IP traffic (Learnt and Unlearnt): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, Outer VLAN, IP Protocol MPLS traffic (Learnt and Unlearnt): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), Ingress Port-Id, Outer and Inner VLANs Non-IP traffic (Learnt and Unlearnt): Source and Destination MAC, Ingress Port-Id, Outer and Inner VLANs
Epipe service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, Outer VLAN, IP Protocol MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), Ingress Port-Id, Outer and Inner VLANs Non-IP traffic: Source and Destination MAC, Ingress Port-Id, Outer and Inner VLANs

Table 8: LAG Hashing mechanism for services configured on 7210 SAS-K 2F4T6C devices

Service and Traffic direction	Packet fields used for Hashing for different traffic types
VPLS Service: SAP to SDP	IP Traffic (Learnt and Unlearnt): Source and Destination IP address, Source and Destination L4 ports, Outer VLAN, IP Protocol, and Ingress Port-ID MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), Ingress Port-Id, Outer and Inner VLANs Non-IP traffic (Learnt and Unlearnt): Source and Destination MAC, Ingress Port-Id, Outer and Inner VLANs
Epipe Service: SAP to SDP	IP Traffic: Source and Destination IP address, Source and Destination L4 ports, Outer VLAN, IP Protocol, and Ingress Port-ID MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), Ingress Port-Id, Outer and Inner VLANs Non-IP traffic: Source and Destination MAC, Ingress Port-Id, Outer and Inner VLANs
VPLS Service: SDP to SAP	Traffic in the payload: IP traffic (Learnt and Unlearnt): Source and Destination IP address, Source and Destination L4 ports, IP Protocol, Ingress Port-Id. Non-IP traffic (Learnt and Unlearnt): Source and Destination MAC, Ingress Port-Id.

Table 8: LAG Hashing mechanism for services configured on 7210 SAS-K 2F4T6C devices

Service and Traffic direction	Packet fields used for Hashing for different traffic types
Epipe Service: SDP to SAP	Traffic in the payload: IP traffic: Source and Destination IP address, Source and Destination L4 ports, IP Protocol, Ingress Port-Id. Non-IP traffic: Source and Destination MAC, Ingress Port-Id.
VPLS Service: SDP to SDP	Traffic in the payload: IP traffic (Learnt and Unlearnt): Source and Destination IP address, Source and Destination L4 ports, IP Protocol, Ingress Port-Id. Non-IP traffic (Learnt and Unlearnt): Source and Destination MAC, Ingress Port-Id.
MPLS – LSR	MPLS label stack (Four labels deep), Outer VLAN, Ingress Port-Id
IES service (IPv4): IES SAP to IES SAP	Source and destination IP, Source and destination L4 ports, Outer VLAN, IP Protocol, Ingress Port-Id
IES service (IPv4): IES SAP to IPv4 network port interface	Source and destination IP, Source and destination L4 ports, Outer VLAN, IP Protocol, Ingress Port-Id
IES service (IPv4): IPv4 network port interface to IES SAP	Source and destination IP, Source and destination L4 ports, Outer VLAN, IP Protocol, Ingress Port-Id

Table 8: LAG Hashing mechanism for services configured on 7210 SAS-K 2F4T6C devices

Service and Traffic direction	Packet fields used for Hashing for different traffic types
Network port IPv4 interface: IPv4 network interface to IPv4 network interface	Source and destination IP, Source and destination L4 ports, Outer VLAN, IP Protocol, Ingress Port-Id
VPRN service: SAP to SAP SDP to SAP SAP to SDP	Source and destination IP, Source and destination L4 ports, Outer VLAN, IP Protocol, Ingress Port-Id

NOTES for 7210 SAS-K 2F4T6C:

1. 'Learnt' wherever mentioned corresponds to Destination MAC.
2. Source/Destination MAC refer to 'Customer Source/Destination MACs' unless otherwise specified.
3. SAP to SAP and SAP to SDP: Packet fields mentioned for IP traffic are used for hashing only if the number of VLAN tags are less than equal to 2. IP packets with more than 2 tags use the same hashing parameters as Non-IP traffic.
4. SDP to SAP and SDP to SDP: Packet fields mentioned for IP traffic are used for hashing only if the number of VLAN tags are less than equal to 1. IP packets with more than 1 tag use the same hashing parameters as Non-IP traffic.
5. RVPLS routed traffic uses same parameters as traffic in IES service.

Multi-Chassis LAG

This section describes the Multi-Chassis LAG (MC-LAG) concept. MC-LAG is an extension of a LAG concept that provides node-level redundancy in addition to link-level redundancy provided by “regular LAG”. Typically, MC-LAG is deployed in a network-wide scenario providing redundant connection between different end points. The whole scenario is then built by combination of different mechanisms (for example, MC-LAG and redundant pseudo-wire to provide e2e redundant p2p connection or dual homing of access devices).

The 7210 SAS supports the capability which enables it to connect to an MC-LAG-enabled node. In particular, the 7210 SAS, allows for provisioning of links into sub-groups in a LAG and supports active/standby links. Note that the MC-LAG solution can be achieved with or without subgroups configured.

G.8032 Protected Ethernet Rings

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

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

802.1x Network Access Control

NOTE: 802.1x Network Access Control is not supported on 7210 SAS-K 2F4T6C devices.

The Nokia 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 Nokia 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

- 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 through 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.

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.

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.

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.

802.1x Tunneling for Epipe Service

Customers who subscribe to Epipe service considers the Epipe as a wire, and run 802.1x between their devices which are located at each end of the Epipe.

Note: This feature only applies to port-based Epipe SAPs because 802.1x runs at port level not VLAN level. Therefore such ports must be configured as null encapsulated SAPs.

When 802.1x tunneling is enabled, the 802.1x messages received at one end of an Epipe are forwarded through the Epipe. When 802.1x tunneling is disabled (by default), 802.1x messages are dropped or processed locally according to the 802.1x configuration (shutdown or no shutdown).

Note that enabling 802.1x tunneling requires the 802.1x mode to be set to force-auth. Enforcement is performed on the CLI level.

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 (for example, link fault, critical event, dying gasp)
- 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 access uplink ports on power failure.
- EFM OAMPDU tunneling.
- 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.

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

802.3ah OAM PDU Tunneling for Epipe Service

The 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 enabling 802.3ah for a port and enabling OAM PDU tunneling for the same port are mutually exclusive. In other words, on a given port either 802.3ah tunneling can be enabled or 802.3ah can be enabled, but both cannot be enabled together.

MTU Configuration Guidelines

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

The 7210 SAS must contend with MTU limitations at many service points. The physical (access and access uplink) port, MTU values must be individually defined.

- Identify the ports that are designated as access uplink ports as these are intended to carry service traffic.
- MTU values should not be modified frequently.
- MTU values must conform to the following conditions on 7210 SAS-D and 7210 SAS-E:
  - The access uplink port MTU must be greater than or equal to the access port MTU plus the overhead added by the system (for example, typically 4 bytes of VLAN tag are added when a packet is transmitted using the QinQ access uplink).
- The 7210 SAS-K 2F2T1C supports service-mtu. The service MTU values must conform to the following conditions:
  - The service MTU must be less than or equal to the access-uplink port MTU.
  - The service MTU must be less than or equal to the access port (SAP) MTU.
- The 7210 SAS-K 2F4T6C supports service-mtu. The service MTU values must conform to the following conditions:
  - The service MTU must be less than or equal to the access-uplink port MTU.
  - The service MTU must be less than or equal to the SDP path MTU when the service is configured to use MPLS SDPs.
  - The service MTU must be less than or equal to the access port (SAP) MTU.

Default MTU Values

Table 9 displays the default MTU values which are dependent upon the (sub-) port type, mode, and encapsulation.

Table 9: MTU Default Values

Port Type	Mode	Encap Type	Default (bytes)
Ethernet	access	null	1514
Ethernet	access	dot1q	1518
Port mode	access	qinq	1522
Fast Ethernet	uplink	—	1522

Table 9: MTU Default Values (Continued)

Port Type	Mode	Encap Type	Default (bytes)
Other Ethernet	uplink	—	9212*
Ethernet	hybrid	—	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 9728 bytes.

Modifying MTU Defaults on 7210 SAS-D and 7210 SAS-E

On 7210 SAS-D and 7210 SAS-E, MTU parameters can be modified only on the port level.

- The port-level MTU parameters configure the maximum payload MTU size for an Ethernet port that is part of a multilink bundle or LAG.

The default MTU values should be modified to ensure that packets are not dropped due to frame size limitations.

Modifying MTU Defaults on 7210 SAS-K 2F2T1C

MTU parameters can be modified on the port level and at the service level.

- The port-level MTU parameters configure the maximum payload MTU size for an Ethernet port that is part of a multi-link bundle or LAG.
- The service-level MTU parameters configure the service payload (Maximum Transmission Unit – MTU) in bytes for the service ID overriding the service-type default MTU.

The default MTU values should be modified to ensure that packets are not dropped due to frame size limitations.

The service MTU must be less than or equal to both the access SAP port MTU and the access-uplink port MTU values. If the service from the 7210 SAS-K, is transported over an SDP in the IP/MPLS network (the SDP is not originating or terminating on the SAS-K), the operational path MTU can be less than the service MTU. In this case, user might need to modify the MTU value accordingly.

Configuration Example for 7210 SAS-K2F2T1C and 7210 SAS-K2F4T6C using SAPs in the service

In order for the maximum length service frame to successfully travel from a local ingress SAP to a remote egress SAP, the MTU values configured on the port on which the local ingress SAP is provisioned and the port on which egress SAP is provisioned must be coordinated to accept the

maximum frame size the service can forward. For example, the targeted MTU values to configure for an Epipe service (ALA-A and ALA-B) are displayed in Figure 4.

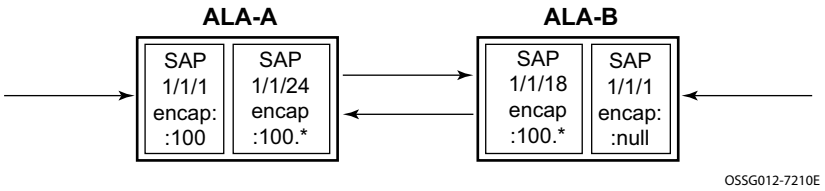

Figure 4: MTU Configuration Example

Since ALA-A uses Dot1q encapsulation, the port 1/1/1 MTU must be set to 1518 to be able to accept a 1514-byte service frame (seeTable 10 for MTU default values). Each of the access uplink port's MTU must be set to at least 1518 as well. Finally, the MTU of ALA-B's SAP (access port 1/1/2) must be at least 1514, as it uses null encapsulation.

Table 10: MTU Configuration Example Values

	ALA-A		ALA-B	
	Access (SAP)	Access Uplink (SAP)	Access Uplink (SAP)	Access (SAP)
Port (slot/MDA/port)	1/1/1	1/1/24	1/1/18	1/1/2
Mode type	access (dot1q)	access-uplink (QinQ)	access-uplink (QinQ)	access (null)
MTU	1518	1518	1518	1514

Instead, if ALA-A uses a dot1p-preserve SAP on port 1/1/1, then port 1/1/1 MTU must be set to 1518 to be able to accept a 1514-byte service frame (see Table 11 for MTU default values). Each of the access uplink port's MTU must be set to at least 1522 as well. Finally, the MTU of ALA-B's SAP (access port 1/1/2) must be at least 1518, as it uses Dot1q encapsulation.

Table 11: MTU Configuration Example Values

	ALA-A		ALA-B	
	Access (SAP)	Access Uplink (SAP)	Access Uplink (SAP)	Access (SAP)
Port (slot/MDA/port)	1/1/1	1/1/24	1/1/18	1/1/2
Mode type	access (dot1q-preserve)	access-uplink (QinQ)	access-uplink (QinQ)	access (dot1q-preserve)
MTU	1518	1522	1522	1518

Modifying MTU Defaults on 7210 SAS-K2F4T6C when using SDP in the service

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

- The service-level MTU parameters configure the service payload (Maximum Transmission Unit – MTU) in bytes for the service ID overriding the service-type default MTU.
- The port-level MTU parameters configure the maximum payload MTU size for an Ethernet port or LAG.

The default MTU values must be modified to ensure that packets are not dropped due to frame size limitations.

In a service configured to use access SAPs and access-uplinks SAPs, the service MTU must be less than or equal to both the access SAP port MTU and the access uplink port MTU values. If the service from the 7210 SAS-K2F4T6C, is transported over an SDP in the IP/MPLS network (the SDP is not originating or terminating on the SAS-K), the operational path MTU can be less than the service MTU. In this case, user might need to modify the MTU value accordingly.

In a service configured to use access SAPs and MPLS SDPs, the service MTU must be less than or equal to both the SAP port MTU and the SDP path MTU values. When an SDP is configured on a network port using default port MTU values, the operational path MTU can be less than the service MTU. In this case, enter the show service sdp command to check the operational state. If the operational state is down, then modify the MTU value accordingly.

Deploying Pre-provisioned Components

Cards and MDAs are auto-provisioned by the system and does not need to be provisioned by the user.

Configuration Process Overview

Figure 5 displays the process to provision chassis slots (if any), line cards (if any), MDAs (if any), and ports.

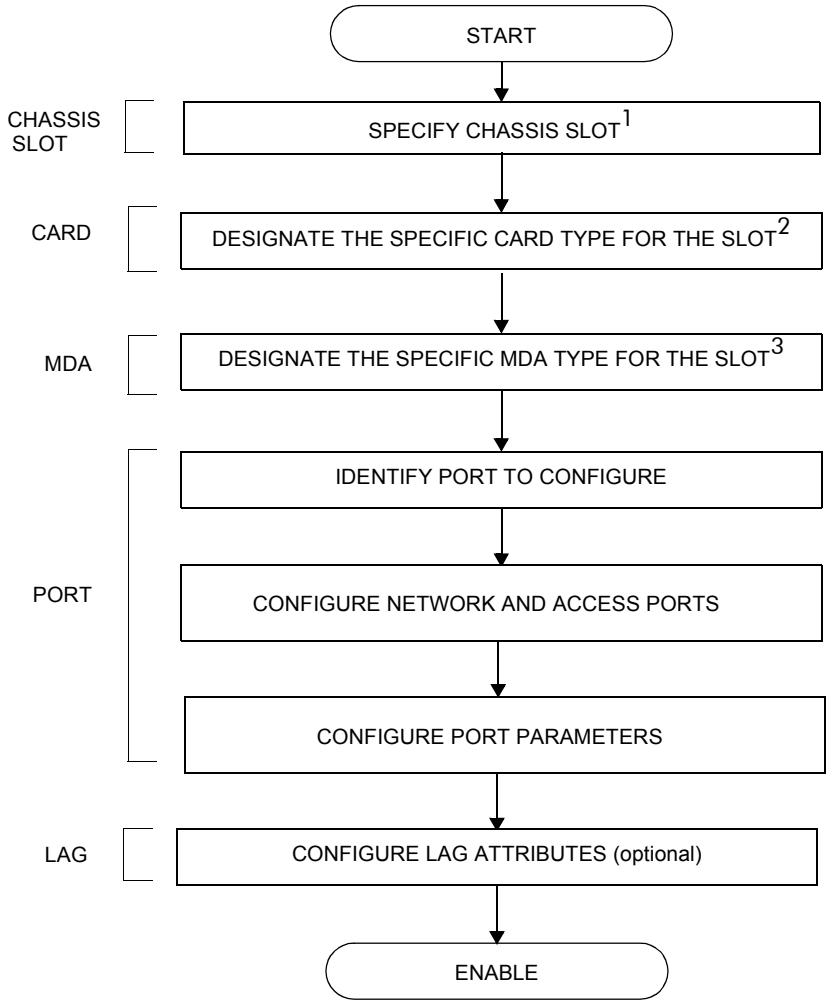

Figure 5: Slot, Card, MDA, and Port Configuration and Implementation Flow

Configuring Physical Ports with CLI

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

Topics in this section include:

- Preprovisioning Guidelines on page 64
  - → Predefining Entities on page 64
  - → Pre-provisioning a Port on page 65
- Basic Configuration on page 66
- Common Configuration Tasks on page 67
  - → Configuring Ports on page 68
- Common Configuration Tasks on page 67
  - → Configuring Ports on page 68
    - – Configuring Ethernet Port Parameters on page 69
  - → Configuring LAG Parameters on page 72
- Service Management Tasks on page 74
  - → Modifying a Card Type on page 75
  - → Deleting a Card on page 76
  - → Deleting Port Parameters on page 76

Preprovisioning Guidelines

7210 SAS routers have a console port to connect terminals to the router. The 7210 SAS does not support a management port.

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

Predefining Entities

The 7210 SAS auto-provisions card and MDA types.

On 7210 SAS platforms, where cards/MDAs are not auto-provisioned, in order to initialize a card, the chassis slot, line card type, and MDA type must match the preprovisioned parameters. In this context, *preprovisioning* means to configure the entity type (such as the line card type, MDA type, port, and interface) that is planned for a chassis slot, line card, or MDA. Preprovisioned entities can be installed but not enabled or the slots can be configured but remain empty until populated. *Provisioning* means that the preprovisioned entity is installed and enabled.

You can:

- Pre-provision ports and interfaces after the line card and MDA types are specified.
- Install line cards in slots with no pre-configuration parameters specified. Once the card is installed, the card and MDA types must be specified. This is required on 7210 SAS chassis based platforms or those platforms that support expansion slots . Typically on 7210 platforms that do not support any removable cards and/or MDAs, the cards are pre-provisioned for fixed ports.
- Install a line card in a slot provisioned for a different card type (the card will not initialize). The existing card and MDA configuration must be deleted and replaced with the current information. This is required on 7210 SAS chassis based platforms or those platforms that support expansion slots . Typically on 7210 platforms that do not support any removable cards and/or MDAs, the MDAs are pre-provisioned for all fixed ports.

Pre-provisioning 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 on page 69.

Basic Configuration

7210 SAS platforms that do not support any removable cards and/or MDAs The most basic configuration must have the following:

- Identify chassis slot.
- Specify line card type (must be an allowed card type).
- Identify MDA slot.
- Specify MDA type (must be an allowed MDA type).
- Identify specific port to configure.

Common Configuration Tasks

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

- Configuring Ports on page 68
  → Configuring Ethernet Port Parameters on page 69
- Configuring LAG Parameters on page 72
- Modifying a Card Type on page 75
- Deleting a Card on page 76
- Deleting Port Parameters on page 76

Configuring Ports

- Configuring Ethernet Port Parameters on page 69

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 shows a network port configuration:

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

Ethernet network port configuration is supported only on 7210 SAS-K 2F4T6C. Access uplink port configuration is supported on 7210 SAS-E, 7210 SAS-D,7210 SAS-K 2F2T1C, and 7210 SAS-K2F4T6C.

Ethernet Access Uplink Port

Access uplink port is network facing and participates in the service provider transport or infrastructure network processes. This is similar to a network port concept, except that the 7210 SAS-E does not allow IP interfaces nor runs routing protocols.

A SAP can be created when a port is configured in access uplink mode. When a port is configured in access uplink mode, then the encapsulation type of the port is set to QinQ.

The following example displays a network port configuration:

```
A:ALA-B>config>port# info
----------------------------------------------
description "Ethernet Access Uplink port"
----------------------------------------------
        ethernet
            mode access uplink
        exit
        no shutdown
----------------------------------------------------
A:ALA-B>config>port#
```

Ethernet Access Port

Services are configured on access ports used for customer-facing traffic. If a Service Access Port (SAP) is to be configured on a port, it must be configured as access mode or access uplink 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 (For 7210 SAS-D):

```
*A:7210-SAS>config>port# info
----------------------------------------------
        ethernet
            mode access
            access
                egress
                exit
            exit
            encap-type dot1q
            mtu 9212
        exit
        no shutdown
----------------------------------------------
*A:7210-SAS>
```

The following example displays an Ethernet access port configuration (For 7210 SAS-E):

```
A:ALA-A>config>port# info
----------------------------------------------
        description "Ethernet access port"
        access
            egress
                pool
                    slope-policy "slopePolicy1"
                exit
            exit
        exit
        ethernet
            mode access
            encap-type dot1q
        exit
        no shutdown
----------------------------------------------
A:ALA-A>config>port#
```

Access port configuration is supported on SAS-E, D, K2F2T1C, and K2F4T6C.

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
----------------------------------------------
```

Configuring LAG Parameters

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

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

The following example displays LAG configuration output:

```
A:ALA-A>config>lag# info detail
----------------------------------------------
        description "LAG2"
        mac 04:68:ff:00:00:01
        port  1/1/1
        port  1/3/1
----------------------------------------------
A:ALA-A>config>lag#
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#
```

CRC Error Monitoring

Note: This feature is supported only on 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C devices.

This feature allows the user to track CRC (cyclic redundancy check) errors received on a given port and notify them. The detection mechanism is based around a configurable threshold specified by the administrator. Two thresholds are configurable, one for CRC degrade and one for CRC signal fail. The first threshold crossing generates an alarm, log entry, trap, but does not bring the physical port down, while the second (signal fail) threshold crossing logs an alarm, trap generation, and brings the port operationally down.

The thresholds are configurable with the following CLI command *config>port>ethernet crc-monitor*.

Note: This behavior is enabled on a per port basis. By default the command and functionality is disabled, for the signal degrade and the signal fail.

The user can configure different values for the sf-threshold and the sd-threshold. However, sf-threshold value must be less than or equal to the sd-threshold value.

The values provided by the user for threshold and multiplier is used to compute the error ratio as (Multiplier * (10 ^ - (threshold value)). Port Stats are collected once per second and accumulated over the configured window size. Each second, the oldest sample is discarded and the new sample is added to a running total. If the error ratio exceeds the configured threshold (as computed above) over the window size for two consecutive seconds, appropriate actions are taken as follows:

- If the number of CRC errors exceeds the signal degrade threshold value, a log warning message, syslog event and SNMP trap with the message “CRC errors in excess of the configured degrade threshold <M>*10e-<N> Set" is raised.
- If the CRC error rate increases further and exceeds configured the signal fail threshold value, an alarm log message, syslog event and SNMP trap should be raised, and the port should be brought operationally down.

When the condition is cleared, a SNMP trap message to clear the event is sent out.

Service Management Tasks

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

- Modifying a Card Type on page 75
- Deleting a Card on page 76
- Deleting Port Parameters on page 76

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.

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.

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 on page 78
- Port Buffer Pool Configuration Commands for 7210 SAS-E and 7210 SAS-D on page 79
- Port Configuration Commands on page 79
- Port-based Split Horizon Group Configuration Commands for 7210 SAS-D and 7210 SAS-E on page 80
- Port Configuration Commands for network mode on page 85
- Port Loopback Commands for 7210 SAS devices on page 86Ethernet Commands on page 81
- Ethernet Ring Commands on page 87
- LAG Commands for 7210 SAS-D and 7210 SAS-E on page 85
- LAG Commands for 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C on page 85
- Ethernet Ring Commands on page 87
- Show Commands on page 88
- Monitor Commands on page 89
- Clear Commands on page 89
- Debug Commands on page 89

Hardware Commands

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

Port Buffer Pool Configuration Commands for 7210 SAS-E and 7210 SAS-D

```
config
    — port
    — no port
        — access
            — egress
                — [no] pool [name]
                    — slope-policy name
                    — no slope-policy
```

Port Configuration Commands

```
config
    — port
    — no port
        — description long-description-string
        — no description
        — ethernet
        — [no] shutdown
```

Port-based Split Horizon Group Configuration Commands for 7210 SAS-D and 7210 SAS-E

config
- — **port**
- — **no port**
  - — **split-horizon-group** ***g****roup-name*
  - — **no split-horizon-group**

config
- — [**no**] **lag** [*lag-id*]
  - — **[no] split-horizon-group** *group-name*

Port Commands for reserving resources of ports on 7210 SAS-E

configure
- — **system**
  - — **loopback-no-svc-port** {**mirror**} *port-id*
  - — **no loopback-no-svc-port**

Ethernet Commands

Port Ethernet QoS commands

NOTE: Not all the commands are available on all the platforms. See the CLI description for more information.

config
- — [**no**] **port** {*port-id*}
  - — **ethernet**
    - — **access**
      - — **accounting-policy** *acct-policy-id*
      - — **no accounting-policy**
      - — [**no**] **collect-stats**
      - — **egress**
        - — **qos** *policy-id*
        - — **no qos**
      - — **uplink**
        - — **accounting-policy** *acct-policy-id*
        - — **no accounting-policy**
        - — [**no**] **collect-stats**
        - — **qos** *policy-id*
        - — **no qos**
        - — **queue-policy** *name*
        - — **no queue-policy**
    - — **egress-rate** *sub-rate* [**max-burst** *size-in-kbits*]
    - — **no egress-rate**
    - — **egress-scheduler-policy** *port-scheduler-policy-name* **)**
    - — **no egress-scheduler-policy**
    - — **enable-dei**
    - — **no enable-dei**
    - — **network**
      - — **accounting-policy** *policy-id*
      - — **no accounting-policy**
      - — [**no**] **collect-stats**
      - — **qos** *policy-id*
      - — **no qos**
      - — **queue-policy** *name*
      - — **no queue-policy**
    - — **statistics**
      - — **egress**
        - — **queue** *queue-id*
          - — **[no] packets-forwarded-count**

Port Ethernet Commands

config
- — [**no**] **port** {*port-id*}
  - — **ethernet**
    - — **autonegotiate** [**limited**]

