7210 Service Access System

Release 24.9.R1

7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide

3HE 20129 AAAB TQZZA
Edition: 01
September 2024

Nokia is committed to diversity and inclusion. We are continuously reviewing our customer documentation and consulting with standards bodies to ensure that terminology is inclusive and aligned with the industry. Our future customer documentation will be updated accordingly.

Table of contents

List of tables

List of figures

1 Getting started

This chapter provides process flow information to configure cards and ports, and also provides an overview of the document organization, content, and terminology used in this guide.

1.1 About this guide

This guide describes system concepts and provides configuration examples to provision cards, MDAs, and ports on the following 7210 SAS platforms, operating in one of the modes described in Table 1: Supported modes of operation and configuration methods . If multiple modes of operation apply, they are explicitly noted in the topic.

Note:
Unless explicitly noted otherwise, this guide uses 7210 SAS-Dxp to refer to the 7210 SAS-Dxp 12p, 7210 SAS-Dxp 16p, and 7210 SAS-Dxp 24p platforms.

- 7210 SAS-D
- 7210 SAS-Dxp 12p (2SFP+ 4SFP 6Tx)
- 7210 SAS-Dxp 16p (2SFP+ 4SFP 10Tx)
- 7210 SAS-Dxp 24p (2SFP+ 6SFP 16Tx)
- 7210 SAS-K 2F1C2T
- 7210 SAS-K 2F6C4T
- 7210 SAS-K 3SFP+ 8C

See 7210 SAS modes of operation for information about the modes of operation supported by the 7210 SAS product family.

Note:
Unless explicitly noted otherwise, the phrase "Supported on all 7210 SAS platforms described in this document" is used to indicate that the topic and CLI commands apply to all the 7210 SAS platforms in the following list, when operating in the specified modes only.

- access-uplink mode of operation

  7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

- network mode of operation

  7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

When configured in the access-uplink or network mode of operation, the 7210 SAS platform implicitly operates in the standalone mode.

1.1.1 Document structure and content

This guide uses the following structure to describe card and port configuration content:

Note:
This guide generically covers Release 24.*x*.R*x* content and may include some content that will be released in later maintenance loads. See the *7210 SAS Software Release Notes 24.x.Rx*, part number 3HE 20148 000*x* TQZZA, for information about features supported in each load of the Release 24.*x*.R*x* software.

- This guide is organized into functional chapters and provides concepts and descriptions of the implementation flow. Each chapter describes a software area and provides CLI syntax and command usage to configure parameters for the functional area.
- Command outputs shown in this guide are examples only; actual displays may differ depending on supported functionality and user configuration.
- See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for boot options to configure the satellite mode of operation on the router. See the 7750 SR software user guides for information about service and protocol provisioning, and operating the 7210 SAS router in satellite mode.
- Unless explicitly noted, the CLI commands and their configuration is similar for both network and access-uplink operating modes for features applicable to both modes of operation.

1.2 7210 SAS modes of operation

Unless explicitly noted, the phrase "mode of operation" and "operating mode" refers to the current operating mode of the 7210 SAS router. Each operating mode provides configuration access to a specific group of CLI commands.

Note:
Not all CLI commands are supported on all 7210 SAS platforms in all modes of operation. Users can only configure CLI commands supported by the current operating mode of the router. See the *7210 SAS Software Release Notes 24.x.Rx*, part number 3HE 20148 000*x* TQZZA, and the appropriate 7210 SAS software user guide for information about features and capabilities supported by a 7210 SAS platform when operating in a specific mode.

The following modes of operation are supported by the 7210 SAS product family:

- **access-uplink**

  In the access-uplink operating mode, the 7210 SAS router uplinks to the network using Layer 2 Ethernet VLAN switching (without IP/MPLS).

  Platforms Supported: 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-T

- **network**

  In the network operating mode, the 7210 SAS router uses IP/MPLS uplinks to the network. The IP routing protocols and MPLS functionality is available; see the appropriate 7210 SAS software user guide for more information about supported features.

Platforms Supported: 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, and 7210 SAS-T

- **satellite**

  In the satellite operating mode, the 7210 SAS platform uses high-capacity uplinks (for example, 10GE ports on the 7210 SAS-Mxp and 100GE ports on the 7210 SAS-Sx 10/100GE) to connect to the 7750 SR host. The 7210 SAS router is managed by the 7750 SR host. There is no direct CLI access to the satellite node, and all services and protocols are configured on the host.

  Platforms Supported: 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE

- **standalone**

  In the standalone operating mode, the 7210 SAS platform supports IP/MPLS uplinks. It is operated and managed independently.

  The functionality and features available on the standalone 7210 SAS platform are similar to the network operating mode. The standalone mode is primarily used to differentiate between a node being managed by the 7750 SR host (in the satellite operating mode), and a node managed independently (standalone operating mode).