```
— [no] autonegotiate
— connection-type connection-type
— down-on-internal-error
— no down-on-internal-error
— duplex {full | half}
— dot1q-etype <0x0600..0xffff>
— no dot1q-etype
— encap-type {dot1q | null | qinq}
— no encap-type
— frame-based-accounting
— no frame-based-accounting
— hold-time {[up hold-time up] [down hold-time down] [seconds| centiseconds]}
— no hold-time
— no ip-mtu mtu-bytes
— [no] lacp-tunnel
— mac ieee-address
— no mac
— mode {access [uplink] network}
— no mode
— mtu mtu-bytes
— no mtu
— no loopback {internal} [service svc-id sap sap-id src-mac SA dst-mac DA]
— no oper-group
— oper-group name
— qinq-etype 0x0600..0xffff
— no qinq-etype
— [no] report-alarm [signal-fail] [remote] [local]
— speed {10 | 100 | 1000}
— [no] shutdown
```

Port Ethernet CRC Monitoring Commands for 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C

```
config
    — [no] port {port-id}
        — ethernet
            — crc-monitor
                — [no] sd-threshold threshold [multiplier multiplier]
                — [no] sf-threshold threshold [multiplier multiplier]
                — [no] window-size seconds
```

Port Ethernet 802.1x Commands

```
config
    — [no] port {port-id}
        — ethernet
            — dot1x
                — max-auth-req max-auth-request
```

```
— port-control {auto | force-auth | force-unauth}
— quiet-period seconds
— [no] 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
— [no] tunneling
```

Port Ethernet Down-when-Looped Commands

```
config
    — [no] port {port-id}
        — ethernet
            — down-on-internal-error
            — no down-on-internal-error
            — down-when-looped
                — keep-alive timer
                — no keep-alive
                — retry-timeout timer
                — no retry-timeout
                — [no] shutdown
```

Port Ethernet EFM OAM Commands

```
config
    — [no] port {port-id}
        — ethernet
            — egress-rate
                — [no] accept-remote-loopback
                — mode {active | passive}
                — [no] shutdown
                — [no] transmit-interval interval [multiplier multiplier]
                — [no] tunneling
```

Port Ethernet LLDP Commands

```
config
    — [no] port {port-id}
        — ethernet
            — lldp
                — [no] tunnel-nearest-bridge-dest-mac (supported only on 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C devices)
```

```
— dest-mac {nearest-bridge | nearest-non-tpmr | nearest-customer}
    — admin-status {rx | tx | tx-rx | disabled}
    — [no] notification
    — port-id-subtype{tx-if-alias | tx-if-name | tx-local}
    — no port-id-subtype
    — tx-mgmt-address [system] [system-ipv6]
    — no tx-mgmt-address
    — tx-tlvs [port-desc] [sys-name] [sys-desc] [sys-cap]
    — no tx-tlvs
```

Port Ethernet Sync Commands for 7210 SAS-D ETR, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C

```
config
    — [no] port {port-id}
        — ethernet
            — no port-clock
            — port-clock {master|slave|automatic}
            — ssm
                — [no] shutdown
                — [no] code-type sonet | sdh
                — [no] tx-dus
```

LAG Commands for 7210 SAS-D and 7210 SAS-E

config
- [**no**] **lag** [*lag-id*]
  - **description** *long-description-string*
  - **no description**
  - **enable-dei**
  - **no enable-dei**
  - **encap-type** {**dot1q** | **null** | **qinq**}
  - **no encap-type**
  - **hold-time down** *hold-down-time*
  - **no hold-time**
  - **lacp** [*mode*] [**administrative-key** *admin-key*] [**system-id** *system-id*][**system-priority** *priority*]
  - **lacp-xmit-interval** {**slow** | **fast**}
  - **no lacp-xmit-interval**
  - [**no**] **lacp-xmit-stdby**
  - **mac** *ieee-address*
  - **no mac**
  - **mode access** [**uplink**]
  - **no mode**
  - **no oper-group**
  - **oper-group** *name*
  - **port** *port-id [port-id ...up to N total]* **[priority** *priority***] [sub-group** *sub-group-id*]
  - **no port** *port-id* [*port-id* ...up to N total]
  - **port-threshold** *value* [**action** { **down**}]
  - **no port-threshold**
  - **selection-criteria [{highest-count|highest-weight|best-port}]** [**slave-to-partner**]
  - **no selection-criteria**
  - **standby-signalling** {**lacp** | **power-off**}
  - **no standby-signalling**
  - [**no**] **shutdown**

LAG Commands for 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C

config
- [**no**] **lag** [*lag-id*]
  - **description** *long-description-string*
  - **no description**
  - [**no**] **dynamic-cost**
  - **encap-type {dot1q|null|qinq}**
  - **no encap-type**
  - **hold-time down** *hold-down-time*
  - **no hold-time**
  - **lacp** [*mode*] [**administrative-key** *admin-key*] [**system-id** *system-id*][**system-priority** *priority*]
  - **lacp-xmit-interval** {**slow** | **fast**}
  - **no lacp-xmit-interval**
  - **mac** *ieee-address*
  - **no mac**
  - **mode** {**access [uplink] network}**
  - **no mode**
  - **port** *port-id* [*port-id* ...up to 4 total] [**priority** *priority*]
  - **no port** *port-id* [*port-id* ...up to 4 total]

— **port-threshold** *value* [**action** {**down**}]
— **no port-threshold**
— **selection-criteria** [{**highest-count**|**highest-weight**|**best-port**}] [**slave-to-partner**]
— **no selection-criteria**
— **standby-signalling** {**lacp** | **power-off**}
— **no standby-signalling**
— [**no**] **shutdown**

Ethernet Ring Commands

```
config
    — eth-ring ring-id
    — no eth-ring
        — [no] ccm-hold-time {down down-timeout | up up-timeout}
        — [no] compatible-version version
        — description description-string
        — no description
        — [no] guard-time time
        — [no] revert-time time
        — [no] rpl-node {owner | nbr}
        — [no] node-id mac
        — [no] sub-ring {virtual-link | non-virtual-link}
        — [no] path {a | b} [{ port-id | lag-id } raps-tag qtag[.qtag] ]
            — description description-string
            — [no] rpl-end
            — eth-cfm
                — [no] mep mep-id domain md-index association ma-index
                    — [no] ccm-enable
                    — [no] ccm-ltm-priority priority
                    — [no] control-mep
                    — [no] description description-string
                    — [no] eth-test-enable
                        — [no] test-pattern {all-zeros | all-ones} [crc-enable]
                        — bit-error-threshold bit-errors
                    — mac-address mac-address
                    — one-way-delay-threshold seconds
                    — [no] shutdown
            — [no] shutdown
```

Show Commands

show
- **chassis** [**environment**] [**power-supply**] ('environment' option not supported on 7210 SAS-D)
- **card** [*slot-number*] [**detail**]
- **card state**
- **pools** *mda-id*[*/port*] [**access-app** *[pool-name]*]
- **pools** *mda-id*[*/port*] [**network-app** *[pool-name]*]
- **lag** [*lag-id*] [**detail**] [**statistics**]
- **lag** *lag-id* **associations**
- **lag** [*lag-id*] **description**
- **lag** [*lag-id*] **port**
- **port** *port-id* [**count**] **[statistics]** [**detail**]
- **port** *port-id* **description**
- **port** *port-id* **associations**
- **port** *port-id* **dot1x** [**detail**]
- **port** *port-id* **ethernet** [**efm-oam** | **detail**]
- **port [A1] [detail] [statistics] [description]**
- **lldp** [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**]
- **system**
  - **internal-loopback-ports** [**detail**]
  - **lldp**
  - **lldp neighbor**

Monitor Commands

Monitor

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

Clear Commands

clear

— **lag** *lag-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

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- Card Commands on page 93
- Interface QoS Commands on page 96
- General Port Commands on page 99
- Ethernet Port Commands on page 105
- 802.1x Port Commands on page 124
- LAG Commands on page 137
- Ethernet Ring Commands on page 144

Generic Commands

description

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

Context config>port
config>lag
config>split-horizon-group

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>ssm

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.

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**.

Card Commands

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 No cards are configured. 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 an 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 card is fixed.

Default The 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 1

Parameters *mda-slot* — The MDA slot number to be configured. Fixed ports on the panel of the chassis belong to MDA 1.

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.

7210 SAS-E and 7210 SAS-D (all platform variants) supports only a fixed MDA. It does not support an expansion slot. The fixed MDA (addressed as mda 1) is auto-equipped and auto-provisioned on bootup. It cannot be deleted. An error message is shown in case the no form of command is performed on fixed MDAs.

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

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

Values m4-tx+6-sfp

sync-e

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

Context config>card>mda

Description This command enables Synchronous Ethernet on the Ethernet ports that support Synchronous Ethernet. When Synchronous Ethernet is enabled, the timing information is derived from the Ethernet ports.

Synchronous Ethernet is supported for both Ethernet SFP ports and fixed copper ports.

Refer to the 7210 SAS Basic System Configuration Guide for more information on Synchronous Ethernet.

Default **no sync-e**

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.

uplink

Syntax **uplink**

Context config>port>access

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

egress

Syntax **egress**

Context config>port>access
config>port>access>uplink

Description This command enables the context to specify the slope policy that is configured in the **config>qos>slope-policy** context.

pool

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

Context config>port>access>egress
config>port>access>uplink>egress

Description **Platforms supported**: 7210 SAS-D and 7210 SAS-E

This command configures pool policies.

Note: The default pool cannot be modified, deleted or created.

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.

slope-policy

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

Context config>port>access>egress>pool
config>port>access uplink>egress>pool

Description **Platforms supported**: 7210 SAS-D and 7210 SAS-E

This command specifies an existing slope policy which defines high and low priority RED slope parameters. 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 Platform supported: 7210 SAS-D and 7210 SAS-E.

This command associates a access-egress QoS policy to the access port.

The no form of the policy removes the explicit association of a user configured QoS policy and associates a default QoS policy with the port.

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

Values 1 — 65535

qos

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

Context config>port>ethernet>access>uplink

Description **Platform supported:** 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command associates a network QoS policy to the access-uplink port.

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

Values 1 — 65535

qos

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

Context config>port>ethernet>network

Description **Platforms Supported:** 7210 SAS-K 2F4T6C.

This command associates a network QoS policy to a network port.

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

Values [1|3..65535]

General Port Commands

port

Syntax **port**
no port

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.

enable-dei

Syntax **enable-dei**
no enable-dei

Context config>port>ethernet
config>lag

Description **Platforms Supported:** 7210 SAS-D.

This command is used to enable DEI based classification on access ports, network ports, access-uplink or hybrid ports.

If enabled, DEI value in the Ethernet packet header is used to determine the initial profile/color of the packet when the meter/policer used to police the FC is configured in color-aware mode. If the meter used to police the FC is configured in color-blind mode, then the DEI value of the packet has no effect. When in color-aware mode, DEI value of 0 is interpreted as in-profile or green packet and DEI value of 1 is interpreted as out-of-profile or yellow packet. In color-aware mode, the following behavior is accorded to packets classified with intial profile/color as in-profile/green and out-of-profile/yellow:

- If a green packet is received and the color-aware meter is within the CIR rate, then packet is assigned a final profile of green and it is assigned a final profile of yellow if the meter exceeds the CIR rate and is within the PIR rate.
- If a yellow packet is received and the color-aware meter is above the CIR rate and within the PIR rate, then the packet is assigned a final profile of yellow.

In other words, in color-aware mode, yellow/out-of-profile packets cannot eat into the CIR bandwidth. It is exclusively reserved for green/in-profile packets.

The final profile assigned at ingress is used by egress to determine the WRED slope to use. The WRED slope determines whether the packet is eligible to be assigned a buffer and can be queued up on egress queue for transmission.

NOTE: For more infomation, see the "7210 SAS QoS Configuration User Guide".

Default no enable-dei

Parameters none

egress-scheduler-policy

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

Context config>port>ethernet

Description **Platforms Supported:** 7210 SAS-D and 7210 SAS-E.

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.

mode

Syntax **mode access** [**uplink**]
no mode

Context config>port>ethernet
config>lag

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F2T1C, and 7210 SAS-K 2F4T6C.

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

Access: 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.

Access-uplink: Access-uplink ports are used to provide native Ethernet connectivity in service provider transport or infrastructure network. This can be achieved by configuring port mode as access uplink. With this option, the encap-type can be configured to only qinq. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access uplink port to allow the operator to differentiate multiple services being carried over a single access uplink port.

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

Default **access**

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

access uplink — Configures the Ethernet port for transport (ethernet uplinks available only in access-uplink mode).

mode

Syntax **mode {access [uplink] network}**
no mode

Context config>port>ethernet
config>lag

Description **Platforms Supported:** 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F2T1C, and 7210 SAS-K 2F4T6C.

This command configures an Ethernet port for access or access uplink mode or network mode of operation.

The following modes are supported on different 7210 platforms:

- 7210 SAS-D, 7210 SAS-E, and 7210 SAS-K 2F2T1C supports only access and access uplink mode.
- 7210 SAS-K 2F4T6C supports access, access uplink and network mode.

The functionality of the different modes is as follows:

Access: 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.

Access-uplink: Access-uplink ports are used to provide native Ethernet connectivity in service provider transport or infrastructure network. This can be achieved by configuring port mode as access uplink. With this option, the encap-type can be configured to only qinq. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access uplink port to allow the operator to differentiate multiple services being carried over a single access uplink port.

Network: A network port participates in the service provider transport or infrastructure network when a network mode is selected. When the network option is configured, the encap-type can be configured to either null or dot1q.

The no form of this command restores the default.

Default On 7210 SAS-D, 7210 SAS-E, and 7210 SAS-K 2F2T1C the default mode is access

On 7210 SAS-K 2F4T6C the default mode is network

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

access uplink — Configures the Ethernet port for transport (ethernet uplinks available only in access-uplink mode).

network — Configures the Ethernet port as service access (available only in network mode).

monitor-oper-group

Syntax **monitor-oper-group** *name*
no **monitor-oper-group**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command specifies the operational group to be monitored by the object under which it is configured. The oper-group name must be already configured under the *config>system* context before its name is referenced in this command.

The no form of the command removes the association from the configuration.

Default no monitor-oper-group

Parameters *name* — Specifies a character string of maximum 32 ASCII characters identifying the group instance.

Values [32 chars max]

mac

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

Context config>port>ethernet
config>lag

Description **Platforms supported**: 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C

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

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 **Platforms supported**: 7210 SAS-D, 7210 SAS-E, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C

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	Access	null	1514
10/100, Gig	Access	dot1q	1518
10/100, Gig	Access	q-in-q	1522

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

Values 512 — 9212

	Range
config>port>ethernet	512 — 9212

Port Loopback Commands

loopback-no-svc-port

Syntax **[no] loopback-no-svc-port** *{mirror } port-id*

Context config>system

Description **Platforms Supported:** 7210 SAS-E.

This command specifies the port to assign for system use when using port loopback or for the mirroring OAM tool. The system utilizes the resources of the port and the port is not available for configuring services.

The system displays an error if the user tries to configure the same port for use with multiple OAM tools OR if the user tries to use the tool without first configuring the port resources to be used by the tool.

The system verifies if any services are configured on the port specified with this command and if services are configured the command fails.

The no form of the command disables the use of this port by the specified OAM tool.

NOTE:

- On 7210 SAS-E, this command must be used and the user needs to dedicate one front-panel port for use with the mirroring applications. Port loopback with mac-swap is not supported on 7210 SAS-E.
- On 7210 SAS-D (ETR and non-ETR variants, user can use the 3 available internal ports (that is, port 1/1/11, 1/1/12, and 1/1/13) for use with either mac-swap or mirroring or testhead OAM tool. User does not need to use this command and the internal port resources are automatically allocated to the ports by software to different OAM tools.

Default None

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

mac-swap - Keyword not supported for 7210 SAS-E.

mirror — Specifies the port specified by the port-id is dedicated for use by the mirroring application/OAM tool.

Ethernet Port Commands

ethernet

Syntax **ethernet**

Context config>port

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

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

autonegotiate

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

Context config>port>ethernet

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

There are three possible settings for autonegotiation:

- "on" or enabled with full port capabilities advertised
- "off" or disabled where there are no auto-negotiation 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.

connection-type

Syntax **connection-type**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command configures the connection type on the ethernet combo port. The combo port provides two physical interface options to the user - sfp or copper. This command lets the user specify the physical interface that will be used.

When configured as SFP port it allows for fiber based connectivity with the flexibility of using suitable optics for longer reach. When configured as a fixed copper port it provides cheaper connectivity for shorter reach. The SFP port support 100/1000 speeds and the copper port can support 10/100/1000Mbps speed.

When configured as 'auto', software will attempt to detect the type of interface in use based on whether the copper cable is plugged in or the SFP optic is plugged in. It is not allowed to plug in copper cable and SFP optics into the ethernet combo port at the same time.

When combo port is used for syncE, the connection type has to be set to either sfp or copper. syncE is not supported with connection-type as auto.

The combo port can be configured either as a SFP port or a copper port or set for automatic detection. In other words, both the interfaces cannot be used simultaneously (even when 'auto' is set, software selects one of the ports based on the interface plugged in).

Default sfp - 7210 SAS-K 2F2T1C
auto - 7210 SAS-K 2F4T6C

Parameters *connection-type* — Specifies the type of ethernet combo port.

Values sfp | copper | auto

crc-monitor

Syntax **crc-monitor**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command configures Ethernet CRC Monitoring parameters.

Default none

sd-threshold

Syntax **[no] sd-threshold** *threshold* **[multiplier** *multiplier***]**

Context config>port>ethernet>crc-monitor

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command specifies the error rate at which to declare the Signal Failure condition on an Ethernet interface.

The value represents a ratio of errored frames over total frames received over seconds of the sliding window. The CRC errors on the interface are sampled once per second. A default of 10 seconds is used when there is no additional window-size configured. The multiplier keyword is optional. If the multiplier keyword is omitted or no sd-threshold is specified the multiplier will return to the default value of 1.

Default no sd-threshold

Parameters *threshold* — Represents the rate of CRC errored Ethernet frames.

Values 1-9

multiplier — Represents the multiplier used to scale the CRC error ratio.

Values 1-9

sf-threshold

Syntax **[no] sf-threshold** *threshold* **[multiplier** *multiplier***]**

Context config>port>ethernet>crc-monitor

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command specifies the error rate at which to declare the Signal Degrade condition on an Ethernet interface.

The value represents a ratio of errored frames over total frames received over seconds of the sliding window. The CRC errors on the interface are sampled once per second. A default of 10 seconds is used when there is no additional window-size configured. The multiplier keyword is optional. If the multiplier keyword is omitted or no sf-threshold is specified the multiplier will return to the default value of 1.

Default no sf-threshold

Parameters *threshold* — Represents the rate of CRC errored Ethernet frames.

Values 1-9

multiplier — Represents the multiplier used to scale the CRC error ratio.

Values 1-9

window-size

Syntax **[no] window-size** *seconds*

Context config>port>ethernet>crc-monitor

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command specifies sliding window size over which the ethernet frames are sampled to detect signal fail or signal degrade conditions. The command is used jointly with the sf-threshold and the sd-threshold to configure the sliding window size.

Default 10 seconds

Parameters *seconds* — The size of the sliding window in seconds over which the errors are measured.

Values [5..60]

down-on-internal-error

Syntax **[no] down-on-internal-error**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command configures the system to allow to bring a port operationally down in the event the systems has detected internal max transmit errors.

Default no down-on-internal-error

dot1q-etype

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

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

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

When the dot1-etype is configured to a value other than 0x8100 (the default value) on a port, the outermost tag in the received packet is matched against the configured value and if there is a match then it is treated as a Dot1q packet and the VLAN ID is used to match against the configured Dot1q SAPs on the port to find the Dot1q SAP the packet should be matched to.

NOTES:

- This command does not change the etype used to match the inner tag for a QinQ SAP. The 7210 SAS devices always uses 0x8100 for matching the inner tag etype. In other words, if this command is configured on a port configured for QinQ encapsulation, then it is ignored and 0x8100 is used always.
- This command takes effect only for access ports and hybrid ports. On hybrid ports, it applies to all traffic (that is, traffic mapped to SAPs and network IP interfaces). It is not supported for network ports.
- Dot1q-preserve SAPs cannot be configured on dot1q encap ports configured to use ethertype other than 0x8100.
- Priority tagged packet received with etype 0x8100 on a dot1q port configured with etype 0x9100 is classified as a priority tagged packet and mapped to a dot1q:0 SAP (if configured) and the priority tag is removed.
- Priority tagged packets received with etype 0x6666 (any value other than 0x8100) on a dot1q port configured with etype 0x9100 is classified as null-tagged packet and mapped to a dot1q:0 SAP (if configured) and the priority tag is retained and forwarded as expected.
- The maximum number of unique dot1q-etypes configurable per node is limited. The resources needed for configuration of dot1q-etype is shared by the default dot1q-etype, default qinq-etype and user configured values for qinq-etype. In other words, the number of unique dot1q-etypes allowed decreases, if the number of unique qinq-etype configured is more. The converse is also true.

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

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

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

Values <0x0600..0xffff> : [1536..65535] - accepts in decimal or hex

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.

egress-rate

Syntax **egress-rate** *sub-rate* [**max-burst** *size-in-kbits*]
no egress-rate

Context config>port>ethernet

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

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

NOTE: For 7210 SAS-E devices, the max-burst command configures a maximum-burst (in kilobits) associated with the egress-rate. This is optional parameter and if not defined then, by default, it is set to 32kb for a 1G port and 64kb for a 10G port. User cannot configure max-burst without configuring egress-rate. The value should be between 32 and 16384 or default. 7210 SAS-D devices do not support 10G port. For more information, see QoS User Guide.

Default no egress-rate

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

Values 1 — 10000000

max-burst *size-in-kbits* **—** The maximum egress burst in kilobits (Kbits). This parameter is configurable only on 7210 SAS-E and 7210 SAS-D.

Values 32 — 16384

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.

The minimum efm-oam session time-out value supported is 300 milliseconds. That is, user can configure "transmit-interval 1 multiplier 3" as the minimum value. This is applicable to all platforms, except SAS-D and SAS-E. On 7210 SAS-D and E, minimum transmit interval is 500msec and multiplier is 4.

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**| **qinq**}
no encap-type

Context config>port>ethernet

Description This command configures the encapsulation method used to distinguish customer traffic on an Ethernet access port, or different VLANs on a port.

NOTES:

- On 7210 SAS E, QinQ encap-type can be specified only for access uplink ports. NULL and Dot1q encap-type can be specified only for access ports. In other words, QinQ encap-type is not supported on access ports.
- On **7**210 SAS-D ETR, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C, QinQ encap-type can be configured for both access and access-uplink ports. NULL and Dot1q encap-type can be specified only for access ports.

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

Default null

Parameters **dot1q —** Ingress frames carry 802.1Q tags where each tag signifies a different service.

null — Ingress frames will not use any tags to delineate a service. As a result, only one service can be configured on a port with a null encapsulation type.

qinq — This encapsulation type is specified for QinQ access SAPs.

frame-based-accounting

Syntax **frame-based-accounting**
no frame-based-accounting

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command configures per port frame-based accounting. It can be enabled or disabled on each port. When enabled, all the shapers rates and queues statistics on that port also account for the Ethernet Layer 1 overhead (of 20 bytes) in both ingress and egress direction. In other words all ingress queue shaper rates, egress queue shaper rates and aggregate SAP shaper rate account for the etherenet overhead.

The no form of the command disables frame-based-accounting.

Default no frame-based-accounting

hold-time

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

Context config>port>ethernet

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

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

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

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

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

Values 0 — 900 seconds
0, 10 — 90000 centiseconds in 5 centisecond increments

Values 0 — 900

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

Values 0 — 900 seconds
0, 10 — 90000 centiseconds in 5 centisecond increments

seconds | **centiseconds** — Specify the units of your hold time in **seconds** or **centiseconds**.

Values 0 — 900

ip-mtu

Syntax **[no] ip-mtu** *mtu-bytes*

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-E

This command allows the user to configure the IP MTU value. This value is used by all IP interfaces created on the port. The IP MTU value specified must be smaller than the configured port MTU value. If the configured IP MTU value is greater than the port MTU value, the IP MTU is set equal to the port MTU

value and the port MTU value is set to default. The MTU check is enforced on self-generated and forwarded packets. The system uses the configured IP MTU value to ensure that packets sent out of the IP interfaces configured on the port are lesser than or equal to the specified value. The IP packets which need to be forwarded but are greater than the configured IP MTU size are dropped. It is supported only on Ethernet ports.

On 7210 SAS-E devices the IES IP interfaces are created on access-uplink ports for In-band management. The IP MTU command allows the operator to specify the IP MTU size to be used for CPU generated IP packets (for example SNMP, FTP and so on). Additionally, it also allows the operators to specify different MTU sizes for service traffic and management traffic (a smaller MTU size value allowed) that share the same port.

Note: Use of ip-mtu command without specifying a value is equivalent to executing the no form of the ip-mtu command.

This command is supported only on 7210 SAS-E devices. For other platforms, the ip-mtu command can be enabled using the CLI "config>service>ies>if> ip-mtu *octets*".

The **no** form of the command sets the IP MTU to default value

Default The IP MTU value is set to the port MTU value.

Parameters *mtu-bytes* — Specifies the IP MTU value in bytes.

Values 512 - 9000

lacp-tunnel

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

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

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

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

Default no lacp-tunnel

Parameters

oper-group

Syntax **no oper-group**
oper-group *name*

Context config>port>ethernet
config>lag

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command associates the context to which it is configured to the operational group specified in the group-name. The oper-group group-name must be already configured under *config>system* context before its name is referenced in this command.

The no form of the command removes the association.

Parameters *name* — Specifies a character string of maximum 32 ASCII characters identifying the group instance.

Values [32 chars max]

qinq-etype

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

Context config>port>ethernet

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

When the qinq-etype is configured to a value other than 0x8100 (the default value used for etype match) on a port, the outermost tag in the received packet is matched against the configured value and the inner tag's etype is matched against 0x8100, if there is a match then it is treated as a QinQ packet and the outer VLAN ID and inner VLAN ID is used to match against the configured Q1.Q2 SAPs on the port to find the QinQ SAP the packet should be matched to. If only the outermost tag's etype matches the qinq-etype configured on the port and the VLAN ID matches any of the Q1.* SAP configured on the port, the packet is processed in the context of that SAP. If the outermost tag's etype does not match the configured qinq-etype, then the packet is considered to be a untagged packet.

NOTES:

- This command takes effect only for access ports and hybrid ports. On hybrid ports, it applies to all traffic (that is, traffic mapped to SAPs and network IP interfaces). It is not supported for network ports.
- The maximum number of unique qinq-etypes configurable per node is limited. The resources needed for configuration of qinq-etype is shared by the default dot1q-etype, default qinq-etype and user configured values for qinq-etype. In other words, the number of unique dot1q-etypes allowed decreases if the number of unique qinq-etype configured is more. The converse is also true.

- The qinq-etype change is not allowed on hybrid port, if there is an interface or a SAP configured on the port.

The **no** form of this command reverts the qinq-etype value to the default. The default value is not user configurable.

Default 0x8100

Parameters *0x0600..0xffff* — Specifies the qinq-etype to expect.

Values 1536 — 65535, in hexadecimal or decimal notation. Ensure that the values do not match any of the IEEE reserved ethertype values such as 0x8a88, 0x9100, and 0x9200.

The **no** form of the command sets the qinq-etype value to the default value.The default value is "0x8100", it is not user configurable.

statistics

Syntax **statistics**

Context config>port>ethernet

Description This command provides the context to configure the counters associated with the egress port.

egress

Syntax **egress**

Context config>port>ethernet>statistics

Description This command provides the context to configure egress per queue statistics counter, it counts the total number of packets forwarded.

queue

Syntax **queue** *queue-id*

Context config>port>ethernet>statistics>egress

Description **Platforms Supported**: 7210 SAS-E

This command enables the context to associate a counter with the egress queue identified by the queue-id.

Default none

Parameters *queue-id* — Identifies the queue with which the counter must be associated.

Values 1 — 8

packets-forwarded-count

Syntax [**no**] **packets-forwarded-count**

Context config>port>ethernet>statistics>egress

Description **Platforms Supported**: 7210 SAS-E

This command associates a counter with the specified queue and counts the number of packets forwarded through the queue.

The **no** form of the command stops the counter and disassociates the counter from the queue. Before issuing the **no** form of the command, ensure all accounting policies using the counter and associated with the port are removed from the configuration.

Default none

port-clock

Syntax **port-clock {master | slave | automatic}**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D ETR, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

With copper ports using 1G speed, the nodes need to determine who will be the master and slave with respect to clock used for transmission and reception. The master-slave relationship between the two ports of the nodes is determined during auto-negotiation of the link parameters and is automated; there is no management intervention in this process. Once this process is complete, the master port's transmit clock will be used for receiving the packets on the slave port. However, when syncE is in use, to maintain clock distribution hierarchy (for example, master will be synchronized to a stable reference and will distribute this clock to the slave) one needs to make sure that one of the ports behave as a master while the remote port of the link in question behaves as a slave.

This command allows the user to force the copper port to be a master or slave or set it for automatic detection. Using a value of master, ensures that the local node is the syncE master. A syncE master port, distributes the system timing over the copper port to the remote peer node. Using a value of slave, ensures that the local node is a syncE slave. A syncE slave port uses the incoming timing information.

For copper ports, when port-clock is set to automatic 'automatic' , the Ethernet interface will automatically negotiate clock mastership along with other link parameters with the far end. Depending upon the capabilities of the two ends, one will be master the other will be slave for clocking.

NOTE: This command is ignored for all ports, other than copper ports that support syncE.

The no form of the command allows the node to automatically determine the master or slave status for the copper port based on the nodes capabilities exchanged during auto-negotiation. In other words, depending on the peer setting, the local end could end up as either a master or a slave when the no form of the command is used.

NOTES:

The following conditions must be met before using syncE on the fixed port copper ports:

1. Auto-negotiation (or auto-negotiation limited) must be turned on. This command is required only when the copper port speed is set to 1Gbps. This CLI command is not supported for fiber ports or for fiber ports that use Copper SFPs.

2.The port clock must be set to slave, if the port is used as a source-port for any reference. On 7210 SAS-K 2F4T6C platform, when using combo port, connection-type has to be set to copper The port-clock parameter is ignored if the connection-type is set to 'sfp' or 'auto'.

Default automatic

Parameters **master** — This option ensures that the local node is the synchronous Ethernet master. A synchronous Ethernet master port, distributes the system timing over the copper port to the remote peer node.

slave — This option ensures that the local node is a synchronous Ethernet slave. A synchronous Ethernet slave port uses the incoming timing information.

aotumatic — For copper ports, when port-clock is set to automatic 'automatic' , the Ethernet interface will automatically negotiate clock mastership along with other link parameters with the far end. Depending upon the capabilities of the two ends, one will be master the other will be slave for clocking.

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.

loopback

Syntax **[no] loopback {internal}[service** *svc-id* **sap** *sap-id* **src-mac** *SA* **dst-mac** *DA***]**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

NOTE:

- 7210 SAS-E supports only port loopback without mac-swap (i.e. the command configure> port> ethernet> loopback internal). Port loopback with mac-swap is not supported.
- 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C supports port loopback without mac-swap (using the command configure> port> ethernet> loopback> internal). It does not support port loopback with mac-swap. Instead it supports SAP loopback with mac-swap.

This command allows for configuration of simple port loopback and port loopback with MAC swap. The command when the optional parameter 'internal' is specified, provides the port loopback without the mac-swap functionality. It enables physical layer loopback of the packets that egress on the SAPs created on a ethernet port. The packets that egress are looped back into the node instead of being transmitted on to the line. After loopback, the packets ingress the system and are mapped to the same SAP from which they were egressed. The packets that are looped back are processed as per the service configuration of the SAP.

The command when used with service-id and MAC address, provides the port loopback with mac-swap functionality. It enables a physical layer loopback, so that packets which egress on the SAPs created on anethernet port are looped back into the system. After loopback, on ingress to the system, the MAC addresses in the Ethernet header are swapped (that is,the source MAC address and destination MAC address is exchanged with each other) by the system before being processed as per the service configuration of the SAP.

On 7210 SAS platforms, use of port loopback with mac-swap, requires resources of another port to be assigned for system use. Users need to assign the resources of either internal virtual port or the resource of the front panel port for use with this OAM tool using the command configure> system> loopback-no-svc-port { mirror | mac-swap| testhead} port-id. The number of internal virtual port resources available for use in different for different platforms and can be obtained using the command show> system> internal-loopback-ports detail. Based on the number of internal virtual port resources and the use of other OAM tool that require the resources of another port, user might need to assign the resources of a front-panel port if the internal virtual port resources are not available.

Note: Port loopback without mac-swap does not require another port to be assigned for system use on any of the 7210 platforms.

The port loopback with mac-swap functionality is currently not supported on 7210 SAS-E devices.Physical layer loopback is used with external third-party Ethernet test devices to diagnose provisioning issues and test end-to-end performance metrics of a service.

Note: For Port loopback without mac-swap:

- Use this command for testing VLL services.
- Enabling this command for testing VPLS services leads to rapid MAC address movement to another port, as source or destination MAC address swap is not performed.
- This command affects all services provisioned on the port.
- Before enabling this command, turn off all layer 2 and IP control protocols (such as LACP, EFM, 802.1x and so on) on the device and its peer to prevent errors such as protocol flaps due to timeout and so on.When port loopback feature is to be used for multicast traffic with IGMP snooping enabled in the service, the corresponding data path has to be statically created using static IGMP groups.
- For loop back to be functional, the following are not required:

- SFP or XFPs need not be inserted into the device.
- Ethernet cables need not be plugged in for copper ports.

- When the loop back command is enabled, ensure that Ethernet parameters such as, speed, duplex, auto-negotiation and so on are not modified.

Notes: For port loopback with mac-swap:

- This command is available for testing VLL services and VPLS services only.
- When enabled, the command affects all services provisioned on the port.
- Before enabling this command, turn off all layer 2 and IP control protocols (such as LACP, EFM, 802.1x and so on) on the device and its peer to prevent errors such as protocol flaps due to timeout and so on.When port loopback feature is to be used for multicast traffic with IGMP snooping enabled in the service, the corresponding data path has to be statically created using static IGMP groups.
- When port loopback with mac-swap enabled, for unicast and unknown-unicast packets, if the packet matches the configured source and destination MAC address it will be swapped and looped back in the service. For broadcast and multicast packets, if the packet matches the configured source MAC address, its source MAC address will be used as the destination MAC address and the system MAC address will be the source MAC address. The packet is looped back in the service as a unicast packet. All other packets sent to the loopback port will be dropped. Since forwarding of these packets after loopback can potentially cause network wide problems.
- For loop back to be functional, the following are not required:

- SFP or XFPs need not be inserted into the device.
- Ethernet cables need not be plugged in for copper ports.

- When the loop back is enabled, ensure that Ethernet parameters such as, speed, duplex, auto-negotiation and so on are not modified.
- When the loopback is enabled, ensure that service parameter and attributes such as ingress qos policy, accounting records, ingress/egress ACLs, and so on are not modified.

- With port loopback in use, the SAP ingress ACLs with IP-criteria is not recommended for use, since only MAC addresses are swapped.

The recommended procedure for using port loopback with mac-swap is:

- Configure the service and SAP on which loopback is to be enabled.
- Configure the assigned loopback port to be used.
- Send bi-directional learning frames on the SAP under test and spoke or uplink from a traffic tester or one can install static MAC for this purpose. Installing a static MAC is highly recommended, since the recommended procedure for enabling port loopback is to shutdown the port –> enable loopback and then execute no shutdown the port.
- Enable port loopback and specify the service, SAP, and the source MAC address (SA) and the destination MAC address (DA). All packets with source Mac matching SA are the only ones processed in the context of the SAP on ingress after the loopback. Any other traffic, is dropped on ingress, to avoid issues due to mac movement and flooding issues in other services/SAPs, since the whole port is in loopback.
- When the port is in loopback, software disable learning and aging on the specified SAP. Once the loopback configuration is removed for the port, then the software enables learning and aging for specified SAP. Hence, port loopback with mac-swap cannot be used for learning or aging.
- It is not recommend to change the service parameters for the SAP and the service when loopback is active. Additionally use of commands which clears the FDB, and so on is highly discouraged.

- Remove the loopback on the SAP port to bring the sap out of MAC swap with loopback mode.

The **no** form of the command disables physical layer loopback on the Ethernet port.

Note: The loop back command is not saved in the configuration file across a reboot.

Listed below is the recommended sequence of commands to be executed to perform loop back:

1. Disable the port, execute the command config>port> shutdown.
2. Enable loop back, execute the command config >port>ethernet> loopback internal
3. Enable the port, execute the command config>port> no shutdown.
4. Perform the required tests.
5. Disable the port, execute the command config>port> shutdown.
6. Disable loop back, execute the command config >port>ethernet> no loopback internal

Enable the port, execute the command config>port> no shutdown.Enable the required services.Listed below is the recommended sequence of commands to be executed to perform loop back when SFP or XFPs are inserted into the device :

1. Insert SFP or XFPs. SFP or XFPs are not required in case of fixed copper ports.
2. Enable the port and execute the command config>port> [no] shutdown.
3. Disable the port and execute the command config>port> shutdown.Enable loop back and execute the command config >port>ethernet> loopback internal
4. Enable the port and execute the command config>port> no shutdown.Perform the required tests.
5. Disable the port and execute the command config>port> shutdown.Disable loop back and execute the command config >port>ethernet> no loopback internal
6. Enable the port and execute the command config>port> no shutdown.Enable the required services.

Listed below is the sequence of commands to be executed to perform loop back when SFP or XFPs are changed :

1. Disable the port, execute the command config>port> shutdown.
2. Insert the new SFP or XFP.
3. Enable the port and execute the command config>port> no shutdown.Disable the port and execute the command config>port> shutdown.Enable loop back and execute the command config >port>ethernet> loopback internal.
4. Enable the port and execute the command config>port> no shutdown.
5. Perform the required tests.
6. Disable the port and execute the command config>port> shutdown.
7. Disable loop back and execute the command config >port>ethernet> no loopback internal.
8. Enable the port and execute the command config>port> no shutdown.
9. Enable the required services.
10. Enable loop back and execute the command config >port>ethernet> loopback internal.
11. Perform the required tests.
12. Disable loop back and execute the command config >port>ethernet> no loopback internal.

13. Enable the required services.

Parameters **internal —** Places the associated port or channel into a internal loopback mode. A internal loopback loops the frames from the local router back at the framer.

service <service-id> — The unique service identification number or string identifying the service in the service domain. This ID must be unique to this service and m**service <service-id> —** The unique service identification number or string identifying the service in the service domain. This ID must be unique to this service and may not be used for any other service of any type. The service-id must be the same number used for every on which this service is defined.

Values service-id 1 — 2147483648

sap <sap-id> — Specifies the physical port identifier portion of the SAP.

Values sap-id null - <port-id>
dot1q - <port-id>:qtag1
qinq - <port-id>:qtag1.qtag2
port-id - slot/mda/port[.channel]
id - [1..1000]
qtag1 - [0..4094]
qtag2 - [*|1..4094]

src-mac <SA> — Specifies the source MAC address.

Values SA 6-byte unicast mac-address (xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx).

dst-mac <DA> — Specifies the destination MAC address.

Values DA 6-byte unicast mac-address (xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx).

ssm

Syntax **ssm**

Context config>port>ethernet

Description **Platforms Supported**: 7210 SAS-D ETR, 7210 SAS-K 2F2T1C, and 7210 SAS-K 2F4T6C.

This command enables Ethernet Synchronous Status Message (SSM).

code-type

Syntax **code-type** [**sonet | sdh**]

Context config>port>ethernet>ssm

Description **Platforms Supported**: 7210 SAS-D ETR, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command configures the encoding of synchronous status messages, that is, to select either SDH or SONET set of values. Configuring the code-type is only applicable to Synchronous Ethernet ports. It is not configurable on TDM ports. For the code-type, SDH refers to ITU-T G.781 Option-1,while SONET refers to G.781 Option 2 (equivalent to Telcordia GR-253-CORE).

Default sdh

Parameters **sdh —** Specifies the values used on a G.781 Option 1 compliant network.

sonet — Specifies the values used on a G.781 Option 2 compliant network.

tx-dus

Syntax [**no**] **tx-dus**

Context config>port>ethernet>ssm
config>port>sonet-sdh

Description **Platforms Supported**: 7210 SAS-D ETR, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command forces the QL value transmitted from the SSM channel of the SONET/SDH port or the Synchronous Ethernet port to be set to QL-DUS/QL-DNU. This capability is provided to block the use of the interface from the SR/ESS for timing purposes.

Default no tx-dus

802.1x Port Commands

tunneling

Syntax **[no] tunneling**

Context config>port>ethernet>dot1x

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C.

This command allows user to enable tunneling of dot1x frames. With dot1x tunneling enabled, dot1x frames received on the port are transparently forwarded to the remote end of the service. To forwards dot1x frames transparently the port on which tunneling is enabled must be configured with NULL SAP and the NULL SAP must be configured in an Epipe service. Tunneling is not supported for any other port encapsulation or when using any other service.

Additionally, dot1x protocol must be disabled on the port (using the command configure> port> ethernet> dot1x> port-control force-auth) before dot1x tunneling can be enabled using this command. If dot1x is configured to use either force-unauath or auto, then dot1x tunneling cannot be enabled. The converse, that is, if dot1x tunneling is enabled, then user cannot configure either force-unauth or auto.

The no form of the command disables dot1x tunneling.

Default no tunneling

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 — 3600

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

LLDP Port Commands

lldp

Syntax **lldp**

Context config>port>ethernet

Description This command enables the context to configure Link Layer Discovery Protocol (LLDP) parameters on the specified port.

tunnel-nearest-bridge-dest-mac

Syntax **[no] tunnel-nearest-bridge-dest-mac**

Context config>port>ethernet>lldp

Description **Platforms Supported:** 7210 SAS-D, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

This command allows user to configure tunneling for LLDP frames that use the nearest-bridge-dest-mac as destination MAC address. If enabled using the command tunnel-nearest-bridge-dest-mac, all frames received with the appropriate destination mac address are forwarded transparently to the remote end of the service. To forward these frames transparently the port on which tunneling is enabled must be configured with NULL SAP and the NULL SAP must be configured in an Epipe service. Tunneling is not supported for any other port encapsulation or when using any other service.

Note: This command is supported only on 7210 SAS-D.

Additionally, before enabling tunneling, admin status for LLDP dest-mac nearest-bridge must be set to disabled or Tx only, using the command admin-status available under configure> port> ethernet> lldp> dest-mac nearest-bridge. If admin-status for dest-mac nearest-bridge is set to receive and process nearest-bridge LLDPDUs (that is, if either rx or tx-rx is set) then it overrides the tunnel-nearest-bridge-dest-mac command. The following table lists the behavior for LLDP with different values set in use for admin-status and when tunneling is enabled or disabled:

Nearest-bridge mac Admin status	Tunneling Enabled	Tunneling Disabled
Rx	Process/Peer	Process/Peer
Tx	Tunnel	Drop
Rx-Tx	Process/Peer	Process/Peer
Disabled	Tunnel	Drop

NOTE: Transparent forwarding of LLDP frames can be achieved using the standard defined mechanism when using the either nearest-non-tmpr or the nearest-customer as the destination MAC address in the LLDP

frames. It is recommended that the customers use these MAC address where possible to conform to standards. This command allows legacy LLDP implementations that do not support these additional destinations MAC addresses to tunnel LLDP frames that use the nearest-bridge destination MAC address.

The no form of the command disable LLDP tunneling for frames using nearest-bridge destination MAC address.

Default no tunnel-nearest-bridge-dest-mac

dest-mac

Syntax **dest-mac** {*bridge-mac*}

Context config>port>ethernet>lldp

Description This command configures destination MAC address parameters.

Parameters **bridge-mac —** Specifies destination bridge MAC type to use by LLDP.

Values **nearest-bridge** — Specifies to use the nearest bridge.
nearest-non-tpmr — Specifies to use the nearest non-Two-Port MAC Relay (TPMR) .
nearest-customer — Specifies to use the nearest customer.

admin-status

Syntax **admin-status** {**rx** | **tx** | **tx-rx** | **disabled**}

Context config>port>ethernet>lldp>dstmac

Description This command specifies the desired administrative status of the local LLDP agent.

Parameters **rx —** Specifies that the LLDP agent receives LLDP frames on this port, also indicates that the LLDP agent does not transmit LLDP frames.

tx — Specifies that the LLDP agent transmits LLDP frames on this port and does not store any information about the remote systems connected.

tx-rx — Specifies that the LLDP agent transmitw and receives LLDP frames on this port.

disabled — Specifies that the LLDP agent does not transmit or receive LLDP frames on this port. If there is remote systems information which is received on this port and stored in other tables, before the port's admin status becomes disabled, then the information will naturally age out.

notification

Syntax [**no**] **notification**

Context config>port>ethernet>lldp>dstmac

Description This command enables LLDP notifications.

The **no** form of the command disables LLDP notifications.

port-id-subtype

Syntax **port-id-subtype {tx-if-alias | tx-if-name | tx-local}**

Context config>port>ethernet>lldp>dstmac

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C.

This command specifies how to encode the PortID TLV transmit to the peer. Some releases of SAM require the PortID value require the default if-Alias in order to properly build the Layer Two topology map using LLDP. Selecting a different option will impact SAM's ability to build those Layer Two topologies.

Default portid-subtype tx-local

Parameters **tx-if-alias —** Transmits the ifAlias String (subtype 1) that describes the port as stored in the IF-MIB, either user configured or the default entry (ie 10/100/Gig ethernet SFP)

tx-if-name — Transmits the ifName string (subtype 5) that describes the port as stored in the IF-MIB ifName info.

tx-local — The interface ifIndex value (subtype 7) as the PortID

tx-mgmt-address

Syntax **tx-mgmt-address** [**system**][**system-ipv6**]
no tx-mgmt-address

Context config>port>ethernet>lldp>dstmac

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C.

This command specifies which management address to transmit. The operator can choose to send the system IPv4 IP Address, the system IPv6 address or both. Note the system address will only be sent once. When both options are configured both system addresses are sent. The system address must be configured for the specific version of the protocol in order to sent the management address.

Default no tx-mgmt-address

Parameters **system —** Specifies to use the system IPv4 address.

system-ipv6 — — Specifies to use the system IPv6 address.

Note that system-ipv6 parameter can only be used on platforms that support IPv6.

tx-tlvs

Syntax **tx-tlvs** [**port-desc**] [**sys-name**] [**sys-desc**] [**sys-cap**]
no tx-tlvs

Context config>port>ethernet>lldp>dstmac

Description This command specifies which LLDP TLVs to transmit. The **no** form of the command resets the value to the default.

no tx-tlvs

Parameters **port-desc —** Indicates that the LLDP agent should transmit port description TLVs.

sys-name — Indicates that the LLDP agent should transmit system name TLVs.

sys-desc — Indicates that the LLDP agent should transmit system description TLVs.

sys-cap — Indicates that the LLDP agent should transmit system capabilities TLVs.

Access Uplink Port Commands

network

Syntax **network**

Context config>port>ethernet

Description **Platforms Supported:** 7210 SAS-K 2F4T6C.

This command enables access to the context to configure network port parameters.

uplink

Syntax **uplink**

Context config>port>access

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C.

This command enables the context to configure access uplink egress port parameters.

accounting-policy

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

Context config>port>ethernet>network
config>port>ethernet>access>uplink
config>port>ethernet>access

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C.

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.

NOTE: the context configure>port> ethernet> network is available only on 7210 SAS-K 2F4T6C.

The **no** form of this command removes the accounting policy association from the network interface, and the acccounting policy reverts to the default.

Default No accounting policies are specified by default. You must explicitly specify a policy. If configured, the accounting policy configured as the default is used.

Parameters *policy-id* — The accounting *policy-id* of an existing policy. Accounting policies record either service (access) or network information. A network accounting policy can only be associated with the network port configurations. Accounting policies are configured in the config>log>accounting-policy context.

Values 1 — 99

collect-stats

Syntax [**no**] **collect-stats**

Context config>port>ethernet>access>uplink
config>port>ethernet>access
config>port>ethernet>network

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C.

This command enables the collection of accounting and statistical data for the network interface. When applying accounting policies, the data, by default, is collected in the appropriate records and written to the designated billing file.

When the **no collect-stats** command is issued, the statistics are still accumulated by the IOM cards, however, the CPU does not obtain the results and write them to the billing file.
If the **collect-stats** command is issued again (enabled), then the counters written to the billing file will include the traffic collected while the **no collect-stats** command was in effect.

NOTE: the context configure>port> ethernet> network is available only on 7210 SAS-K 2F4T6C.

Default no collect-stats

queue-policy

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

Context config>port>ethernet>network
config>port>ethernet>access>uplink

Description **Platforms Supported:** 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

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.

NOTE: the context configure>port> ethernet> network is available only on 7210 SAS-K 2F4T6C.

A default CBS is defined for the queues and this is not configurable.

Default default

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

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 upto two 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 2 links can be supported in a single LAG, up to 6 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 LAG 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 SAS-D-[1..5]
SAS-E-[1..6]
7210 SAS-K 2F2T1C-[1..3]
7210 SAS-K 2F4T6C-[1...6]

dynamic-cost

Syntax [**no**] **dynamic-cost**

Context config>lag *lag-id*

Description This command enables OSPFcosting of a Link Aggregation Group (LAG) based on the available aggregated, operational bandwidth.

The path cost is dynamically calculated based on the interface bandwidth. OSPF path cost can be changed through the interface metric or the reference bandwidth.

If dynamic cost is configured, then costing is applied based on the total number of links configured and the cost advertised is inversely proportional to the number of links available at the time. This is provided that the number of links that are up exceeds the configured LAG threshold value at which time the configured threshold action determines if, and at what cost, this LAG will be advertised.

For example:

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

If dynamic cost is not configured and OSPF autocost is configured, then costing is applied based on the total number of links configured. This cost will remain static provided the number of links that are up exceeds the configured LAG threshold value at which time the configured threshold action determines if and at what cost this LAG will be advertised.

If dynamic-cost is configured and OSPF autocost is not configured, the cost is determined by the cost configured on the OSPF metric provided the number of links available exceeds the configured LAG threshold value at which time the configured threshold action determines if this LAG will be advertised.

If neither dynamic-cost nor OSPF autocost are configured, the cost advertised is determined by the cost configured on the OSPF metric provided the number of links available exceeds the configured LAG threshold value at which time the configured threshold action determines if this LAG will be advertised.

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

Default no dynamic-cost

encap-type

Syntax **encap-type** {**dot1q** | **null** | **qinq**}
no encap-type

Context config>lag

Description This command configures the encapsulation method used to distinguish customer traffic on a LAG. The encapsulation type is configurable on a LAG port. The LAG port and the port member encapsulation types must match when adding a port member.

If the encapsulation type of the LAG port is changed, the encapsulation type on all the port members will also change. The encapsulation type can be changed on the LAG port only if there is no interface associated

with it. If the MTU is set to a non default value, it will be reset to the default value when the encap type is changed.

Notes:

- On 7210 SAS-E, QinQ encap-type can be specified only for access uplink port/LAG. NULL and Dot1q encap-type can be specified only for access port/LAG. In other words, QinQ encap-type is not supported on access ports/LAG.
- On 7210 SAS-D, QinQ encap-type can be configured for both access and access-uplink port/LAG. Null, Dot1, and QinQ, encap-type can be specified for access port/LAG.
- On 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C, QinQ encap-type can be configured on access-uplink LAG. Null, dot1q, and QinQ encap-type can be specified for access port/LAG.

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

Default **null** — All traffic on the port belongs to a single service or VLAN.

Parameters **dot1q —** Ingress frames carry 802.1Q tags where each tag signifies a different service.

null — Ingress frames will not use any tags to delineate a service. As a result, only one service can be configured on a port with a null encapsulation type.

qinq — Specifies QinQ encapsulation.This value is not supported on access Port/LAG of 7210 SAS-E platform.

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*] [**system-id** *system-id*] [**system**-**priority** *priority*]

Context config>lag

Description This command specifies the LACP mode for aggregated Ethernet interfaces only. This command enables the LACP protocol. Per the IEEE 802.3ax standard (formerly 802.3ad), the Link Aggregation Control Protocol (LACP) provides a standardized means for exchanging information between Partner Systems on a link to allow their Link Aggregation Control instances to reach agreement on the identity of the Link Aggregation Group to which the link belongs, move the link to that Link Aggregation Group, and enable its transmission and reception functions in an orderly manner. LACP can be enabled on a maximum of 256 ports.

Default no lacp

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

Values **passive** — Starts transmitting LACP packets only after receiving packets.
active — Initiates the transmission of LACP packets.
power-off — Disables transmitter of standby ports.

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

system-id *system-id* — Specifies a 6 byte value expressed in the same notation as MAC address

Values xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx

system-priority *priority* — Specifies the system priority to be used for the LAG in the context of the MC-LAG.

Values 0 — 65535

lacp-xmit-interval

Syntax **[no] 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 **Platforms Supported**: 7210 SAS-D, 7210 SAS-K2F2T1C, and 7210 SAS-K2F4T6C

This command enables LACP message transmission on standby links.

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

Default lacp-xmit-stdby

port

Syntax **port** *port-id* [*port-id …*up to N total] [**priority** *priority*] [**subgroup** *sub-group-id*]
no port *port-id* [*port-id …*up to N total]

Context config>lag *lag-id*

Description **Platforms Supported**: 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C.

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.

The maximum number of ports allowed in a LAG link depends on the platform. The limits per platforms is as follows:

- On 7210 SAS-D and 7210 SAS-E a maximum of 4 (space separated) ports can be added or removed from the LAG as long as the maximum of 4 ports is not exceeded.
- On 7210 SAS-K2F2T1C and K2F4T6C, a maximum of 3 (space separated) ports can be added or removed from the LAG as long as the maximum of 3 ports is not exceeded.

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

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

Default No ports are defined as members of a LAG.

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

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

Values 1 — 65535

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

Values 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F4T6C2: 1-8

Values 7210 SAS-K 2F2T1C: 1-2

Values 1 — 82 identifies a LAG subgroup.
The **auto-mda** subgroup is defined based on the MDA.

port-threshold

Syntax **port-threshold** *value* [**action** {**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 [{**down}] —** Specifies the action to take if the number of active links in the LAG is at or below the threshold value.

If the number of operational links is equal to or less than the configured threshold value and action **down** is specified the LAG is brought to an operationally down state. The LAG is considered as operationally up only when the number of operational links exceeds the configured threshold value.

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|best-port}]** [**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.

best-port — Selection criteria used with "power-off" mode of operation. The sub-group containing the port with highest priority port. In case of equal port priorities the sub-group containing the port with the lowest port-id is taken

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.

standby-signalling

Syntax **standby-signalling** {**lacp** | **power-off**}
no standby-signalling

Context config>lag

Description This command specifies how the state of a member port is signalled to the remote side when the status corresponding to this member port has the **standby** value.

Default lacp

Parameters *lacp* — Specifies that LACP protocol is used to signal standby links of the LAG.

power-off — The laser of the standby links in the LAG are shutoff to indicate "standby" status. It allows user to use LAG standby link feature without LACP, if the peer node does not support LACP.

Ethernet Ring Commands

eth-ring

Syntax **eth-ring** *ring-id*
no eth-ring

Context config

Description This command configures a G.8032 protected Ethernet ring. G.8032 Rings may be configured as major rings with two paths (a&b).

The **no** form of this command deletes the Ethernet ring specified by the ring-id.

Default no eth-ring

Parameters *ring-id* — Specifies the ring ID.

Values 1—128

guard-time

Syntax **guard-time** *time*
no guard-time

Context config>eth-ring

Description This command configures the guard time for an Eth-Ring. The guard timer is standard and is configurable from “x”ms to 2 seconds

The **no** form of this command restores the default guard-time.

Default 5 deciseconds

Parameters *value* — Specifies the guard-time.

Values 1—20 deciseconds

revert-time

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

Context config>eth-ring

This command configures the revert time for an Eth-Ring. It ranges from 60 seconds to 720 second by 1 second intervals.

The no form of this command this command means non-revertive mode and revert time essentially is 0 meaning the revert timers are not set.

Default 300 seconds

Parameters *value* — Specifies the guard-time.

Values 60 —720 seconds

ccm-hold-time

Syntax **ccm-hold-time** {**down** *down-timeout* | **up** *up-timeout*}
no ccm-hold-time

Context config>eth-ring

This command configures eth-ring dampening timers.

The **no** form of this command set the up and down timer to the default values.

down

Syntax **down** *down-timeout*

Context config>eth-ring>ccm-hold-time

This command specifies the timer, which controls the delay between detecting that ring path is down and reporting it to the G.8032 protection module. If a non-zero value is configured, the CPM will wait for the time specified in the value parameter before reporting it to the G.8032 protection module.

Note: This parameter applies only to ring path CCM. It does NOT apply to the ring port link state. To damp ring port link state transitions, use hold-time parameter from the physical member port.

Default 0 - the fault will be reported immediately to the protection module.

Parameters *value* — Specifies the down timeout.

Values 0 — 5000 deciseconds

up

Syntax **up** *up-timeout*

Context config>eth-ring>ccm-hold-time

This command specifies the timer, which controls the delay between detecting that ring path is up and reporting it to the G.8032 protection module. If a non-zero value is configured, the CPM will wait for the time specified in the value parameter before reporting it to the G.8032 protection module.

Note: This parameter applies only to ring path CCM. It does NOT apply to the member port link state. To damp member port link state transitions, use hold-time parameter from the physical member port.

Default 20 deciseconds

Parameters *value* — Specifies the hold-time for reporting the recovery.

Values 0 — 5000 deciseconds

rpl-node

Syntax **rpl-node <owner | nbr>**
no rpl-node

Context config>eth-ring

This command configures the G.8032 ring protection link type as owner or neighbor. The no form of the command means this node is not connected to an RPL link. When RPL owner or neighbor is specified either the a or b path must be configured with the RPL end command. An owner is responsible for operation of the rpl link. Configuring the RPL as neighbor is optional (can be left as no rpl-node) but if the command is used the nbr is mandatory.

The **no** form of this command removes the RPL link.

Default no rpl-node

node-id

Syntax **node-id**
no node-id

Context config>eth-ring

This optional command configures the MAC address of the RPL control. The default is to use the chassis MAC for the ring control. This command allows the chassis MAC to be overridden with another MAC address.

The no form of this command removes the RPL link.

Default no node-id

Parameters *mac* — <xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx>

sub-ring

Syntax **sub-ring {virtual-link | non-virtual-link}**
[no] sub-ring

Context config>eth-ring>sub-ring

This command specifies this ring-id to be sub-ring as defined in G.8032. By declaring the ring as a sub-ring object, the ring will only have one valid path and the sub-ring will be connected to a major ring or a VPLS instance. The virtual-link parameter declares that a sub-ring is connected to another ring and that control

messages can be sent over the attached ring to the other side of the sub-ring. The non-virtual channel parameter declares that a sub-ring may be connected to a another ring or to a VPLS instance but that no control messages from the sub-ring use the attached ring or VPLS instance. The non-virtual channel behavior is standard G.8032 capability.

The no form of this command deletes the sub-ring and its virtual channel associations.

Default no sub-ring

Parameters *virtual-link* — Specifies the interconnection is to a ring and a virtual link will be used.

non-virtual-link — Specifies the interconnection is to a ring or a VPLS instance and a virtual link will not be used.

compatible-version

Syntax **compatible-version** *version*
[no] compatible-version

Context config>eth-ring

Description This command configures the backward compatibility logic for the Ethernet rings.

Default 2

Parameters *version* — Specifies the Ethernet ring version.

Values 1— 2

path

Syntax **path {a | b}** <*portid*> **raps-tag** <*qtag [.qtag]*>
[no] path {a | b}

Context config>eth-ring

Description This command assigns the ring (major or sub-ring) path to a port and defines the Ring APS tag. Rings typically have two paths a and b.

The no form of this command removes the path a or b.

Default no path

Parameters *raps-tag <qtag [.qtag]>* — Specifies the qtag.

Values Dot1q: 1—4094

Values QinQ: 1—4094.1—4094

description

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

Context config>eth-ring>path

Description This command adds a text description for the ring path. The no form of this command removes the text description.

Default ""

Parameters *string* — Specifies the text description up to 160 characters in length.

rpl-end

Syntax **rpl-end**
no rpl-end

Context config>eth-ring>path

Description This command configures the G.8032 path as a ring protection link end. The ring should be declared as either a RPL owner or RPL neighbor for this command to be allowed. Only path a or path b can be declared an RPL-end.

The no form of this command sets the rpl-end to default no rpl-end.

Default no rpl-end

eth-cfm

Syntax **eth-cfm**

Context config>eth-ring>path

Description This command enables the context to configure ETH-CFM parameters.

mep

Syntax [**no**] **mep** *mep-id* **domain** *md-index* **association** *ma-index*

Context config>eth-ring>path>eth-cfm

Description This command provisions an 802.1ag maintenance endpoint (MEP).

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

Parameters *mep-id* — Specifies the maintenance association end point identifier.

Values 1 — 81921

md-index — Specifies the maintenance domain (MD) index value.

Values 1 — 4294967295

ma-index — Specifies the MA index value.

Values 1 — 4294967295

ccm-enable

Syntax [**no**] **ccm-enable**

Context config>eth-ring>path>eth-cfm>mep

Description This command enables the generation of CCM messages.

The **no** form of the command disables the generation of CCM messages.

ccm-ltm-priority

Syntax **ccm-ltm-priority** *priority*
no ccm-ltm-priority

Context config>eth-ring>path>eth-cfm>mep

Description This command specifies the priority value for CCMs and LTMs transmitted by the MEP.

The **no** form of the command removes the priority value from the configuration.

Default The highest priority on the bridge-port.

Parameters *priority* — Specifies the priority of CCM and LTM messages.

Values 0 — 7

control-mep

Syntax **no control-mep**

Context config>eth-ring>path>eth-cfm>mep

Description This command enables the usage of the CC state by the Ethernet ring for consideration in the protection algorithm. The use of control-mep command is recommended if fast failure detection is required, especially when Link Layer OAM does not provide the required detection time.

The **no** form of this command disables the use of the CC state by the Ethernet ring.

Default no control-mep

eth-test-enable

Syntax [**no**] **eth-test-enable**

Context config>eth-ring>path>eth-cfm>mep

Description This command enables eth-test functionality on MEP. For this test to work, operators need to configure ETH-test parameters on both sender and receiver nodes. The ETH-test then can be done using the following OAM commands:

`oam eth-cfm eth-test` *`mac-address`* `mep` *`mep-id`* `domain` *`md-index`* `association` *`ma-index`* `[priority` *`priority`*`] [data-length` *`data-length`*`]`

A check is done for both the provisioning and test to ensure the MEP is an Y.1731 MEP (MEP provisioned with domain format none, association format icc-based). If not, the operation fails. An error message in the CLI and SNMP will indicate the problem.

test-pattern

Syntax **test-pattern** {**all-zeros** | **all-ones**} [**crc-enable**]
no test-pattern

Context config>eth-ring>path>eth-cfm>mep>eth-test-enable

Description This command configures the test pattern for eth-test frames.

The **no** form of the command removes the values from the configuration.

Parameters **all-zeros** — Specifies to use all zeros in the test pattern.

all-ones — Specifies to use all ones in the test pattern.

crc-enable — Generates a CRC checksum.

Default all-zeros

bit-error-threshold

Syntax **bit-error-threshold** *bit-errors*

Context config>eth-ring>path>eth-cfm>mep

Description This command specifies the lowest priority defect that is allowed to generate a fault alarm.

Default 1

Parameters *bit-errors* — Specifies the lowest priority defect.

Values 0 — 11840

mac-address

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

Context config>eth-ring>path>eth-cfm>mep

Description This command specifies the MAC address of the MEP.

The **no** form of this command reverts the MAC address of the MEP back to that of the port (if the MEP is on a SAP) or the bridge (if the MEP is on a spoke SDP).

Parameters *mac-address — Specifies the MAC address of the MEP.*

Values 6-byte unicast mac-address (xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx) of the MEP. Using the all zeros address is equivalent to the no form of this command.

one-way-delay-threshold

Syntax **one-way-delay-threshold** *seconds*

Context config>eth-ring>path>eth-cfm>mep

Description This command enables one way delay threshold time limit.

Default 3 seconds

Parameters *priority* — Specifies the value for the threshold in seconds.

Values 0 — 600

shutdown

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

Context config>eth-ring>path>eth-cfm>mep

Description This command administratively enables or disables the MEP.

The **no** form of this command disables or enables the MEP.

Default shutdown

shutdown

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

Context config>eth-ring>path
config>eth-ring

Description This command administratively enables or disables the path.

The **no** form of this command disables or enables the path.

Default shutdown

shutdown

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

Context config>eth-ring

Description This command administratively enables/disables the ethernet ring.

The **no** form of this command disables/enables the path.

Default shutdown

description

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

Context config>eth-tunnel

Description This command adds a text description for the eth-tunnel.

The **no** form of this command removes the text description.

Default "Eth-tunnel"

Parameters *string* — Specifies the text description up to 160 characters in length.

split-horizon-group

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

Context config>lag
config>port

Description **Platforms Supported:** 7210 SAS-D and 7210 SAS-E**.**

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.

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.

Alcatel-Lucent's Show Commands

Hardware Commands

chassis

Syntax **chassis** [**environment**] [**power-supply**] (environment' option not supported on 7210 SAS-D)

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 device 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

Note:This CLI output is obtained only if the hardware supports "DC source failure detection".