  Platforms Supported: 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE

- **standalone-VC**

  In the standalone-VC operating mode, a set of 7210 SAS devices are stacked to provide larger 1GE/10GE port density and control-plane redundancy. The stack of nodes is provisioned and managed as a single chassis, and not as individual nodes.

  The functionality and features available on the 7210 SAS platform are similar to the network operating mode, with additional capabilities, such as control-plane redundancy with non-stop routing and non-stop services.

  Platforms Supported: 7210 SAS-Sx/S 1/10GE

For 7210 SAS platforms that support multiple explicit modes of operation (Table 1: Supported modes of operation and configuration methods), the operating mode must be configured in the Boot Option File (BOF) to ensure the router boots up in the specified mode. For example, the 7210 SAS-T supports access-uplink and network modes of operation, and the 7210 SAS-Sx/S 1/10GE supports satellite, standalone, and standalone-VC mode of operations. In some cases, the 7210 SAS router operates in a specific mode implicitly, and explicit configuration is not required.

See the appropriate *Basic System Configuration Guide* for boot options and information about how to boot the 7210 SAS platform in a specific operating mode.

The following table lists the supported modes of operation and the configuration methods for the 7210 SAS platforms. Unless explicitly noted otherwise, the operating mode is supported on all variants of the specific 7210 SAS platform.

Table 1: Supported modes of operation and configuration methods

7210 SAS platform	Mode of operation and configuration method				
	Network	Access-uplink	Standalone	Standalone-VC	Satellite
7210 SAS-D		Implicit	Implicit		
7210 SAS-Dxp		Implicit	Implicit		

7210 SAS platform	Mode of operation and configuration method				
	Network	Access-uplink	Standalone	Standalone-VC	Satellite
7210 SAS-K 2F1C2T		Implicit	Implicit		
7210 SAS-K 2F6C4T[1]	Port Mode Configuration[2]	Port Mode Configuration[2]	Implicit		
7210 SAS-K 3SFP+ 8C[1]	Port Mode Configuration[2]	Port Mode Configuration[2]	Implicit		
7210 SAS-Mxp	Implicit[3]		Explicit BOF Configuration		Explicit BOF Configuration
7210 SAS-R6[4]	Implicit		Implicit		
7210 SAS-R12[4]	Implicit		Implicit		
7210 SAS-Sx/S 1/10GE	Implicit[3]		Explicit BOF Configuration	Explicit BOF Configuration	Explicit BOF Configuration
7210 SAS-Sx 10/100GE	Implicit[3]		Explicit BOF Configuration		Explicit BOF Configuration
7210 SAS-T	Explicit BOF Configuration	Explicit BOF Configuration	Implicit		

1.3 7210 SAS port modes

Unless explicitly noted, the phrase "port mode" refers to the current port configuration of the 7210 SAS node. The 7210 SAS platform supports the configuration of the following port modes:

- **access port mode**

  Access ports are configured for customer-facing traffic if Service Access Points (SAPs) are required. The appropriate encapsulation type must be configured to distinguish the services on the port; services are configured on the port based on the encapsulation value.

  Access ports can be configured on all the 7210 SAS platforms.

- **access-uplink port mode**

1 By default, the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C boot up in the network mode of operation. These platforms also allow the use of access-uplink port mode (without explicit BOF configuration), which provides the option to use Layer 2 uplinks instead of IP/MPLS uplinks to the network core, similar to the 7210 SAS-K 2F1C2T router.

2 See section 7210 SAS port modes for information about port mode configuration

3 Implicitly operates in network mode when standalone mode of operation is configured

4 Supports MPLS uplinks only and implicitly operates in network mode

Access-uplink ports provide native Ethernet connectivity in service provider transport or in an infrastructure network. 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 uplink port.

This is the default port mode of a 7210 SAS node in the access-uplink mode of operation.

- **network port mode**

  Network ports are configured for network-facing traffic in the service provider transport or infrastructure network, and provide IP/MPLS uplinks.

  This is the default port mode of a 7210 SAS node in the network or standalone mode of operation.

- **hybrid port mode**

  Hybrid ports are configured for access and network facing traffic, and allow a single port to operate in both access and network modes.

Port modes available for configuration on a 7210 SAS node are determined by the current mode of operation of the router.

Note:
The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C are unique; all port modes listed in Table 2: Supported port modes by mode of operation are available for configuration on the router, regardless of the current mode of operation.

The following table lists the port mode configuration support per 7210 SAS mode of operation.

Table 2: Supported port modes by mode of operation

Mode of operation	Supported port mode			
	Access	Network	Hybrid	Access-uplink
Access-Uplink	✓			✓
Network	✓	✓	✓	
Satellite[5] [6]				
Standalone	✓	✓	✓	
Standalone-VC	✓	✓	✓	

The following table lists the port mode configuration supported by the 7210 SAS product family. See the appropriate *Interface Configuration Guide* for more information about configuring the port modes for a specific platform.