```
A:7210-SAS-E> show chassis
===============================================================================
Chassis Information
===============================================================================
    Name                          : STU2597
    Type                          : 7210 SAS-E-1
    Location                      :
    Coordinates                   :
    CLLI code                     :
    Number of slots               : 2
    Number of ports               : 24
    Critical LED state            : Red
    Major LED state               : Off
    Minor LED state               : Off
    Over Temperature state        : OK
    Base MAC address              : 00:25:ba:04:b9:bc

Hardware Data
    Part number                   : 3HE04410ABAC01
    CLEI code                     : IPMK310JRA
    Serial number                 : NS1026C0341
    Manufacture date              : 06292010
    Manufacturing string          :
    Manufacturing deviations      :
    Time of last boot             : 2010/11/09 16:12:40
    Current alarm state           : alarm active
-------------------------------------------------------------------------------
```

```
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  : dc
    Status                        : failed
    DC power                      : out of range
    Input power                   : out of range
    Output power                  : within range

    Power supply number           : 2
    Configured power supply type  : dc
    Status                        : up
    DC power                      : within range
    Input power                   : within range
    Output power                  : within range
===============================================================================
A:7210-SAS-E>

A:7210-SAS-E> show chassis
===============================================================================
Chassis Information
===============================================================================
    Name                          : STU2597
    Type                          : 7210 SAS-E-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              : 00:25:ba:04:b9:bc

Hardware Data
    Part number                   : 3HE04410ABAC01
    CLEI code                     : IPMK310JRA
    Serial number                 : NS1026C0341
    Manufacture date              : 06292010
    Manufacturing string          :
    Manufacturing deviations      :
    Time of last boot             : 2010/11/09 16:12:40
    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  : dc
    Status                        : up
    DC power                      : within range
    Input power                   : within range
    Output power                  : within range

    Power supply number           : 2
    Configured power supply type  : dc
    Status                        : up
    DC power                      : within range
    Input power                   : within range
    Output power                  : within range
===============================================================================
A:7210-SAS-E>

*A:SAS-D>show# chassis

===============================================================================
Chassis Information
===============================================================================
    Name                          : SAS-D
    Type                          : 7210 SAS-D 6F4T-1
    Location                      :
    Coordinates                   :
    CLLI code                     :
    Number of slots               : 2
    Number of ports               : 10
    Critical LED state            : Off
    Major LED state               : Off
    Minor LED state               : Off
    Over Temperature state        : OK
    Base MAC address              : 00:3f:11:ab:ca:11

Hardware Data
    Part number                   :
    CLEI code                     :
    Serial number                 : NS1050C0071
    Manufacture date              :
    Manufacturing string          :
    Manufacturing deviations      :
    Time of last boot             : 1970/01/01 00:00:03
    Current alarm state           : alarm cleared
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Power Supply Information
    Number of power supplies      : 1

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

```
===============================================================================
*A:SAS-D>show#
```

card

Syntax **card** [*slot-number*] [**detail**]
card state

Context show

Description This command displays card information.

If no command line parameters are specified, a card summary for all cards is displayed.

Parameters *slot-number* — Displays information for the specified card slot.

Default Displays all cards.

Values 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 for 7210 SAS-K 2F2T1C:

```
*A:SAH01-051>show# card

===============================================================================
Card Summary
===============================================================================
Slot   Provisioned Type                          Admin Operational   Comments
           Equipped Type (if different)          State State
-------------------------------------------------------------------------------
1      iom-sas                                   up    up
A      sfm-sas                                   up    up/active
===============================================================================
*A:SAH01-051>show#
```

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

Label	Description
Slot/MDA	The slot number of the card in the chassis.
Provisioned Type	The card type that is configured for the slot.
Equipped Type	The card type that is actually populated in the slot.
Admin State	Up — The card is administratively up.
	Down — The card is administratively down.
Operational State	Up — The card is operationally up.
	provisioned — There is no card in the slot but it has been pre-configured.
Num Ports	The number of ports available on the MDA.
Num MDA	The number of MDAs installed.
Comments	Indicates whether the SF/CPM is the active or standby.

Sample Output

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

Label	Description
Clock source	Source of clock for the IOM. Note: Currently this parameter always displays 'none'
Available MDA slots	The number of MDA slots available on the IOM.
Installed MDAs	The number of MDAs installed on the IOM
Part number	The IOM part number.
CLEI code	The Common Language Location Identifier (CLLI) code string for the router.
Serial number	The serial number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Manufacturing deviations	Displays a record of changes by manufacturing to the hardware or software and which is outside the normal revision control process.
Administrative state	Up — The card is administratively up.
	Down — The card is administratively down.
Operational state	Up — The card is operationally up.
	Down — The card is operationally down.
Temperature	Internal chassis temperature.
Temperature threshold	The value above which the internal temperature must rise in order to indicate that the temperature is critical.
Software boot version	The version of the boot image.
Software version	The software version number.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Base MAC address	Displays the base MAC address of the hardware component.
Memory Capacity	Displays the memory capacity of the card.

Sample Output

Sample for 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C:

```
*A:SAH01-051>show# mda 1 detail

===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned Type                              Admin     Operational
                Equipped Type (if different)             State     State
-------------------------------------------------------------------------------
1     1     m2-tx+2-sfp+1-combo                          up        up


MDA Specific Data
    Maximum port count            : 5
    Number of ports equipped      : 5
    Network ingress queue policy  : default
    Capabilities                  : Ethernet

Hardware Data
    Platform type                 : N/A
    Part number                   :
    CLEI code                     :
    Serial number                 : SAH01-051
    Manufacture date              :
    Manufacturing string          : (Not Specified)
    Manufacturing deviations      : (Not Specified)
    Manufacturing assembly number :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 49C
    Temperature threshold         : 58C
    Software version              : N/A
    Time of last boot             : 2014/01/14 05:14:03
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:27:15:50
    Firmware version              : N/A
===============================================================================
*A:SAH01-051>show#
```

CPM Output — The following table describes the output fields for a CPM card.

Label	Description
Slot	The slot of the card in the chassis.
Card Provisioned	The SF/CPM type that is configured for the slot.
Card Equipped	The SF/CPM type that is actually populated in the slot.

Label	Description (Continued)
Admin State	Up — The SF/CPM is administratively up. Down — The SF/CPM is administratively down.
Operational State	Up — The SF/CPM is operationally up. Down — The SF/CPM is operationally down.
BOF last modified	The date and time of the most recent BOF modification.
Config file version	The configuration file version.
Config file last modified	The date and time of the most recent config file modification.
Config file last modified	The date and time of the most recent config file modification.
Config file last saved	The date and time of the most recent config file save.
CPM card status	active — The card is acting as the primary (active) CPM in a redundant system. standby — The card is acting as the standby (secondary) CPM in a redundant system.
Administrative state	Up — The CPM is administratively up. Down — The CPM is administratively down.
Operational state	Up — The CPM is operationally up. Down — The CPM is operationally down.
Serial number	The compact flash part number. Not user modifiable.
Firmware revision	The firmware version. Not user modifiable.
Model number	The compact flash model number. Not user modifiable.
Size	The amount of space available on the compact flash card.
Free space	The amount of space remaining on the compact flash card.
Part number	The SF/CPM part number.
CLEI code	The code used to identify the router.
Serial number	The SF/CPM part number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.

Label	Description (Continued)
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

```
Sample output for 7210 SAS-E:

*A:SAS-E>bof# /show card

===============================================================================
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up
A         sfm-sas             sfm-sas             up         up/active
===============================================================================
*A:SAS-E>bof#


Sample output for 7210 SAS D:

*A:SAS-D>show# card

===============================================================================
Card Summary
===============================================================================
```

```
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up
A         sfm-sas             sfm-sas             up         up/active
===============================================================================
*A:SAS-D>show#
```

Sample for 7210 SAS-K 2F2T1C:

```
*A:SAH01-051>show# card detail

===============================================================================
Card 1
===============================================================================
Slot   Provisioned Type                            Admin Operational   Comments
           Equipped Type (if different)            State State
-------------------------------------------------------------------------------
1      iom-sas                                     up    up


IOM Card Specific Data
    Clock source                 : none
    Named Pool Mode              : Disabled
    Available MDA slots          : 2
    Installed MDAs               : 1

Hardware Data
    Platform type                : N/A
    Part number                  :
    CLEI code                    :
    Serial number                : SAH01-051
    Manufacture date             :
    Manufacturing string         : (Not Specified)
    Manufacturing deviations     : (Not Specified)
    Manufacturing assembly number :
    Administrative state         : up
    Operational state            : up
    Temperature                  : 49C
    Temperature threshold        : 58C
    Software boot (rom) version  : X-0.0.I2282 on Sat Dec 20 14:21:54 IST
                                   2014 by builder
    Software version             : TiMOS-B-7.0.B1-205 both/xen NOKIA SAS-K *
    Time of last boot            : 2014/01/14 05:13:59
    Current alarm state          : alarm cleared
    Base MAC address             : 00:03:fa:27:15:4e
    Last bootup reason           : hard boot
    Memory capacity              : 1,024 MB
* indicates that the corresponding row element may have been truncated.

===============================================================================
Card A
===============================================================================
Slot   Provisioned Type                            Admin Operational   Comments
           Equipped Type (if different)            State State
-------------------------------------------------------------------------------
```

```
A      sfm-sas                                    up    up/active


BOF last modified                : N/A
Config file version              : THU JAN 01 00:19:52 1970 UTC
Config file last modified        : 2014/02/10 05:36:50
Config file last saved           : N/A
M/S clocking ref state           : primary

Flash - cf1:
    Administrative State         : up
    Operational state            : up
    Serial number                : 4C530007300704117312
    Firmware revision            : 1.27
    Model number                 : Flash 0
    Size                         : 7,629 MB
    Free space                   : 7,574 MB

Flash - uf1:
    Administrative State         : up
    Operational state            : not equipped

Hardware Data
    Platform type                : N/A
    Part number                  :
    CLEI code                    :
    Serial number                : SAH01-051
    Manufacture date             :
    Manufacturing string         : (Not Specified)
    Manufacturing deviations     : (Not Specified)
    Manufacturing assembly number :
    Administrative state         : up
    Operational state            : up
    Temperature                  : 49C
    Temperature threshold        : 58C
    Software boot (rom) version  : X-0.0.I2282 on Sat Dec 20 14:21:54 IST
                                   2014 by builder
    Software version             : TiMOS-B-7.0.B1-205 both/xen NOKIA SAS-K *
    Time of last boot            : 2014/01/14 05:13:50
    Current alarm state          : alarm cleared
    Base MAC address             : 00:03:fa:27:15:4e
    Memory capacity              : 1,024 MB
* indicates that the corresponding row element may have been truncated.
===============================================================================
*A:SAH01-051>show#
```

Description

mda

Syntax **mda** [*slot* [*lmda*]] [**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.

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

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.

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

Label	Description
Slot	The chassis slot number.
Slot	The MDA slot number.
Provisioned Provisioned-type	The provisioned MDA type.
Equipped Mda-type	The MDA type that is physically inserted into this slot in this chassis.
Admin State	Up – The MDA is administratively up.
	Down – The MDA is administratively down.
Operational State	Up – The MDA is operationally up.
	Down – The MDA is operationally down.

Label	Description (Continued)
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	Indicates the source for the timing used by the MDA.
Sync interface timing status	Indicates whether the MDA has qualified one of the timing signals from the CPMs.
Network Ingress Queue Policy	Specifies the network queue policy applied to the MDA to define the queueing structure for this object.
Capabilities	Specifies the minimum size of the port that can exist on the MDA.
Part number	The hardware part number.
CLEI code	The code used to identify the MDA.
Serial number	The MDA part number. Not user modifiable.
Manufacture date	The MDA manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Administrative state	Up – The MDA is administratively up.
	Down – The MDA is administratively down.
Operational state	Up – The MDA is operationally up.
	Down – The MDA is operationally down.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific MDA.
Base MAC address	The base chassis Ethernet MAC address. Special purpose MAC addresses used by the system software are constructed as offsets from this base address.

Sample Output

```
B:Dut-D# show mda 1/1 detail
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m10-1gb-sfp           m10-1gb-sfp           up        up

MDA Specific Data
    Maximum port count            : 10
    Number of ports equipped      : 10
    Network ingress queue policy  : default
    Capabilities                  : Ethernet

Hardware Data
    Part number                   : 3HE00026AAAC01
    CLEI code                     :
    Serial number                 : NS042800525
    Manufacture date              : 07082004
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 42C
    Temperature threshold         : 75C
    Time of last boot             : 2007/04/11 09:37:52
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:0e:9e:03
===============================================================================
B:Dut-D#
```

Sample Output (for 7210 SAS D)

```
*A:SAS-D>show# mda 1 detail

===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m4-tx+6-sfp           m4-tx+6-sfp           up        up


MDA Specific Data
    Maximum port count            : 10
    Number of ports equipped      : 10
    Network ingress queue policy  : default
    Capabilities                  : Ethernet

Hardware Data
```

```
    Part number                  :
    CLEI code                    :
    Serial number                : NS1050C0071
    Manufacture date             :
    Manufacturing string         :
    Manufacturing deviations     :
    Administrative state         : up
    Operational state            : up
    Temperature                  : 44C
    Temperature threshold        : 55C
    Software version             : N/A
    Time of last boot            : 1970/01/01 00:00:30
    Current alarm state          : alarm cleared
    Base MAC address             : 00:3f:11:ab:ca:13

-------------------------------------------------------------------------------
QOS Settings
-------------------------------------------------------------------------------
Ing. Named Pool Policy           : None
Egr. Named Pool Policy           : None
===============================================================================
*A:SAS-D>show#
```

pools

Syntax **pools** *mda-id* [/*port*] [<**access-app**> [<*pool-name*>]]
pools *mda-id* [/*port*] [<**network-app**> [*[pool-name*]]

Context show

Description **Platforms Supported**: 7210 SAS-D and 7210 SAS-E

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

network-app *pool-name* **—** Displays the pool information of the specified QoS policy.

Values network-egress

Output **Show Pool Output —** The following table describes show pool output fields.

Label	Description
Type	Specifies the pool type.

Label	Description (Continued)
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 access uplink at 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-Threshold	Specifies the percentage of the buffer utilized after which the drop probability starts to rise above 0.
Actual ResvCBS	Specifies the actual percentage of pool size reserved for CBS.
Admin ResvCBS	Specifies the percentage of pool size reserved for CBS.
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 shared pools that is in use.
For 7210 SAS D	
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.

Dumping concise pool information for all ports in the MDA:

```
*A:card-1>config# show pools 1/1
===============================================================================
Type    Id        App.    Pool Name                  Actual ResvCBS  PoolSize
                                                     Admin ResvCBS
-------------------------------------------------------------------------------
Port    1/1/1     Acc-Egr default                    0               0
                                                     Sum
Port    1/1/1     AUp-Egr default                    50              99
                                                     Sum
Port    1/1/2     Acc-Egr default                    26              79
                                                     Sum
```

```
Port    1/1/2     AUp-Egr default                    0               0
                                                    Sum
Port    1/1/3     Acc-Egr default                    26              79
                                                    Sum
Port    1/1/3     AUp-Egr default                    0               0
                                                    Sum
Port    1/1/4     Acc-Egr default                    26              79
                                                    Sum
...
                                                    Sum
Port    1/1/24    AUp-Egr default                    0               0
                                                    Sum
===============================================================================
*A:card-1>config#
```

Sample Output (for 7210 SAS D**)**

```
*A:SAS-D>show# pools 1/1

===============================================================================

===============================================================================
Type    Id        App.    Pool Name                 Actual ResvCBS  PoolSize
                                                    Admin ResvCBS
-------------------------------------------------------------------------------
Port    1/1/1     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/1     Net-Egr default                    0               0
                                                    Sum
Port    1/1/2     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/2     Net-Egr default                    0               0
                                                    Sum
Port    1/1/3     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/3     Net-Egr default                    0               0
                                                    Sum
Port    1/1/4     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/4     Net-Egr default                    0               0
                                                    Sum
Port    1/1/5     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/5     Net-Egr default                    0               0
                                                    Sum
Port    1/1/6     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/6     Net-Egr default                    0               0
                                                    Sum
Port    1/1/7     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/7     Net-Egr default                    0               0
                                                    Sum
Port    1/1/8     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/8     Net-Egr default                    0               0
                                                    Sum
```

```
Port    1/1/9     Acc-Egr default                    68              186
                                                    Sum
Port    1/1/9     Net-Egr default                    0               0
                                                    Sum
Port    1/1/10    Acc-Egr default                    0               0
                                                    Sum
Port    1/1/10    Net-Egr default                    68              186
                                                    Sum
===============================================================================
*A:SAS-D>show#
```

The following output displays egress pool information for the access port:

```
*A:card-1>config#     show pools 1/1/5 access-egress
===============================================================================
Pool Information
===============================================================================
Port                : 1/1/5
Application         : Acc-Egr           Pool Name          : default
Resv CBS            : Sum
-------------------------------------------------------------------------------
Utilization                   State       Start-Threshold
-------------------------------------------------------------------------------
High-Slope                    Down              75%
Low-Slope                     Down              50%
-------------------------------------------------------------------------------
Queue                    High Slope Drop Rate(%)       Low Slope Drop Rate(%)
-------------------------------------------------------------------------------
Queue 1                         6.250000               100.000000
Queue 2                         6.250000               100.000000
Queue 3                         6.250000               100.000000
Queue 4                         6.250000               100.000000
Queue 5                         6.250000               100.000000
Queue 6                         6.250000               100.000000
Queue 7                         6.250000               100.000000
Queue 8                         6.250000               100.000000

Pool Total          : 79 KB
Pool Shared         : 53 KB             Pool Resv          : 26 KB

Pool Total In Use   : 0 KB
Pool Shared In Use  : 0 KB              Pool Resv In Use   : 0 KB
-------------------------------------------------------------------------------
FC-Maps                          ID       CBS          Depth  A.CIR     A.PIR
                                                              O.CIR     O.PIR
-------------------------------------------------------------------------------
be                               1/1/5    3200         0      0         1000000
                                                               0         Max
l2                               1/1/5    3200         0      0         1000000
                                                               0         Max
af                               1/1/5    3200         0      0         1000000
                                                               0         Max
l1                               1/1/5    3200         0      0         1000000
                                                               0         Max
h2                               1/1/5    3200         0      0         1000000
                                                               0         Max
ef                               1/1/5    3200         0      0         1000000
                                                               0         Max
h1                               1/1/5    3200         0      0         1000000
```

```
                                                          0          Max
nc                              1/1/5    3200        0    0          1000000
                                                          0          Max
===============================================================================
*A:card-1>config#
```

Sameple Output (for 7210 SAS D)

```
*A:SAS-D>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           : 186 KB
Pool Shared          : 118 KB            Pool Resv          : 68 KB

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

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

The following output displays egress pool information for an access uplink port:

```
*A:card-1>config#     show pools 1/1/1 access-uplink-egress
===============================================================================
Pool Information
===============================================================================
Port                 : 1/1/1
Application          : AUp-Egr           Pool Name          : default
Resv CBS             : Sum
-------------------------------------------------------------------------------
Utilization                  State       Start-Threshold
```

```
-------------------------------------------------------------------------------
High-Slope                    Down             75%
Low-Slope                     Down             50%
-------------------------------------------------------------------------------
Queue                   High Slope Drop Rate(%)       Low Slope Drop Rate(%)
-------------------------------------------------------------------------------
Queue 1                          6.250000               100.000000
Queue 2                          6.250000               100.000000
Queue 3                          6.250000               100.000000
Queue 4                          6.250000               100.000000
Queue 5                          6.250000               100.000000
Queue 6                          6.250000               100.000000
Queue 7                          6.250000               100.000000
Queue 8                          6.250000               100.000000

Pool Total           : 99 KB
Pool Shared          : 49 KB             Pool Resv          : 50 KB

Pool Total In Use    : 0 KB
Pool Shared In Use   : 0 KB              Pool Resv In Use   : 0 KB
-------------------------------------------------------------------------------
FC-Maps                          ID       CBS          Depth  A.CIR     A.PIR
                                                              O.CIR     O.PIR
-------------------------------------------------------------------------------
be                               1/1/1    3557         0      0         1000000
                                                              0         Max
l2                               1/1/1    3557         0      250000    1000000
                                                              249984    Max
af                               1/1/1    10671        0      250000    1000000
                                                              249984    Max
l1                               1/1/1    3557         0      250000    1000000
                                                              249984    Max
h2                               1/1/1    10671        0      1000000   1000000
                                                              Max       Max
ef                               1/1/1    10671        0      1000000   1000000
                                                              Max       Max
h1                               1/1/1    3557         0      100000    1000000
                                                              100032    Max
nc                               1/1/1    3557         0      100000    1000000
                                                              100032    Max
===============================================================================
*A:card-1>config#
```

Sample Output (for 7210 SAS D)

```
*A:SASD>config>port# show pools 1/1/9 access-uplink-egress

===============================================================================
Pool Information
===============================================================================
Port                 : 1/1/9
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           : 186 KB
Pool Shared          : 102 KB           Pool Resv          : 68 KB

Pool Total In Use    : 0 KB
```

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

-------------------------------------------------------------------------------
ID                          FC-MAPS       CBS (B)     Depth  A.CIR     A.PIR
                                                             O.CIR     O.PIR
-------------------------------------------------------------------------------
1/1/9                            be       8698        0      0         40000
                                                               0         Max
1/1/9                            l2       8698        0      0         40000
                                                               0         Max
1/1/9                            af       8698        0      0         40000
                                                               0         Max
1/1/9                            l1       8698        0      0         40000
                                                               0         Max
1/1/9                            h2       8698        0      0         40000
                                                               0         Max
1/1/9                            ef       8698        0      0         40000
                                                               0         Max
1/1/9                            h1       8698        0      0         40000
                                                               0         Max
1/1/9                            nc       8698        0      0         40000
                                                               0         Max
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:SASD>config>port#
```

Port Show Commands

port

Syntax **port** *port-id* [**count**] [**detail**]
port *port-id* **description**
port *port-id* **associations**
port *port-id* **ethernet** [**efm-oam** | **detail**]
port *port-id* **dot1x** [**detail**]
port *port-id* **vport** [*vport-name*] **associations**
port [**A1**] [**detail**] [**statistics**] [**description**](Out-of-band Ethernet port is not supported on 7210 SAS D devices)

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

Port Values 1 — 60 (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.

A1 — Displays the out-of-band Ethernet port information. (Supported only on 7210 SAS-E)

Port Output — The following tables describe port output fields:

- General Port Output Fields on page 181
- Entering port ranges: on page 185
- Specific Port Output Fields on page 191
- Detailed Port Output Fields on page 195
- Ethernet Output Fields on page 207
- Ethernet-Like Medium Statistics Output Fields on page 214
- Port Associations Output Fields on page 218

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.
	MDI — Indicates that the Ethernet interface is of type MDI (Media Dependent Interface).

Label	Description (Continued)
	MDX — Indicates that the Ethernet interface is of type MDX (Media Dependent Interface with crossovers).
IP MTU	Displays the configured IP MTU value.

Sample Output

```
*A:ALU-211# show port 1/1/2
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
Interface          : 1/1/2                       Oper Speed       : 100 mbps
Link-level         : Ethernet                    Config Speed     : 100 mbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up - Active in LAG 10       Config Duplex    : full
Physical Link      : Yes                         MTU              : 1514
Single Fiber Mode  : No                                           : Internal
IfIndex            : 35717120                    Hold time up     : 0 seconds
Last State Change  : 12/16/2008 19:31:40         Hold time down   : 0 seconds
Last Cleared Time  : 12/16/2008 19:31:48
IP MTU             : 1000
===============================================================================
*A:ALU-211#


*A:ALU-211# show port 1/1/2
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
Interface          : 1/1/2                       Oper Speed       : 100 mbps
Link-level         : Ethernet                    Config Speed     : 100 mbps
Admin State        : up                          Oper Duplex      : full
Oper State         : down - Standby in LAG 10    Config Duplex    : full
Physical Link      : Yes                         MTU              : 1514
Single Fiber Mode  : No                                           : None
IfIndex            : 35717120                    Hold time up     : 0 seconds
Last State Change  : 12/16/2008 18:28:52         Hold time down   : 0 seconds
Last Cleared Time  : 12/16/2008 18:28:51
IP MTU             : 1000
===============================================================================
*A:ALU-211#
```

Sample Output (for 7210 SAS D)

```
*A:7210SAS>show# port 1/1/2 detail

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
```

```
Interface          : 1/1/2                      Oper Speed       : 1 Gbps
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : up                         Oper Duplex      : full
Oper State         : up                         Config Duplex    : full
Physical Link      : Yes                        MTU              : 1518
Single Fiber Mode  : No                         LoopBack Mode    : Internal
IfIndex            : 35717120                   Hold time up     : 0 seconds
Last State Change  : 01/01/1970 00:18:10        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled

Configured Mode    : access                     Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                    Network Qos Pol  : n/a
Egr. Sched. Pol    : default                    Access Egr. Qos *: 1

Acc Egr Marking    : Port-Based                 Acc Egr Policy ID: 1

Auto-negotiate     : true                       MDI/MDX          : MDI
Accounting Policy  : None                       Collect-stats    : Disabled
Egress Rate        : Default                    Max Burst        : Default
LACP Tunnel        : Disabled

Uplink             : No
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                   Keep-alive       : 10
Loop Detected      : False                      Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A
Code-Type          : SDH                        Tx Quality Level : N/A
Tx DUS/DNU         : Disabled

Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                  CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled

Configured Address : 00:12:ab:34:cd:59
Hardware Address   : 00:12:ab:34:cd:59
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALA  IPUIAELDAB
TX Laser Wavelength: 850 nm                     Diag Capable     : yes
Connector Code     : LC                         Vendor OUI       : 00:90:65
Manufacture date   : 2010/06/14                 Media            : Ethernet
Serial Number      : PHR06BD
Part Number        : FTRJ8519P2BNL-A6
Optical Compliance : GIGE-SX
Link Length support: 550m for 50u MMF; 300m for 62.5u MMF

===============================================================================
```

```
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
===============================================================================
                            Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)            +26.8     +95.0      +90.0      -20.0     -25.0
Supply Voltage (V)          3.27      3.90       3.70       2.90      2.70
Tx Bias Current (mA)         6.9      17.0       14.0        2.0       1.0
Tx Output Power (dBm)      -4.39     -2.00      -2.00     -11.02    -11.74
Rx Optical Power (avg dBm) -7.24      1.00      -1.00     -18.01    -20.00
===============================================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0

===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                  0  Drop Events      :                    0
Multicast Pckts  :                  0  CRC/Align Errors :                    0
Undersize Pckts  :                  0  Fragments        :                    0
Oversize Pckts   :                  0  Jabbers          :                    0
Collisions       :                  0

Octets                         :                 0
Packets                        :                 0
Packets of 64 Octets           :                 0
Packets of 65 to 127 Octets    :                 0
Packets of 128 to 255 Octets   :                 0
Packets of 256 to 511 Octets   :                 0
Packets of 512 to 1023 Octets  :                 0
Packets of 1024 to 1518 Octets :                 0
Packets of 1519 or more Octets :                 0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                     0
Multicast Packets                                       0                     0
Broadcast Packets                                       0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                    0
```

```
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
===============================================================================


===============================================================================
Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
                        Packets                  Octets
-------------------------------------------------------------------------------
Egress Queue  1 (be)
Fwd Stats             :          0                        0
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             :          0                        0
Drop Stats            :          0                        0
===============================================================================
*A:7210SAS>show#
```

Entering port ranges:

```
*A:7210SAS# show port

===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
-------------------------------------------------------------------------------
1/1/1       Down  No   Down    1514 1514    - accs null xcme
1/1/2       Up    Yes  Up      1518 1518    - accs dotq xcme   MDI GIGE-SX
1/1/3       Up    No   Down    1518 1518    - accs dotq xcme
1/1/4       Up    No   Down    1514 1514    - accs null xcme
1/1/5       Up    Yes  Up      1518 1518    - accs dotq xcme   MDI GIGE-T
1/1/6       Down  No   Down    1514 1514    - accs null xcme
1/1/7       Down  No   Down    1514 1514    - accs null xcme
1/1/8       Down  No   Down    1514 1514    - accs null xcme
```

```
1/1/9       Up    Yes  Up      1522 1522    - l2up qinq xcme   MDX
1/1/10      Up    Yes  Up      1522 1522    - l2up qinq xcme   MDI
===============================================================================
*A:7210SAS#
```

Sample for 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C:

```
*A:SAH01-051>show# port 1/1/3

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet Combo
Interface          : 1/1/3                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Oper Grp           : disabled                    Monitor Oper Grp : disabled
Physical Link      : No                          MTU              : 1514
Config Conn Type   : Auto-SFP                    Oper Conn Type   : N/A
Single Fiber Mode  : No                          LoopBack Mode    : None
IfIndex            : 35749888                    Hold time up     : 0 seconds
Last State Change  : 01/16/2014 03:19:32         Hold time down   : 0 seconds
Last Cleared Time  : 01/16/2014 03:12:24
Phys State Chng Cnt: 0

Configured Mode    : access                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                     Network Qos Pol  : n/a
Auto-negotiate     : limited                     MDI/MDX          : unknown
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Max Burst        : Default
LACP Tunnel        : Disabled                    DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                    Rx Quality Level : N/A
Tx DUS/DNU         : Disabled                    Tx Quality Level : N/A
SSM Code Type      : sdh

Down On Int. Error : Disabled

CRC Mon SD Thresh  : Disabled                    CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled

Configured Address : 00:03:fa:27:15:52
Hardware Address   : 00:03:fa:27:15:52

===============================================================================
Traffic Statistics
===============================================================================
```

```
                                                    Input                  Output
-------------------------------------------------------------------------------
Octets                                                  0                       0
Packets                                                 0                       0
Errors                                                  0                       0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                    Input                  Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                       0
Multicast Packets                                       0                       0
Broadcast Packets                                       0                       0
Discards                                                0                       0
Unknown Proto Discards                                  0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
===============================================================================
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show# ^C
*A:SAH01-051>show# port 1/1/3 de
detail       description
*A:SAH01-051>show# port 1/1/3 detail

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet Combo
Interface          : 1/1/3                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Oper Grp           : disabled                    Monitor Oper Grp : disabled
Physical Link      : No                          MTU              : 1514
Config Conn Type   : Auto-SFP                    Oper Conn Type   : N/A
Single Fiber Mode  : No                          LoopBack Mode    : None
IfIndex            : 35749888                    Hold time up     : 0 seconds
Last State Change  : 01/16/2014 03:19:32         Hold time down   : 0 seconds
Last Cleared Time  : 01/16/2014 03:12:24
Phys State Chng Cnt: 0
```

```
Configured Mode    : access                    Encap Type       : null
Dot1Q Ethertype    : 0x8100                    QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                       Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                   Network Qos Pol  : n/a
Auto-negotiate     : limited                   MDI/MDX          : unknown
Accounting Policy  : None                      Collect-stats    : Disabled
Egress Rate        : Default                   Max Burst        : Default
LACP Tunnel        : Disabled                  DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                  Keep-alive       : 10
Loop Detected      : False                     Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                  Rx Quality Level : N/A
Tx DUS/DNU         : Disabled                  Tx Quality Level : N/A
SSM Code Type      : sdh

Down On Int. Error : Disabled

CRC Mon SD Thresh  : Disabled                  CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled

Configured Address : 00:03:fa:27:15:52
Hardware Address   : 00:03:fa:27:15:52

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                    0
Packets                                                0                    0
Errors                                                 0                    0

===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                   0  Drop Events      :                   0
Multicast Pckts  :                   0  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :                  0
Packets                         :                  0
Packets of 64 Octets            :                  0
Packets of 65 to 127 Octets     :                  0
Packets of 128 to 255 Octets    :                  0
Packets of 256 to 511 Octets    :                  0
Packets of 512 to 1023 Octets   :                  0
Packets of 1024 to 1518 Octets  :                  0
Packets of 1519 or more Octets  :                  0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
```

```
Port Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                      0
Multicast Packets                                       0                      0
Broadcast Packets                                       0                      0
Discards                                                0                      0
Unknown Proto Discards                                  0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                    0
FCS Errors       :                  0  Mult Collisions  :                    0
SQE Test Errors  :                  0  Late Collisions  :                    0
CSE              :                  0  Excess Collisns  :                    0
Too long Frames  :                  0  Int MAC Tx Errs  :                    0
Symbol Errors    :                  0  Int MAC Rx Errs  :                    0
===============================================================================
*A:SAH01-051>show#
```

Sample for 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C:

```
*7210SAS>show# port 1/1/3 ethernet

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet Combo
Interface          : 1/1/3                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : down                        Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Oper Grp           : disabled                    Monitor Oper Grp : disabled
Physical Link      : No                          MTU              : 9212
Config Conn Type   : Copper                      Oper Conn Type   : N/A
Single Fiber Mode  : No                          LoopBack Mode    : None
IfIndex            : 35749888                    Hold time up     : 0 seconds
Last State Change  : 02/21/2017 08:50:53         Hold time down   : 0 seconds
Last Cleared Time  : N/A
Phys State Chng Cnt: 0

Configured Mode    : network                     Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                     Network Qos Pol  : 2
Auto-negotiate     : true                        MDI/MDX          : unknown
Port-clock         : automatic
Accounting Policy  : None                        Collect-stats    : Disabled
Acct Plcy Eth Phys : None                        Collect Eth Phys : Disabled
Egress Rate        : Default                     Max Burst        : Default
LACP Tunnel        : Disabled                    DEI Classificati*: Disabled
```

```
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                    Rx Quality Level : N/A
Tx DUS/DNU         : Disabled                    Tx Quality Level : N/A
SSM Code Type      : sdh

Frame Based Acc    : No

Down On Int. Error : Disabled

CRC Mon SD Thresh  : Disabled                    CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled

EFM OAM            : Disabled                    EFM OAM Link Mon : Disabled

Configured Address : c4:08:4a:88:25:fd
Hardware Address   : c4:08:4a:88:25:fd

Transceiver Data

Transceiver Status : not-equipped
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0

===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                     0
Multicast Packets                                       0                     0
Broadcast Packets                                       0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================

===============================================================================
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:7210SAS>show#
```

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.
LoopBack Mode	Indicates if the port is in use by loopback mac-swap application. If 'None' is displayed the port is not enabled for loopback testing. If 'Internal' is displayed, the port is in use by port loopback mac-swap application and no services can be configured on this port. This field is displayed only on the 7210 SAS-D sample output.
Admin State	Up — The port is administratively up. Down — The port is administratively down.
Oper State	Up — The port is operationally up. Down — The port is operationally down. Additionally, the *lag-id* of the LAG it belongs to in addition to the status of the LAG member (active or standby) is specified.
Duplex	Full — The link is set to full duplex mode. Half — The link is set to half duplex mode.
Hold time up	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
Hold time down	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
Physical Link	Yes — A physical link is present. No — A physical link is not present.
IfIndex	Displays the interface's index number which reflects its initialization sequence.
Last State chg	Displays the system time moment that the peer is up.

Label	Description (Continued)
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.
Port-clock	Displays the mode of the port-clock. The port-clock can be set either as master, slave, or it can be automatic.
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.
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.

Label	Description (Continued)
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.
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 through the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
Errors	This field displays the number of cells discarded due to uncorrectable HEC errors. Errors do not show up in the raw cell counts.
Sync. Status Msg	Whether synchronization status messages are enabled or disabled.
Tx DUS/DNU	Whether the QL value is forcibly set to QL-DUS/QL-DNU.
Rx Quality Level	Indicates which QL value has been received from the interface.
Tx Quality Level	Indicates which QL value is being transmitted out of the interface.
SSM Code Type	Indicates the SSM code type in use on the port.
Frame Based Acc	Indicates if frame-based-accounting is enabled or disabled on the port

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

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.
Speed	The speed of the interface.
Link-level	Ethernet – The port is configured as Ethernet.
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.
Down On Int. Error	Indicates if down-on-internal-error is enabled or not.
CRC Mon SD Thresh	Indicates if signal-degrade threshold is configured or not.
CRC Mon SF Thresh	Indicates if signal-fail threshold is configured or not.
CRC Mon Window	Displays the value of window size used for CRC error monitoring when the signal-degrade or signal-fail thresholds are configured.
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.
Errors Input/ Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.

Label	Description (Continued)
Unicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Broadcast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Discards Input/ Output	The number of inbound packets chosen to be discarded to possibly free up buffer space.
Unknown Proto Discards Input/ Output	For packet-oriented interfaces, the number of packets received through the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
LLF Admin State	Displays the Link Loss Forwarding administrative state.
LLF Oper State	Displays the Link Loss Forwarding operational state.
Rx S1 Byte	Displays the received S1 byte and its decoded QL value.
Tx DUS/DNU	Displays whether the QL value is forcibly set to QL-DUS/QL-DNU.
Qinq etype	Displays the ethertype used for qinq packet encapsulation.
Sync. Status Msg.	Enabled- If SSM is enabled. Disabled-If SSM is disabled.
Code-Type	Displays the encoding type of SSM messages as SONET or SDH.

Label	Description (Continued)
Rx Quality Level	When SSM is enabled on this port, it displays the Clock Quality level for the clock received through that interface. The Clock Quality level is typically sent by the peer in the ESMC/SSM protocol. The quality level shown depends on the quality level mode used (SONET or SDH).
Tx Quality Level	When SSM is enabled on this port, it displays the System Clock Quality level that the system advertises to the peer using the ESMC/ SSM protocol. The quality level shown depends on the quality level mode used (SONET or SDH).

Sample Output

```
*A:SN12345678# show port 1/1/15
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet TX
Interface          : 1/1/15                      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              : 1522
IfIndex            : 36143104                    Hold time up     : 0 seconds
Last State Change  : 03/19/2001 21:21:07         Hold time down   : 0 seconds
Last Cleared Time  : N/A
IP MTU             : 1000

Configured Mode    : access                      Encap Type       : QinQ
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Net. Egr. Queue Pol: default                     Access Egr. Qos *: n/a
Egr. Sched. Pol    : default                     Network Qos Pol  : 1
Auto-negotiate     : limited                     MDI/MDX          : MDI
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Ingress Rate     : Default
Uplink             : Yes

Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:87:98:76:65:0e
Hardware Address   : 00:87:98:76:65:0e
Cfg Alarm          :
Alarm Status       :
===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                    2229540275006                    0
```

```
Packets                                          2177285416                     0
Errors                                                 14                       0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                     Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                  2177285416                     0
Multicast Packets                                       0                       0
Broadcast Packets                                       0                       0
Discards                                                0                       0
Unknown Proto Discards                                  0
===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                   0  Sngl Collisions  :                    0
FCS Errors       :                  13  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:SN12345678#
*A:SN12345678#   show port 1/1/15 detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet TX
Interface          : 1/1/15                      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              : 1522
IfIndex            : 36143104                    Hold time up     : 0 seconds
Last State Change  : 03/19/2001 21:21:07         Hold time down   : 0 seconds
Last Cleared Time  : N/A

Configured Mode    : access                      Encap Type       : QinQ
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Net. Egr. Queue Pol: default                     Access Egr. Qos *: n/a
Egr. Sched. Pol    : default                     Network Qos Pol  : 1
Auto-negotiate     : limited                     MDI/MDX          : MDI
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Ingress Rate     : Default
Uplink             : Yes

Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                    CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:87:98:76:65:0e
Hardware Address   : 00:87:98:76:65:0e
Cfg Alarm          :
```

```
Alarm Status       :
===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Octets                                     2199575527230                     0
Packets                                       2148022967                     0
Errors                                              14                       0
===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                   0  Drop Events      :                   0
Multicast Pckts  :                   0  CRC/Align Errors :                  13
Undersize Pckts  :                   0  Fragments        :                   1
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :       2199575527230
Packets                         :          2148022967
Packets of 64 Octets            :                   0
Packets of 65 to 127 Octets     :                   0
Packets of 128 to 255 Octets    :                   1
Packets of 256 to 511 Octets    :                   0
Packets of 512 to 1023 Octets   :                  12
Packets of 1024 to 1518 Octets  :          2148022966
Packets of 1519 or more Octets  :                   0
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Port Statistics
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                            2148272026                        0
Multicast Packets                                   0                        0
Broadcast Packets                                   0                        0
Discards                                            0                        0
Unknown Proto Discards                              0
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                  13  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
===============================================================================
Meter Statistics
===============================================================================

-------------------------------------------------------------------------------
                       Packets                 Octets
-------------------------------------------------------------------------------
Ingress Meter  1 (Unicast)
For. InProf           :         0                       0
For. OutProf          :         0                       0
```

```
Ingress Meter  9 (Multipoint)
For. InProf           :         0                       0
For. OutProf          :         0                       0
===============================================================================
*A:SN12345678#
```

Sample Output (for 7210 SAS D)

```
*A:SAS-D>config# show port 1/1/2

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/2                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : down                        Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Physical Link      : No                          MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 35717120                    Hold time up     : 0 seconds
Last State Change  : 01/01/1970 00:00:08         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled

Configured Mode    : access                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                     Network Qos Pol  : n/a
Egr. Sched. Pol    : default                     Access Egr. Qos *: 1
Auto-negotiate     : true                        MDI/MDX          : unknown
Port-clock         : master
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Max Burst        : Default
Load-balance-algo  : default                     LACP Tunnel      : Disabled
LACP Tunnel        : Disabled

Uplink             : No
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                    Rx Quality Level : N/A
Code-Type          : SDH                         Tx Quality Level : N/A
Tx DUS/DNU         : Disabled
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:3f:11:ab:ca:14
Hardware Address   : 00:3f:11:ab:ca:14
Cfg Alarm          :
Alarm Status       :

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                 0                     0
```

```
Packets                                                 0                    0
Errors                                                  0                    0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                    0
Multicast Packets                                       0                    0
Broadcast Packets                                       0                    0
Discards                                                0                    0
Unknown Proto Discards                                  0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                   0
FCS Errors       :                  0  Mult Collisions  :                   0
SQE Test Errors  :                  0  Late Collisions  :                   0
CSE              :                  0  Excess Collisns  :                   0
Too long Frames  :                  0  Int MAC Tx Errs  :                   0
Symbol Errors    :                  0  Int MAC Rx Errs  :                   0
===============================================================================


*A:ALA-A# show port 1/1/1 detail
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                       Oper Speed       : 0 mbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Reason Down        : linkLossFwd
Physical Link      : No                          MTU              : 1514
IfIndex            : 35684352                    Hold time up     : 0 seconds
Last State Change  : 01/22/2010 23:54:49         Hold time down   : 0 seconds
Last Cleared Time  : 01/21/2010 17:40:16

Configured Mode    : access                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
Net. Egr. Queue Pol: default                     Access Egr. Qos *: 1
Egr. Sched. Pol    : default                     Network Qos Pol  : n/a
Auto-negotiate     : false                       MDI/MDX          : unknown
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Max Burst        : Default
Uplink             : No

Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                    CRC Mon Window   : 10 seconds
```

```
CRC Mon SF Thresh  : Enabled
Configured Address : 28:06:01:01:00:01
Hardware Address   : 28:06:01:01:00:01
Cfg Alarm          :
Alarm Status       :

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0

===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                   0  Drop Events      :                   0
        0 Pckts  :                   0  CRC/Align Errors :
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :                   0
Packets                         :                   0
Packets of 64 Octets            :                   0
Packets of 65 to 127 Octets     :                   0
Packets of 128 to 255 Octets    :                   0
Packets of 256 to 511 Octets    :                   0
Packets of 512 to 1023 Octets   :                   0
Packets of 1024 to 1518 Octets  :                   0
Packets of 1519 or more Octets  :                   0
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:ALA-A#

*A:SAS-D>config# show port 1/1/2 detail

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/2                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : down                        Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Physical Link      : No                          MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 35717120                    Hold time up     : 0 seconds
Last State Change  : 01/01/1970 00:00:08         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled

Configured Mode    : access                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
```

```
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                    Network Qos Pol  : n/a
Egr. Sched. Pol    : default                    Access Egr. Qos *: 1
Auto-negotiate     : true                       MDI/MDX          : unknown
Accounting Policy  : None                       Collect-stats    : Disabled
Egress Rate        : Default                    Max Burst        : Default
Load-balance-algo  : default                    LACP Tunnel      : Disabled
LACP Tunnel        : Disabled

Uplink             : No
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                   Keep-alive       : 10
Loop Detected      : False                      Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A
Code-Type          : SDH                        Tx Quality Level : N/A
Tx DUS/DNU         : Disabled
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:3f:11:ab:ca:14
Hardware Address   : 00:3f:11:ab:ca:14
Cfg Alarm          :
Alarm Status       :

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                                  0                     0
Packets                                                 0                     0
Errors                                                  0                     0

===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                   0  Drop Events      :                   0
Multicast Pckts  :                   0  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :                   0
Packets                         :                   0
Packets of 64 Octets            :                   0
Packets of 65 to 127 Octets     :                   0
Packets of 128 to 255 Octets    :                   0
Packets of 256 to 511 Octets    :                   0
Packets of 512 to 1023 Octets   :                   0
Packets of 1024 to 1518 Octets  :                   0
Packets of 1519 or more Octets  :                   0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
```

```
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                         0                     0
Multicast Packets                                       0                     0
Broadcast Packets                                       0                     0
Discards                                                0                     0
Unknown Proto Discards                                  0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                    0
FCS Errors       :                  0  Mult Collisions  :                    0
SQE Test Errors  :                  0  Late Collisions  :                    0
CSE              :                  0  Excess Collisns  :                    0
Too long Frames  :                  0  Int MAC Tx Errs  :                    0
Symbol Errors    :                  0  Int MAC Rx Errs  :                    0
===============================================================================


===============================================================================
Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
                        Packets                 Octets
-------------------------------------------------------------------------------
Egress Queue  1 (be)
Fwd Stats             :          0                       0
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             :          0                       0
Drop Stats            :          0                       0
===============================================================================
```

Ethernet Output Fields

Sample output for 7210 SAS-D:

```
*7210SAS-D># show port 1/1/3 detail

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/3                       Oper Speed       : 1 Gbps
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : full
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1514
Single Fiber Mode  : No                          LoopBack Mode    : None
IfIndex            : 35749888                    Hold time up     : 0 seconds
Last State Change  : 01/01/1970 00:15:29         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled

Configured Mode    : access                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7                      Acc Egr Sch Mode : Fc-Based
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                     Network Qos Pol  : n/a
Egr. Sched. Pol    : default                     Access Egr. Qos *: 1
Auto-negotiate     : true                        MDI/MDX          : MDI
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Max Burst        : Default
LACP Tunnel        : Disabled

Uplink             : No
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Enabled                     Rx Quality Level : 0x2(prc)
Code-Type          : SDH                         Tx Quality Level : 0xf(dnu)
Tx DUS/DNU         : Disabled
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:32:fb:04:1a:04
Hardware Address   : 00:32:fb:04:1a:04
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALA  IPUIAELDAB
TX Laser Wavelength: 850 nm                      Diag Capable     : yes
Connector Code     : LC                          Vendor OUI       : 00:90:65
Manufacture date   : 2010/06/02                  Media            : Ethernet
```

```
Serial Number      : PHP2JMJ
Part Number        : FTRJ8519P2BNL-A6
Optical Compliance : GIGE-SX
Link Length support: 550m for 50u MMF; 300m for 62.5u MMF

===============================================================================
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
===============================================================================
                             Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)              +44.9     +95.0      +90.0      -20.0     -25.0
Supply Voltage (V)            3.30      3.90       3.70       2.90      2.70
Tx Bias Current (mA)           6.8      17.0       14.0        2.0       1.0
Tx Output Power (dBm)        -4.71     -2.00      -2.00     -11.02    -11.74
Rx Optical Power (avg dBm)   -5.18      1.00      -1.00     -18.01    -20.00
===============================================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Octets                                            30976                  30720
Packets                                             308                    304
Errors                                                0                      0

===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                   0  Drop Events      :                   0
Multicast Pckts  :                 612  CRC/Align Errors :                   0
Undersize Pckts  :                   0  Fragments        :                   0
Oversize Pckts   :                   0  Jabbers          :                   0
Collisions       :                   0

Octets                          :              61696
Packets                         :                612
Packets of 64 Octets            :                260
Packets of 65 to 127 Octets     :                  0
Packets of 128 to 255 Octets    :                352
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                                       0                      0
Multicast Packets                                   308                    304
Broadcast Packets                                     0                      0
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================
```

```
===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                   0
FCS Errors       :                  0  Mult Collisions  :                   0
SQE Test Errors  :                  0  Late Collisions  :                   0
CSE              :                  0  Excess Collisns  :                   0
Too long Frames  :                  0  Int MAC Tx Errs  :                   0
Symbol Errors    :                  0  Int MAC Rx Errs  :                   0
===============================================================================


===============================================================================
Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
                        Packets                 Octets
-------------------------------------------------------------------------------
Egress Queue  1 (be)
Fwd Stats             :          0                       0
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             :          0                       0
Drop Stats            :          0                       0
===============================================================================
```

Sample output for 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C

```
*A:SAH01-051>show# port

===============================================================================
Ports on Slot 1
===============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   C/QS/S/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
```

```
-------------------------------------------------------------------------------
1/1/1       Up    Yes  Up      1514 1514    - accs null xcme   MDX GIGE-T
1/1/2       Down  No   Down    1514 1514    - accs null xcme
1/1/3       Up    No   Down    1514 1514    - accs null xcme   COMBO
1/1/4       Up    Yes  Up      1514 1514    - accs null xcme   MDI
1/1/5       Up    Yes  Up      1514 1514    - accs null xcme   MDI
===============================================================================
*A:SAH01-051>show# port 1/1/1 ethernet

===============================================================================
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
Oper Grp           : disabled                    Monitor Oper Grp : disabled
Physical Link      : Yes                         MTU              : 1514
Config Conn Type   : SFP                         Oper Conn Type   : SFP
Single Fiber Mode  : No                          LoopBack Mode    : None
IfIndex            : 35684352                    Hold time up     : 0 seconds
Last State Change  : 01/16/2014 03:26:46         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled
Phys State Chng Cnt: 5

Configured Mode    : access                      Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                     Network Qos Pol  : n/a
Auto-negotiate     : true                        MDI/MDX          : MDX
Accounting Policy  : None                        Collect-stats    : Disabled
Egress Rate        : Default                     Max Burst        : Default
LACP Tunnel        : Disabled                    DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                    Keep-alive       : 10
Loop Detected      : False                       Retry            : 120
Use Broadcast Addr : False

Sync. Status Msg.  : Disabled                    Rx Quality Level : N/A
Tx DUS/DNU         : Disabled                    Tx Quality Level : N/A
SSM Code Type      : sdh

Down On Int. Error : Disabled

CRC Mon SD Thresh  : Disabled                    CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled

Configured Address : 00:03:fa:27:15:50
Hardware Address   : 00:03:fa:27:15:50

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00062AAAA01  ALA  IPUIAEHDAA
TX Laser Wavelength: 0 nm                        Diag Capable     : no
Connector Code     : Unknown                     Vendor OUI       : 90:00:00
```

```
Manufacture date   : 2011/08/09                Media            : Ethernet
Serial Number      : PL71FG4
Part Number        : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
Link Length support: 100m for copper

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                         1889792832            38756224
Packets                                          29528013              605566
Errors                                                 0                   0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                  1577678              605566
Multicast Packets                                      0                   0
Broadcast Packets                                27950335                   0
Discards                                               0                   0
Unknown Proto Discards                                 0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
===============================================================================
*A:SAH01-051>show#
```

Ethernet Output — The following table describes Ethernet output fields.

Label	Description
Broadcast Pckts	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Multicast Pckets	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Undersize Pckets	The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed.
Oversize Pckts	The total number of packets received that were longer than can be accepted by the physical layer of that port (9900 octets excluding framing bits, but including FCS octets for GE ports) and were otherwise well formed.
Collisions	The best estimate of the total number of collisions on this Ethernet segment.
Drop Events	The total number of events in which packets were dropped by the probe due to lack of resources. Note that this number is not necessarily the number of packets dropped; it is just the number of times this condition has been detected.
CRC Align Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Fragments	The total number of packets received that were less than 64 octets in length (excluding framing bits but including FCS octets) and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).

Label	Description (Continued)
Jabbers	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
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.
Config Conn Type	The type of ethernet configuration connection.

Sample Output (for 7210 SAS-E)

```
===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                  0  Drop Events      :                  0
Multicast Pckts  :                  0  CRC/Align Errors :                  0
Undersize Pckts  :                  0  Fragments        :                  0
Oversize Pckts   :                  0  Jabbers          :                  0
Collisions       :                  0

Octets                         :                  0
Packets                        :                  0
Packets of 64 Octets           :                  0
Packets of 65 to 127 Octets    :                  0
Packets of 128 to 255 Octets   :                  0
Packets of 256 to 511 Octets   :                  0
Packets of 512 to 1023 Octets  :                  0
Packets of 1024 to 1518 Octets :                  0
Packets of 1519 or more Octets :                  0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                       0                      0
Multicast Packets                                     0                      0
Broadcast Packets                                     0                      0
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================

===============================================================================
Ethernet Statistics
===============================================================================
```

```
Broadcast Pckts  :              42621  Drop Events      :                  0
Multicast Pckts  :                  0  CRC/Align Errors :                  0
Undersize Pckts  :                  0  Fragments        :                  0
Oversize Pckts   :                  0  Jabbers          :                  0
Collisions       :                  0

Octets                          :            2727744
Packets                         :              42621
Packets of 64 Octets            :              42621
Packets of 65 to 127 Octets     :                  0
Packets of 128 to 255 Octets    :                  0
Packets of 256 to 511 Octets    :                  0
Packets of 512 to 1023 Octets   :                  0
Packets of 1024 to 1518 Octets  :                  0
Packets of 1519 or more Octets  :                  0
===============================================================================
Port Statistics
===============================================================================
                                                  Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                       0                      0
Multicast Packets                                     0                      0
Broadcast Packets                                 42621                      0
Discards                                              0                      0
Unknown Proto Discards                                0
===============================================================================
...
```

Ethernet-like Medium Statistics Output — The following table describes Ethernet-like medium statistics output fields.

Label	Description
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets.
FCS Errors	The number of frames received on a particular interface that are an integral number of octets in length but do not pass the FCS check.
SQE Errors	The number of times that the SQE TEST ERROR is received on a particular interface.
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame on a particular interface.
Too long Frames	The number of frames received on a particular interface that exceed the maximum permitted frame size.
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present.

Label	Description (Continued)
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully.
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully.
Late Collisions	The number of times that a collision is detected on a particular interface later than one slotTime into the transmission of a packet.
Excess Collisns	The number of frames for which transmission on a particular interface fails due to excessive collisions.
Int MAC Tx Errs	The number of frames for which transmission on a particular interface fails due to an internal MAC sublayer transmit error,
Int MAC Rx Errs	The number of frames for which reception on a particular interface fails due to an internal MAC sublayer receive error.
Ingress Meter	Specifies themeter ID.
For. InProf	The number of in-profile packets and octets (rate below CIR) forwarded by the ingress meter.
For. OutProf	The number of out-of-profile packets and octets (rate below CIR) forwarded by the ingress meter.

Ethernet-like Medium Statistics — the following table describe Ethernet-like Medium Statistics field..

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 that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets.
FCS Errors	The number of frames received that are an integral number of octets in length but do not pass the FCS check.
SQE Errors	The number of times that the SQE TEST ERROR is received.
CSE	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame.
Too long Frames	The number of frames received that exceed the maximum permitted frame size.
Symbol Errors	For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present

Label	Description
Sngl Collisions	The number of frames that are involved in a single collision, and are subsequently transmitted successfully.
Mult Collisions	The number of frames that are involved in more than one collision and are subsequently transmitted successfully.
Late Collisions	The number of times that a collision is detected later than one slot Time into the transmission of a packet.
Excess Collisions	The number of frames for which a transmission fails due to excessive collisions.
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sub-layer transmit error.
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sub-layer receive error.
Multicast Pckts	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast 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 unicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Undersize Pckts	The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed.
Oversize Pckts	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed.
Collisions	The best estimate of the total number of collisions on this Ethernet segment.
Drop Events	The total number of times that packets were detected as being dropped due to a lack of resources (not necessarily the total number of packets dropped).
CRC Align Errors	The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Fragments	The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).

Label	Description
Jabbers	The total number of packets received that were longer than 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Octets	Total number of octets received.
Packets	The number of packets received, broken down by size Port Statistics.
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 not addressed to a unicast 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 unicast or broadcast address at this sub-layer,including those that were discarded or not sent.
Broadcast packets input/output	The number of packets, delivered by this sub-layer to a higher (sub-) layer,which were not addressed to a unicast or multicast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sub-layer, including those that were discarded or not sent.
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 that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
Unknown proto	Discards do not show up in the packet counts.

Sample Output (for 7210 SAS-E)

```
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
```

```
Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
===============================================================================



.............


A:ALA-48# show port 1/3/1 detail
===============================================================================
...
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
*A:ALU-SAS#
===============================================================================
...
Meter Statistics
===============================================================================
                        Packets                 Octets
-------------------------------------------------------------------------------
Ingress Meter  1 (Unicast)
For. InProf           :         0                       0
For. OutProf          :         0                       0
Ingress Meter  9 (Multipoint)
For. InProf           :         0                       0
For. OutProf          :         0                       0
 ...
===============================================================================
*A:ALU-SAS#
```

Port Associations Output — The following table describes port associations output fields.

Label	Description
Svc ID	The service identifier.
Name	The name of the IP interface.
Encap Value	The dot1q or qinq encapsulation value on the port for this IP interface

Sample Output

```
A:ALA-1# show port 1/1/6 associations
```

```
===============================================================================
Interface Table
===============================================================================
Router/ServiceId                Name                            Encap Val
-------------------------------------------------------------------------------
Router: Base                    if1000                          1000
Router: Base                    if2000                          2000
-------------------------------------------------------------------------------
Interfaces
===============================================================================
A;ALA-1#
```

A1 Detailed Output — The following table describes A1 detailed output fields.(Out of Band Ethernet port is not supported on 7210 SAS D devices)

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the slot/mda/port format.
Oper Speed	The operating speed of the interface.
Link-level	Ethernet — the port is configured as Ethernet.
Config Speed	The configured speed of the interface.
Admin State	up — the port is administratively up. down — the port is administratively down.
Oper Duplex	The operating duplex mode of the interface.
Oper State	up — the port is operationally up. down — the port is operationally down.
Config Duplex	full — the link is configured to full duplex mode. half — the link is configured to half duplex mode.
Physical Link	Yes — a physical link is present. No — a physical link is not present.
MTU	The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets.
IfIndex	The interface's index number that reflects its initialization sequence.
Hold time up	The link-up dampening time in seconds. The port link dampening timer value that reduces the number of link transitions reported to upper layer protocols.
Last State Change	The last time that the operational status of the port changed state.
Hold time down	The link-down dampening time in seconds. The down timer controls the dampening timer for link down transitions.

Label	Description (Continued)
Configured Mode	network — the port is configured for transport. network use access — the port is configured for service access.
Encap Type	null — ingress frames will not use any tags or labels to delineate a service. dot1q — ingress frames carry 802.1Q tags where each tag signifies a different service.
Dot1Q Ethertype	The protocol carried in an Ethernet frame.
Net.Egr. Queue Pol.	The number of the associated network egress queue QoS policy, or default if the default policy is used.
ACFC	Indicates whether Address and Control Field PPP Header Compression is enabled.
PFC	Indicates whether Protocol Field PPP Header Compression is enabled.
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.
Egress Rate	The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.
Loopback	The type of loopback configured on the port, either line,internal, or none.
Loopback Time Left	The number of seconds left in a timed loopback If there is no loopback configured or the configured loopback is latched, the value is unspecified.
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)
Traffic Statistics	Octets input/output – the total number of octets received and transmitted on the port Packets input/output – the number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sub-layer, including those that were discarded or not sent. Errors input/output – for packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Ethernet Statistics	Broadcast Pckts — the number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast or multicast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sub-layer, including those that were discarded or not sent.

```
A:7210>show# port A/1 detail

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
Interface          : A/1                         Oper Speed       : 10 mbps
Link-level         : Ethernet                    Config Speed     : 100 mbps
Admin State        : up                          Oper Duplex      : half
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 67141632                    Hold time up     : 0 seconds
Last State Change  : 07/09/2010 16:30:04         Hold time down   : 0 seconds
Last Cleared Time  : N/A

Configured Mode    : network                     Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol:                             Network Qos Pol  : n/a
```

```
Egr. Sched. Pol    : default                    Access Egr. Qos *: n/a
Egr. Sched. Pol    : default
Auto-negotiate     : true                       MDI/MDX          : MDI
Accounting Policy  : None                       Collect-stats    : Disabled
Egress Rate        : Default                    Max Burst        : Default

Split Horizon Group: (Not Specified)
Down-when-looped   : N/A                        Keep-alive       : N/A
Loop Detected      : N/A                        Retry            : N/A
Use Broadcast Addr : N/A

Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:aa:01:ab:02:02
Hardware Address   : 00:aa:01:ab:02:02
Cfg Alarm          :
Alarm Status       :

===============================================================================
Traffic Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Octets                                            5950409                     0
Packets                                              4274                     0
Errors                                                  0                     0

===============================================================================
Ethernet Statistics
===============================================================================

Broadcast Pckts  :                38  Drop Events      :                    0
Multicast Pckts  :                 0  CRC/Align Errors :                    0
Undersize Pckts  :                 0  Fragments        :                    0
Oversize Pckts   :                 0  Jabbers          :                    0
Collisions       :                 0

Octets                          :            6102041
Packets                         :               4382
Packets of 64 Octets            :                 34
Packets of 65 to 127 Octets     :                  0
Packets of 128 to 255 Octets    :                366
Packets of 256 to 511 Octets    :                  0
Packets of 512 to 1023 Octets   :                  0
Packets of 1024 to 1518 Octets  :               3982
Packets of 1519 or more Octets  :                  0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
Unicast Packets                                      4416                     0
Multicast Packets                                       0                     0
```

```
Broadcast Packets                                  38                      0
Discards                                            0                      0
Unknown Proto Discards                              0
===============================================================================

===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                  0
FCS Errors       :                  0  Mult Collisions  :                  0
SQE Test Errors  :                  0  Late Collisions  :                  0
CSE              :                  0  Excess Collisns  :                  0
Too long Frames  :                  0  Int MAC Tx Errs  :                  0
Symbol Errors    :                  0  Int MAC Rx Errs  :                  0
===============================================================================
```

Sample for dot1x detail:

```
A:7210SAS>show# port 1/1/2 dot1x detail
===============================================================================
802.1x Port Status
===============================================================================

Port control            : force-auth
Port status             : authorized
Authenticator PAE state : force-auth
Backend state           : idle
Reauth enabled          : no           Reauth period         : N/A
Max auth requests       : 2            Transmit period       : 30
Supplicant timeout      : 30           Server timeout        : 30
Quiet period            : 60
Radius-plcy             : N/A
Dot1x-Tunnel            : Disabled

===============================================================================
802.1x Session Statistics
===============================================================================

authentication method   : remote-radius
last session id         : PAC-02210000-C28294A4
last session time       : 49213d07h
last session username   : N/A
last session term cause : N/A
user tx octets          : 0            user tx frames        : 0
user rx octets          : 2648353056   user rx frames        : 247852776

===============================================================================
802.1x Authentication Statistics
===============================================================================

tx frames               : 0            rx frames             : 0
tx req/id frames        : 0            rx resp/id frames     : 0
tx request frames       : 0            rx response frames    : 0
rx start frames         : 0            rx logoff frames      : 0
rx unknown frame type   : 0            rx bad eap length     : 0
```

```
rx last version         : 0           rx last source mac    :

===============================================================================
802.1x Authentication Diagnostics
===============================================================================

Enters Connecting                    : 0
EapLogoffs While Connecting          : 0
Logoffs While Connecting             : 0
Success While Authenticating         : 0
Timeouts While Authenticating        : 0
Failures While Authenticating        : 0
Reauths While Authenticating         : 0
EapStarts While Authenticating       : 0
EapLogoffs While Authenticating      : 0
Reauths While Authenticated          : 0
EapStarts While Authenticated        : 0
EapLogoffs While Authenticated       : 0
Backend Responses                    : 0
Backend Access Challenges            : 0
Backend Requests To Supplicant       : 0
Backend Access Challenges            : 0
Backend Non Nak Responses            : 0
Backend Auth Successes               : 0
Backend Auth Failures                : 0
```

lldp

Syntax **lldp** [**nearest-bridge**|**nearest-non-tpmr**|**nearest-customer**] [**remote-info**] [**detail**]

Context show>port>ethernet

Description This command displays Link Layer Discovery Protocol (LLDP) information.

Parameters **nearest-bridge —** Displays nearest bridge information.

nearest-non-tpmr — Displays nearest Two-Port MAC Relay (TPMR) information.

nearest-customer — Displays nearest customer information.

remote-info — Displays remote information on the bridge MAC.

detail — Shows detailed information.

Output **Sample Output**

```
*A:hw_sasm_duta>show# port 1/1/1 ethernet lldp

===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================

Port 1/1/1 Bridge nearest-bridge
```

```
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::


Port 1/1/1 Bridge nearest-non-tpmr
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::


Port 1/1/1 Bridge nearest-customer
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::

===============================================================================
*A:hw_sasm_duta>show#



*A:hw_sasm_duta>show# port 1/1/1 ethernet lldp nearest-bridge

===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================

Port 1/1/1 Bridge nearest-bridge
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::
===============================================================================
*A:hw_sasm_duta>show#
```

```
*A:7210-SAS# show port 1/1/3 ethernet lldp remote-info detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/1/3 Bridge nearest-bridge Remote Peer Information
-------------------------------------------------------------------------------
No remote peers found

Port 1/1/3 Bridge nearest-non-tpmr Remote Peer Information
-------------------------------------------------------------------------------
Remote Peer Index 142 at timestamp 06/10/2010 00:23:22:
Supported Caps        : bridge router
Enabled Caps          : bridge router
Chassis Id Subtype    : 4 (macAddress)
Chassis Id            : 0a:a5:ff:00:00:00
PortId Subtype        : 7 (local)
Port Id               : 35749888
Port Description      : 10/100/Gig Ethernet SFP
System Name           : Dut-B
System Description    : TiMOS-B-0.0.I927 both/i386 NOKIA SAS 7210
                        Copyright (c) 2017 Nokia.
                        All rights reserved. All use subject to applicable
                        license agreements.
                        Built on Wed Dec 1 22:23:12 IST 2010 by builder in
                        /builder/0.0/panos/main

Remote Peer Index 142 management addresses at time 06/10/2010 00:23:22:
No remote management addresses found


Port 1/1/3 Bridge nearest-customer Remote Peer Information
-------------------------------------------------------------------------------
Remote Peer Index 143 at timestamp 06/10/2010 00:23:22:
Supported Caps        : bridge router
Enabled Caps          : bridge router
Chassis Id Subtype    : 4 (macAddress)
Chassis Id            : 0a:a7:ff:00:00:00
PortId Subtype        : 7 (local)
Port Id               : 35782656
Port Description      : 10/100 Ethernet TX
System Name           : Dut-G
System Description    : TiMOS-B-8.0.R5 both/i386 NOKIA SR 7750 Copyright (c)
                         2017 Nokia.
                        All rights reserved. All use subject to applicable
                        license agreements.
                        Built on Tue Sep 28 18:24:07 PDT 2010 by builder in
                        /rel8.0/b1/R5/panos/main
Remote Peer Index 143 management addresses at time 06/10/2010 00:23:22:
```

internal-loopback-ports

Syntax **internal-loopback-ports** [**detail**]

Context show>system

Description **Platforms Supported**: 7210 SAS-D and 7210 SAS-E.

This command displays information about internal loopback ports and is applicable only to 7210 SAS-D.

Parameters *Detail* — keyword - includes application information

Command to display the list of loopback ports assigned to different OAM tools and also the list of virtual internal port(s) available and its current association.

Sample Output

```
*A:7210SAS>config>port# show system internal-loopback-ports detail
===============================================================================
Internal Loopback Port Status
===============================================================================
Port                Loopback            Application         Service
Id                  Type                                    Enabled
-------------------------------------------------------------------------------
1/1/2               Physical            Mac-Swap            Yes
1/1/11              Virtual             Mac-Swap            No

=======================================
Mac-swap Application Status
=======================================
Enabled            : Yes
Test Service Id    : 1
Test Sap Id        : 1/1/2:40
Loopback Src Addr  : 00:00:01:00:02:00
Loopback Dst Addr  : 00:00:01:00:03:00
=======================================
===============================================================================
*A:7210SAS>config>port#
```

Mac-swap Application Status — The following table describes Mac-swap Application Status associations output fields.

Label	Description
LoopBack Type	The Loopback type indicates whether the port is in Physical Front panel port or Internal Virtual port.
Application	Application mentions the application in use of the port.
Service enabled	The Service enabled displays, if services can be configured over this port.
Enabled	Displays the current status.
Test Service Id	The service ID that is used in the configuration of Mac-swap test.
Test Sap Id	The SAP ID that is used to configure the loopback SAP for the Mac-swap application.

Label	Description
Loopback Src Addr	The source MAC address that is used in the configuration of port loopback mac-swap test.
Loopback Dst Addr	The destination MAC address that is used in the configuration of port loopback mac-swap test.

lldp

Syntax **lldp**
lldp *neighbor*

Context show>system

Description This command displays local Link Layer Discovery Protocol (LLDP) information at the system level. This includes an option keyword to display summary information for all known peers.

Parameters **neighbor —** Display all peer summary information .

Sample Output

```
*A:hw_sasm_duta>show>system# lldp

===============================================================================
LLDP Configuration
===============================================================================
Transmit Interval      : 30
Hold Multiplier        : 4
Reinit Delay           : 2
Notification Interval  : 5
Tx Credit Max          : 5
Message Fast Tx        : 1
Message Fast Tx Init   : 4
Admin Enabled          : True

-------------------------------------------------------------------------------
LLDP System Information
-------------------------------------------------------------------------------
Chassis Id Subtype     : 4
Chassis Id             : 00:12:cf:b4:71:b8
System Name            : hw_sasm_duta
System Description     : TiMOS-B-9.0.B1-12 both/mpc Nokia SAS-M 7210 Copyright
                         (c) 2000-2016 Nokia.
                         All rights reserved. All use subject to applicable
                         license agreements.
                         Built on Tue Oct 18 15:22:40 IST 2016 by builder in /
                         home/builder/9.0B1/panos/main
Capabilities Supported : bridge router
Capabilities Enabled   : bridge router

-------------------------------------------------------------------------------
```

```
LLDP Destination Addresses
-------------------------------------------------------------------------------
Index 1                : 01:80:c2:00:00:0e
Index 2                : 01:80:c2:00:00:03
Index 3                : 01:80:c2:00:00:00

-------------------------------------------------------------------------------
LLDP Remote Statistics
-------------------------------------------------------------------------------
Last Change Time       : 10/21/2016 00:08:29
Rem Table Inserts      : 0
Rem Table Deletes      : 0
Rem Table Drops        : 0
Rem Table Ageouts      : 0

-------------------------------------------------------------------------------
LLDP System Management Addresses
-------------------------------------------------------------------------------

===============================================================================
*A:hw_sasm_duta>show>system#

show system lldp neighbor

Link Layer Discovery Protocol (LLDP) System Information
===============================================================================
NB = nearest-bridge   NTPMR = nearest-non-tpmr   NC = nearest-customer
===============================================================================
Lcl Port  Scope  Remote Chassis ID   Index  Remote Port     Remote System Name
-------------------------------------------------------------------------------
1/1/2     NB     D8:1D:FF:00:00:00   1      1/2/2           cses-v29
1/1/5     NB     D8:1E:FF:00:00:00   2      1/1/4           cses-v30
1/1/7     NB     D8:1E:FF:00:00:00   3      1/1/6           cses-v30
1/1/4     NB     D8:20:FF:00:00:00   5      1/1/5           cses-v32
1/1/6     NB     D8:20:FF:00:00:00   6      1/1/7           cses-v32
1/1/1     NB     D8:1C:FF:00:00:00   9      1/2/2           cses-V28
===============================================================================
```

LAG Commands

lag

Syntax **lag** [*lag-id*] [**detail**] [**statistics**]
lag *lag-id* **associations**
lag [*lag-id*] **description**
lag [*lag-id*] **port**

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 SAS-D-[1..5]
SAS-E-[1..6]
7210 SAS-K 2F2T1C-[1..3]
7210 SAS-K 2F4T6C- [1..6]

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.

description — Displays LAG description strings.

port — Display the LAG ports

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.

Label	Description
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

On 7210 SAS-K 2F2T1C and 7210 SAS-K 2F4T6C:

```
*A:SAH01-051>show# lag 1

===============================================================================
Lag Data
===============================================================================
Lag-id         Adm     Opr     Port-Threshold   Up-Link-Count   MC Act/Stdby
-------------------------------------------------------------------------------
1              down    down    0                0               N/A
===============================================================================
*A:SAH01-051>show#
*A:SAH01-051>show# lag 1 de
detail       description
*A:SAH01-051>show# lag 1 detail

===============================================================================
LAG Details
===============================================================================
Description        : N/A
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 1                    Mode                : access
Adm                 : down                 Opr                 : down
Thres. Exceeded Cnt : 0                    Port Threshold      : 0
Thres. Last Cleared : 04/29/2014 20:51:33   Threshold Action    : down
Dynamic Cost        : false                Encap Type          : null
Configured Address  : 00:03:fa:27:15:6a    Lag-IfIndex         : 1342177281
Hardware Address    : 00:03:fa:27:15:6a
Hold-time Down      : 0.0 sec
LACP                : disabled
Uplink              : No
Standby Signaling   : lacp                 DEI Classification  : Disabled

-------------------------------------------------------------------------------
Port-id    Adm     Act/Stdby Opr     Primary Sub-group    Forced   Prio
-------------------------------------------------------------------------------
===============================================================================
*A:SAH01-051>show#
```

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 signaled 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.
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 Pri-ority	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.

Label	Description (Continued)
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.

```
*A:Dut-B# show lag 10 detail
===============================================================================
LAG Details
===============================================================================
Description : N/A
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id : 10 Mode : access
Adm : up Opr : up
Thres. Exceeded Cnt : 1 Port Threshold : 0
Thres. Last Cleared : 05/17/2009 19:33:00 Threshold Action : down
Dynamic Cost : false Encap Type : qinq
Configured Address : 00:03:fa:8d:45:d2 Lag-IfIndex : 1342177290
Hardware Address : 00:03:fa:8d:45:d2 Adapt Qos : distribute
Hold-time Down : 0.0 sec Port Type : standard
Per FP Ing Queuing : disabled
LACP : enabled Mode : active
LACP Transmit Intvl : fast LACP xmit stdby : enabled
```

```
Selection Criteria : highest-count Slave-to-partner : disabled
Number of sub-groups: 1 Forced : -
System Id : 00:03:fa:8d:44:88 System Priority : 32768
Admin Key : 32777 Oper Key : 40009
Prtr System Id : 00:03:fa:13:6f:a7 Prtr System Priority : 32768
Prtr Oper Key : 32777
MC Peer Address : 10.20.1.2 MC Peer Lag-id : 10
MC System Id : 00:02:80:01:00:0a MC System Priority : 100
MC Admin Key : 40009 MC Active/Standby : active
MC Lacp ID in use : true MC extended timeout : false
MC Selection Logic : peer decided
MC Config Mismatch : no mismatch
Source BMAC LSB : use-lacp-key Oper Src BMAC LSB : 9c:49
-------------------------------------------------------------------------------
Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio
-------------------------------------------------------------------------------
1/1/10 up active up yes 1 - 32768
-------------------------------------------------------------------------------
Port-id Role Exp Def Dist Col Syn Aggr Timeout Activity
-------------------------------------------------------------------------------
1/1/10 actor No No Yes Yes Yes Yes Yes Yes
1/1/10 partner No No Yes Yes Yes Yes Yes Yes
===============================================================================
*A:ALA-48>show# lag  1 detail
===============================================================================
LAG Details
===============================================================================
Description:
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 1                     Mode                 : access
Adm                 : up                    Opr                  : down
Thres. Exceeded Cnt : 0                     Port Threshold       : 3
Thres. Last Cleared : 02/21/2007 12:39:36   Threshold Action     : dynamic cost
Dynamic Cost        : false                 Encap Type           : null
Configured Address  : 04:67:01:01:00:01     Lag-IfIndex          : 1342177281
Hardware Address    : 14:30:ff:00:01:41     Adapt Qos            : distribute
Hold-time Down      : 0.0 sec
LACP                : enabled               Mode                 : active
LACP Transmit Intvl : fast                  LACP xmit stdby      : enabled
Selection Criteria  : highest-count         Slave-to-partner     : enabled
Number of sub-groups: 0                     Forced               : -
System Id           : 14:30:ff:00:00:00     System Priority      : 1
Admin Key           : 32768                 Oper Key             : 32666
Prtr System Id      :                       Prtr System Priority : 0
Prtr Oper Key       : 0

MC Peer Address     : 10.10.10.2            MC Peer Lag-id       : 1
MC System Id        : 00:00:00:33:33:33     MC System Priority   : 32888
MC Admin Key        : 32666                 MC Active/Standby    : active
MC Lacp ID in use   : true                  MC extended timeout  : false
MC Selection Logic  : peer timed out (no route to peer), selected local
                      subgroup
MC Config Mismatch  : no mismatch
-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced   Prio
-------------------------------------------------------------------------------
===============================================================================
```

```
*A:ALA-48>show#

*A:7210-SAS>show# lag 1 detail

===============================================================================
LAG Details
===============================================================================
Description        : N/A
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 1                     Mode                : access
Adm                 : up                    Opr                 : down
Thres. Exceeded Cnt : 0                     Port Threshold      : 1
Thres. Last Cleared : 05/31/2011 11:55:49   Threshold Action    : down
Encap Type          : null
Configured Address  : 00:25:ba:0a:33:cc     Lag-IfIndex         : 1342177281
Hardware Address    : 00:25:ba:0a:33:cc
Hold-time Down      : 0.0 sec
LACP                : disabled
Uplink              : No
Split Horizon Group : (Not Specified)

-------------------------------------------------------------------------------
Port-id        Adm     Act/Stdby Opr     Primary   Sub-group     Forced  Prio
-------------------------------------------------------------------------------
===============================================================================
*A:7210-SAS>show#

*A:PE4-M2>show# lag 1 detail

===============================================================================
LAG Details
===============================================================================
Description        : N/A
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 1                     Mode                : network
Adm                 : up                    Opr                 : up
Thres. Exceeded Cnt : 10                    Port Threshold      : 0
Thres. Last Cleared : 11/03/2016 18:38:22   Threshold Action    : down
Dynamic Cost        : false                 Encap Type          : null
Configured Address  : c4:08:41:61:61:bf     Lag-IfIndex         : 1342177281
Hardware Address    : c4:08:41:61:61:bf     Load Balancing      : default
Hold-time Down      : 0.0 sec
LACP                : enabled               Mode                : active
LACP Transmit Intvl : fast                  LACP xmit stdby     : enabled
Selection Criteria  : highest-count         Slave-to-partner    : disabled
MUX control         : coupled
Subgrp hold time    : 0.0 sec               Remaining time      : 0.0 sec
Subgrp selected     : 1                     Subgrp candidate    : -
Subgrp count        : 1
System Id           : c4:08:41:61:61:a3     System Priority     : 32768
Admin Key           : 31776                 Oper Key            : 31776
Prtr System Id      : 4c:5f:d2:c1:5d:3a     Prtr System Priority : 32768
Prtr Oper Key       : 31776
Standby Signaling   : lacp                  DEI Classification  : Disabled
```

```
-------------------------------------------------------------------------------
Port-id    Adm     Act/Stdby Opr     Primary Sub-group    Forced   Prio
-------------------------------------------------------------------------------
1/1/1      up      active    up      yes     1          -      32768
1/1/7      up      active    up              1          -      32768

-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
-------------------------------------------------------------------------------
1/1/1      actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/1      partner   No    No    Yes   Yes   Yes   Yes   Yes      No
1/1/7      actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/7      partner   No    No    Yes   Yes   Yes   Yes   Yes      No
===============================================================================
*A:PE4-M2>show#
```

LAG Statistics Output — The following table describes detailed LAG statistics output fields.

Label	Description
LAG ID	The LAG or multi-link trunk (MLT) that the port is assigned to.
Port ID	The port ID configured or displayed in the *slot/mda/port* format.
Input Bytes	The number of incoming bytes for the LAG on a per-port basis.
Input Packets	The number of incoming packets for the LAG on a per-port basis.
Output Bytes	The number of outbound bytes for the LAG on a per-port basis.
Output Packets	The number of outbound packets for the LAG on a per-port basis.
Input/Output Errors	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character- oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Totals	Displays the column totals for bytes, packets, and errors.

Sample Output

```
ALA-1# show lag statistics
===============================================================================
LAG Statistics
===============================================================================
Description:
Lag-id Port-id   Input     Input      Output    Output     Input     Output
                 Bytes     Packets    Bytes     Packets    Errors    Errors
-------------------------------------------------------------------------------
1      1/1/3     0         1006       0         2494       0         0
       1/1/4     0         435        0         401        0         0
       1/1/5     0         9968       0         9833       0         0
-------------------------------------------------------------------------------
Totals           0         11409      0         12728      0         0
===============================================================================
ALA-1#
```

LAG Associations Output — The following table describes LAG associations output fields.

Label	Description
Service ID	The service associated with the LAG.
Name	The name of the IP interface.
Encap Val	The 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 without MC-LAG Output — The following example displays LAG output without MC LAG:

```
*A:pc5# show lag 2 detail
===============================================================================
LAG Details
===============================================================================
Description:
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Lag-id              : 2                    Mode                : access
Adm                 : up                   Opr                 : up
Thres. Exceeded Cnt : 4                    Port Threshold      : 0
Thres. Last Cleared : 04/11/2007 02:03:49   Threshold Action    : down
Dynamic Cost        : false                Encap Type          : dot1q
Configured Address  : 8e:8b:ff:00:01:42    Lag-IfIndex         :
1342177282
Hardware Address    : 8e:8b:ff:00:01:42    Adapt Qos           :
distribute
Hold-time Down      : 0.0 sec
LACP                : enabled              Mode                : active
LACP Transmit Intvl : fast                 LACP xmit stdby     : enabled
Selection Criteria  : highest-count        Slave-to-partner    : disabled
Number of sub-groups: 2                    Forced              : -
System Id           : 8e:8b:ff:00:00:00    System Priority     : 32768
Admin Key           : 32768                Oper Key            : 32768
Prtr System Id      : 8e:89:ff:00:00:00    Prtr System Priority : 32768
Prtr Oper Key       : 32768
-------------------------------------------------------------------------------
Port-id        Adm    Act/Stdby Opr    Primary   Sub-group     Forced
Prio
```

```
-------------------------------------------------------------------------------
1/1/1          up     active    up     yes       7             -        99
1/1/2          up     standby   down             8             -        100
-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout
Activity
-------------------------------------------------------------------------------
1/1/1          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/1          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/2          actor     No    No    No    No    No    Yes   Yes      Yes
1/1/2          partner   No    No    No    No    Yes   Yes   Yes      Yes
===============================================================================
*A:pc5#
```

Port Monitor Commands

port

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

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

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 SAS-D-1..5
SAS-E-1..6
7210 SAS-K 2F2T1C-1..3
7210 SAS-K 2F4T6C-1..6

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

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.

Values

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.

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

Note: The information presented is subject to change without notice.

Nokia assumes no responsibility for inaccuracies contained herein.

M(A,N) means 7210 SAS-M in both Access-uplink mode and Network mode; Similarly M(N) means 7210 SAS-M in network mode only

T(A,N) means 7210 SAS-M in both Access-uplink mode and Network mode; Similarly T(N) means 7210 SAS-T in network mode only

K5 means 7210 SAS-K 2F2T1C

K12 means 7210 SAS-K 2F4T6C

Sx/S-1/10GE means all variants of 7210 SAS-Sx 1/10GE and 7210 SAS-S 1/10GE platforms

Sx-1/10GE means only the variants of 7210 SAS-Sx 1/10G

R6 means 7210 SAS-R6

R12 means 7210 SAS-R12

D means 7210 SAS-D and 7210 SAS-D ETR; if a line item applies to 7210 SAS-D ETR, then it is indicated as D-ETR

E means 7210 SAS-E

X means 7210 SAS-X

BGP

draft-ietf-idr-add-paths-04, Advertisement of Multiple Paths in BGP is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-sidr-origin-validation-signaling-04, BGP Prefix Origin Validation State Extended Community is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1772, Application of the Border Gateway Protocol in the Internet is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1997, BGP Communities Attribute is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2385, Protection of BGP Sessions via the TCP MD5 Signature Option is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2439, BGP Route Flap Damping is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2545, Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2858, Multiprotocol Extensions for BGP-4 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2918, Route Refresh Capability for BGP-4 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx-10/100GE, R6, and R12

RFC 3107, Carrying Label Information in BGP-4 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3392, Capabilities Advertisement with BGP-4 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4271, A Border Gateway Protocol 4 (BGP-4) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4360, BGP Extended Communities Attribute is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4364, BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4456, BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4659, BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4724, Graceful Restart Mechanism for BGP (Helper Mode) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4760, Multiprotocol Extensions for BGP-4 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4798, Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4893, BGP Support for Four-octet AS Number Space is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5004, Avoid BGP Best Path Transitions from One External to Another is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5291, Outbound Route Filtering Capability for BGP-4 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5668, 4-Octet AS Specific BGP Extended Community is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6811, Prefix Origin Validation is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Circuit Emulation

RFC 4553, Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) is supported on M(N)

RFC 5086, Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN) is supported on M(N)

RFC 5287, Control Protocol Extensions for the Setup of Time-Division Multiplexing (TDM) Pseudowires in MPLS Networks is supported on M(N)

Ethernet

IEEE 802.1AB, Station and Media Access Control Connectivity Discovery is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1ad, Provider Bridges is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, R6, and R12

IEEE 802.1ag, Connectivity Fault Management is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1ah, Provider Backbone Bridges is supported on M(N), X, and T(N)

IEEE 802.1ax, Link Aggregation is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1D, MAC Bridges is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1p, Traffic Class Expediting is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1Q, Virtual LANs is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1s, Multiple Spanning Trees is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1w, Rapid Reconfiguration of Spanning Tree is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.1X, Port Based Network Access Control is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3ab, 1000BASE-T is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3ac, VLAN Tag is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3ad, Link Aggregation is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3ae, 10 Gb/s Ethernet is supported on M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3ah, Ethernet in the First Mile is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3ba, 40 Gb/s and 100 Gb/s Ethernet is supported on R6 and R12

IEEE 802.3i, Ethernet is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3u, Fast Ethernet is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 802.3z, Gigabit Ethernet is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8032, Ethernet Ring Protection Switching is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T Y.1731, OAM functions and mechanisms for Ethernet based networks is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Fast Reroute

draft-ietf-rtgwg-lfa-manageability-08, Operational management of Loop Free Alternates is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5286, Basic Specification for IP Fast Reroute: Loop-Free Alternates is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IP — General

draft-grant-tacacs-02, The TACACS+ Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 768, User Datagram Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 793, Transmission Control Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 854, TELNET Protocol Specifications is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 951, Bootstrap Protocol (BOOTP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1034, Domain Names - Concepts and Facilities is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1035, Domain Names - Implementation and Specification is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1350, The TFTP Protocol (revision 2) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1534, Interoperation between DHCP and BOOTP is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1542, Clarifications and Extensions for the Bootstrap Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2131, Dynamic Host Configuration Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2347, TFTP Option Extension is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2348, TFTP Blocksize Option is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2349, TFTP Timeout Interval and Transfer Size Options is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2428, FTP Extensions for IPv6 and NATs is supported on D, E, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2865, Remote Authentication Dial In User Service (RADIUS) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2866, RADIUS Accounting is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3046, DHCP Relay Agent Information Option (Option 82) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3596, DNS Extensions to Support IP version 6 is supported on D, E, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3768, Virtual Router Redundancy Protocol (VRRP) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4250, The Secure Shell (SSH) Protocol Assigned Numbers is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4251, The Secure Shell (SSH) Protocol Architecture is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4254, The Secure Shell (SSH) Connection Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4632, Classless Inter-domain Routing (CIDR): The Internet Address Assignment and Aggregation Plan is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5880, Bidirectional Forwarding Detection (BFD) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5881, Bidirectional Forwarding Detection (BFD) IPv4 and IPv6 (Single Hop) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5883, Bidirectional Forwarding Detection (BFD) for Multihop Paths is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6528, Defending against Sequence Number Attacks is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IP — Multicast

RFC 1112, Host Extensions for IP Multicasting is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2236, Internet Group Management Protocol, Version 2 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3306, Unicast-Prefix-based IPv6 Multicast Addresses is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3376, Internet Group Management Protocol, Version 3 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3446, Anycast Rendevous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4601, Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4604, Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4607, Source-Specific Multicast for IP is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4608, Source-Specific Protocol Independent Multicast in 232/8 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4610, Anycast-RP Using Protocol Independent Multicast (PIM) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5059, Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5384, The Protocol Independent Multicast (PIM) Join Attribute Format is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6513, Multicast in MPLS/BGP IP VPNs is supported on T(N), Mxp, R6, and R12

RFC 6514, BGP Encodings and Procedures for Multicast in MPLS/IP VPNs is supported on T(N), Mxp, R6, and R12

RFC 6515, IPv4 and IPv6 Infrastructure Addresses in BGP Updates for Multicast VPNs is supported on T(N), Mxp, R6, and R12

RFC 6625, Wildcards in Multicast VPN Auto-Discover Routes is supported on T(N), Mxp, R6, and R12

RFC 6826, Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Path is supported on T(N), Mxp, R6, and R12

RFC 7385, IANA Registry for P-Multicast Service Interface (PMSI) Tunnel Type Code Points is supported on T(N), Mxp, R6, and R12

IP — Version 4

RFC 791, Internet Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 792, Internet Control Message Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 826, An Ethernet Address Resolution Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1519, Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1812, Requirements for IPv4 Routers is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1981, Path MTU Discovery for IP version 6 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2401, Security Architecture for Internet Protocol is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2460, Internet Protocol, Version 6 (IPv6) Specification is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IP — Version 6

RFC 2464, Transmission of IPv6 Packets over Ethernet Networks is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3021, Using 31-Bit Prefixes on IPv4 Point-to-Point Links is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3122, Extensions to IPv6 Neighbor Discovery for Inverse Discovery Specification is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3587, IPv6 Global Unicast Address Format is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4007, IPv6 Scoped Address Architecture is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4193, Unique Local IPv6 Unicast Addresses is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4291, Internet Protocol Version 6 (IPv6) Addressing Architecture is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4443, Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4861, Neighbor Discovery for IP version 6 (IPv6) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4862, IPv6 Stateless Address Autoconfiguration (Router Only) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5095, Deprecation of Type 0 Routing Headers in IPv6 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5952, A Recommendation for IPv6 Address Text Representation is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6106, IPv6 Router Advertisement Options for DNS Configuration is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6164, Using 127-Bit IPv6 Prefixes on Inter-Router Links is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IPsec

RFC 2401, Security Architecture for the Internet Protocol is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2406, IP Encapsulating Security Payload (ESP) is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IS-IS

draft-ietf-isis-mi-02, IS-IS Multi-Instance is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-kaplan-isis-ext-eth-02, Extended Ethernet Frame Size Support is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ISO/IEC 10589:2002, Second Edition, Nov. 2002, Intermediate system to Intermediate system intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1195, Use of OSI IS-IS for Routing in TCP/IP and Dual Environments is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3359, Reserved Type, Length and Value (TLV) Codepoints in Intermediate System to Intermediate System is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3719, Recommendations for Interoperable Networks using Intermediate System to Intermediate System (IS-IS) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3787, Recommendations for Interoperable IP Networks using Intermediate System to Intermediate System (IS-IS) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4971, Intermediate System to Intermediate System (IS-IS) Extensions for Advertising Router Information is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5120, M-ISIS: Multi Topology (MT) Routing in IS-IS is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5130, A Policy Control Mechanism in IS-IS Using Administrative Tags is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5301, Dynamic Hostname Exchange Mechanism for IS-IS is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5302, Domain-wide Prefix Distribution with Two-Level IS-IS is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5303, Three-Way Handshake for IS-IS Point-to-Point Adjacencies is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5304, IS-IS Cryptographic Authentication is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5305, IS-IS Extensions for Traffic Engineering TE is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5306, Restart Signaling for IS-IS (Helper Mode) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5308, Routing IPv6 with IS-IS is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5309, Point-to-Point Operation over LAN in Link State Routing Protocols is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5310, IS-IS Generic Cryptographic Authentication is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6232, Purge Originator Identification TLV for IS-IS is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6233, IS-IS Registry Extension for Purges is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Management

draft-ieft-snmpv3-update-mib-05, Management Information Base (MIB) for the Simple Network Management Protocol (SNMP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-idr-bgp4-mib-05, Definitions of Managed Objects for the Fourth Version of Border Gateway Protocol (BGP-4) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-isis-wg-mib-06, Management Information Base for Intermediate System to Intermediate System (IS-IS) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-mpls-ldp-mib-07, Definitions of Managed Objects for the Multiprotocol Label Switching, Label Distribution Protocol (LDP) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-mpls-lsr-mib-06, Multiprotocol Label Switching (MPLS) Label Switching Router (LSR) Management Information Base Using SMIv2 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-mpls-te-mib-04, Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-ospf-mib-update-08, OSPF Version 2 Management Information Base is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ianaaddressfamilynumbers-mib, IANA-ADDRESS-FAMILY-NUMBERS-MIB is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ianaiftype-mib, IANAifType-MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ianaiprouteprotocol-mib, IANA-RTPROTO-MIB is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE8021-CFM-MIB, IEEE P802.1ag(TM) CFM MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE8021-PAE-MIB, IEEE 802.1X MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE8023-LAG-MIB, IEEE 802.3ad MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

LLDP-MIB, IEEE P802.1AB(TM) LLDP MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1157, A Simple Network Management Protocol (SNMP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1215, A Convention for Defining Traps for use with the SNMP is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1724, RIP Version 2 MIB Extension is supported on Mxp

RFC 2021, Remote Network Monitoring Management Information Base Version 2 using SMIv2 is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2115, Management Information Base for Frame Relay DTEs Using SMIv2 is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2138, Remote Authentication Dial In User Service (RADIUS) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2206, RSVP Management Information Base using SMIv2 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2213, Integrated Services Management Information Base using SMIv2 is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2494, Definitions of Managed Objects for the DS0 and DS0 Bundle Interface Type is supported on M(N)

RFC 2571, An Architecture for Describing SNMP Management Frameworks is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2572, Message Processing and Dispatching for the Simple Network Management Protocol (SNMP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2573, SNMP Applications is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2574, User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2575, View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2578, Structure of Management Information Version 2 (SMIv2) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2579, Textual Conventions for SMIv2 is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2787, Definitions of Managed Objects for the Virtual Router Redundancy Protocol is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2819, Remote Network Monitoring Management Information Base is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2856, Textual Conventions for Additional High Capacity Data Types is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2863, The Interfaces Group MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2864, The Inverted Stack Table Extension to the Interfaces Group MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2933, Internet Group Management Protocol MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3014, Notification Log MIB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3164, The BSD syslog Protocol is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3165, Definitions of Managed Objects for the Delegation of Management Scripts is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3231, Definitions of Managed Objects for Scheduling Management Operations is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3273, Remote Network Monitoring Management Information Base for High Capacity Networks is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3416. Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3417, Transport Mappings for the Simple Network Management Protocol (SNMP) (SNMP over UDP over IPv4) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3419, Textual Conventions for Transport Addresses is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3584, Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3593, Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals is supported on K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3635, Definitions of Managed Objects for the Ethernet-like Interface Types is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3826, The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3877, Alarm Management Information Base (MIB) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3895, Definitions of Managed Objects for the DS1, E1, DS2, and E2 Interface Types is supported on M(N)

RFC 4001, Textual Conventions for Internet Network Addresses is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4022, Management Information Base for the Transmission Control Protocol (TCP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4113, Management Information Base for the User Datagram Protocol (UDP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4220, Traffic Engineering Link Management Information Base is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4292, IP Forwarding Table MIB is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4293, Management Information Base for the Internet Protocol (IP) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6241, Network Configuration Protocol (NETCONF) is supported on K5, K12, R6, and R12

RFC 6242, Using the NETCONF Protocol over Secure Shell (SSH) is supported on K5, K12, R6, and R12

MPLS — General

RFC 3031, Multiprotocol Label Switching Architecture is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3032, MPLS Label Stack Encoding is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3443, Time To Live (TTL) Processing in Multi-Protocol Label Switching (MPLS) Networks is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4182, Removing a Restriction on the use of MPLS Explicit NULL is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5332, MPLS Multicast Encapsulations is supported on T(N), Mxp, R6, and R12

MPLS — GMPLS

draft-ietf-ccamp-rsvp-te-srlg-collect-04, RSVP-TE Extensions for Collecting SRLG Information is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

MPLS — LDP

draft-pdutta-mpls-ldp-adj-capability-00, LDP Adjacency Capabilities is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-pdutta-mpls-ldp-v2-00, LDP Version 2 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-pdutta-mpls-tldp-hello-reduce-04, Targeted LDP Hello Reduction is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3037, LDP Applicability is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3478, Graceful Restart Mechanism for Label Distribution Protocol (Helper Mode) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5036, LDP Specification is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5283, LDP Extension for Inter-Area Label Switched Paths (LSPs) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5443, LDP IGP Synchronization is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5561, LDP Capabilities is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6388, Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

MPLS — MPLS-TP

RFC 5586, MPLS Generic Associated Channel is supported on T(N), R6, and R12

RFC 5921, A Framework for MPLS in Transport Networks is supported on T(N), R6, and R12

RFC 5960, MPLS Transport Profile Data Plane Architecture is supported on T(N), R6, and R12

RFC 6370, MPLS Transport Profile (MPLS-TP) Identifiers is supported on T(N), R6, and R12

RFC 6378, MPLS Transport Profile (MPLS-TP) Linear Protection is supported on T(N), R6, and R12

RFC 6426, MPLS On-Demand Connectivity and Route Tracing is supported on T(N), R6, and R12

RFC 6428, Proactive Connectivity Verification, Continuity Check and Remote Defect indication for MPLS Transport Profile is supported on T(N), R6, and R12

RFC 6478, Pseudowire Status for Static Pseudowires is supported on T(N), R6, and R12

RFC 7213, MPLS Transport Profile (MPLS-TP) Next-Hop Ethernet Addressing is supported on T(N), R6, and R12

MPLS — OAM

RFC 6424, Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6425, Detecting Data Plane Failures in Point-to-Multipoint Multiprotocol Label Switching (MPLS) - Extensions to LSP Ping is supported on T(N), Mxp, R6, and R12

MPLS — RSVP-TE

RFC 2702, Requirements for Traffic Engineering over MPLS is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2747, RSVP Cryptographic Authentication is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2961, RSVP Refresh Overhead Reduction Extensions is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3097, RSVP Cryptographic Authentication -- Updated Message Type Value is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3209, RSVP-TE: Extensions to RSVP for LSP Tunnels is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3477, Signalling Unnumbered Links in Resource ReSerVation Protocol - Traffic Engineering (RSVP-TE) is supported on M(N), T(N), X, Mxp, R6, and R12

RFC 4090, Fast Reroute Extensions to RSVP-TE for LSP Tunnels is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4561, Definition of a Record Route Object (RRO) Node-Id Sub-Object is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4875, Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs) is supported on T(N), Mxp, R6, and R12

RFC 4950, ICMP Extensions for Multiprotocol Label Switching is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5712, MPLS Traffic Engineering Soft Preemption is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5817, Graceful Shutdown in MPLS and Generalized MPLS Traffic Engineering Networks is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

OSPF

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1765, OSPF Database Overflow is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2328, OSPF Version 2 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3101, The OSPF Not-So-Stubby Area (NSSA) Option is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3509, Alternative Implementations of OSPF Area Border Routers is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3623, Graceful OSPF Restart Graceful OSPF Restart (Helper Mode) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3630, Traffic Engineering (TE) Extensions to OSPF Version 2 is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4222, Prioritized Treatment of Specific OSPF Version 2 Packets and Congestion Avoidance is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4552, Authentication/Confidentiality for OSPFv3 is supported on M(N), T(N), X, Mxp, R6, and R12

RFC 4576, Using a Link State Advertisement (LSA) Options Bit to Prevent Looping in BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4577, OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4970, Extensions to OSPF for Advertising Optional Router Capabilities is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5185, OSPF Multi-Area Adjacency is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5187, OSPFv3 Graceful Restart (Helper Mode) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5243, OSPF Database Exchange Summary List Optimization is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5250, The OSPF Opaque LSA Option is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5309, Point-to-Point Operation over LAN in Link State Routing Protocols is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5340, OSPF for IPv6 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5838, Support of Address Families in OSPFv3 is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6987, OSPF Stub Router Advertisement is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Pseudowire

draft-ietf-l2vpn-vpws-iw-oam-04, OAM Procedures for VPWS Interworking is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3916, Requirements for Pseudo- Wire Emulation Edge-to-Edge (PWE3) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3985, Pseudo Wire Emulation Edge-to-Edge (PWE3) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4385, Pseudo Wire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4446, IANA Allocations for Pseudowire Edge to Edge Emulation (PWE3) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4447, Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4448, Encapsulation Methods for Transport of Ethernet over MPLS Networks is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5659, An Architecture for Multi-Segment Pseudowire Emulation Edge-to-Edge is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6073, Segmented Pseudowire is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6310, Pseudowire (PW) Operations, Administration, and Maintenance (OAM) Message Mapping is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6391, Flow-Aware Transport of Pseudowires over an MPLS Packet Switched Network is supported on Mxp, R6, and R12

RFC 6718, Pseudowire Redundancy is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6870, Pseudowire Preferential Forwarding Status bit is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 7023, MPLS and Ethernet Operations, Administration, and Maintenance (OAM) Interworking is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 7267, Dynamic Placement of Multi-Segment Pseudowires is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Quality of Service

RFC 2430, A Provider Architecture for Differentiated Services and Traffic Engineering (PASTE) is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2474, Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 2598, An Expedited Forwarding PHB is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3140, Per Hop Behavior Identification Codes is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 3260, New Terminology and Clarifications for Diffserv is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RIP

RFC 1058, Routing Information Protocol is supported on Mxp

RFC 2082, RIP-2 MD5 Authentication is supported on Mxp

RFC 2453, RIP Version 2 is supported on Mxp

Timing

GR-1244-CORE, Clocks for the Synchronized Network: Common Generic Criteria, Issue 3, May 2005 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

GR-253-CORE, SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 1588-2008, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx-1/10GE, R6, and R12

ITU-T G.781, Synchronization layer functions, issued 09/2008 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.813, Timing characteristics of SDH equipment slave clocks (SEC), issued 03/2003 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8261, Timing and synchronization aspects in packet networks, issued 04/2008 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8262, Timing characteristics of synchronous Ethernet equipment slave clock (EEC), issued 08/2007 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8264, Distribution of timing information through packet networks, issued 10/2008 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8265.1, Precision time protocol telecom profile for frequency synchronization, issued 10/2010 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx-1/10GE, R6, and R12

ITU-T G.8275.1, Precision time protocol telecom profile for phase/time synchronization with full timing support from the network, issued 07/2014 is supported on X, Mxp, R6, and R12

RFC 5905, Network Time Protocol Version 4: Protocol and Algorithms Specification is supported on D, E, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

VPLS

RFC 4761, Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4762, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5501, Requirements for Multicast Support in Virtual Private LAN Services is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 6074, Provisioning, Auto-Discovery, and Signaling in Layer 2 Virtual Private Networks (L2VPNs) is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

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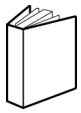

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