5 Port modes are configured on the 7750 SR

6 host and managed by the host.

Table 3: 7210 SAS platforms supporting port modes

Platform	Port mode			
	Access	Network	Hybrid	Access-uplink
7210 SAS-D	Yes	No	No	Yes
7210 SAS-Dxp	Yes	No	No	Yes
7210 SAS-K 2F1C2T	Yes	No	No	Yes
7210 SAS-K 2F6C4T	Yes	Yes	Yes	Yes
7210 SAS-K 3SFP+ 8C	Yes	Yes	Yes	Yes
7210 SAS-Mxp	Yes	Yes	Yes	No
7210 SAS-R6 IMM-b (IMMv2)	Yes	Yes	Yes	No
7210 SAS-R6 IMM-c 100GE (IMM-c 1QSFP28)	Yes	Yes	Yes	No
7210 SAS-R12 IMM-b	Yes	Yes	Yes	No
7210 SAS-R12 IMM-c 100GE (IMM-c 1QSFP28)	Yes	Yes	Yes	No
7210 SAS-Sx/S 1/10GE	Yes	Yes	Yes	No
7210 SAS-Sx 10/100GE	Yes	Yes	Yes	No
7210 SAS-T	Yes	Yes[7]	Yes[8]	Yes[9]

1.4 Interface configuration process

The following table describes the tasks necessary to configure cards 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.

7 Network ports are supported only if the node is operating in network mode.

8 Hybrid ports are supported only if the node is operating in network mode.

9 Access-uplink ports are supported only if the node is operating in access-uplink mode.

Table 4: Configuration process

Area	Task	Chapter
Provisioning	Chassis slots and cards	Chassis slots and cards
	Ports	Ports
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and protocol support

1.5 Conventions

This section describes the general conventions used in this guide.

1.5.1 Precautionary and information messages

The following information symbols are used in the documentation.

DANGER: Danger warns that the described activity or situation may result in serious personal injury or death. An electric shock hazard could exist. Before you begin work on this equipment, be aware of hazards involving electrical circuitry, be familiar with networking environments, and implement accident prevention procedures.

WARNING: Warning indicates that the described activity or situation may, or will, cause equipment damage, serious performance problems, or loss of data.

Caution: Caution indicates that the described activity or situation may reduce your component or system performance.

Note: Note provides additional operational information.

Tip: Tip provides suggestions for use or best practices.

1.5.2 Options or substeps in procedures and sequential workflows

Options in a procedure or a sequential workflow are indicated by a bulleted list. In the following example, at step 1, the user must perform the described action. At step 2, the user must perform one of the listed options to complete the step.

Example: Options in a procedure

1. User must perform this step.
2. This step offers three options. User must perform one option to complete this step:
   - This is one option.

- This is another option.
- This is yet another option.

Substeps in a procedure or a sequential workflow are indicated by letters. In the following example, at step 1, the user must perform the described action. At step 2, the user must perform two substeps (a. and b.) to complete the step.

Example: Substeps in a procedure

1. User must perform this step.
2. User must perform all substeps to complete this action:
   a. This is one substep.
   b. This is another substep.

2 7210 SAS interfaces

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

2.1 Configuration overview

Note:
This document uses the term preprovisioning in the context of preparing or preconfiguring entities such as chassis slots, media dependent adapters (MDAs), ports, and interfaces, before initialization. These entities can be installed but not enabled. When the entity is in a **no shutdown** state (administratively enabled), the entity is considered to be provisioned.

The 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C and the variants are platforms with a fixed port configuration, and no expansion slots. The 7210 SAS software inherits the concept of CPM, IOM and MDA from the 7750 SR to represent the hardware logically. These components are fixed and are not removable. The software creates two logical cards to represent the CPM and IOM and these are preprovisioned on boot-up. The IOM card is modeled with a single MDA, a logical entity to represent the fixed ports on the system. This MDA is auto-provisioned on boot-up and the user does not need to provision it. Ports and interfaces can also be preprovisioned.

2.1.1 Chassis slots and cards

- The 7210 SAS-D supports the following ports:
  - 6 × 10/100/1000 SFP ports
  - 4 × 10/100/1000 Base-T ports
  - 1 management console port
- The 7210 SAS-Dxp supports the following ports:
  - 2 × 1GE/10GE SFP+ ports
  - 6 × 10/100/1000 Base-T ports
  - 4 × 100/1000 SFP ports
  - 1 management console port
- The 7210 SAS-K 2F1C2T supports the following ports:
  - 2 × 10/100/1000 Base-T fixed copper ports
  - 1 management console port
- The 7210 SAS-K 2F6C4T supports the following ports:
  - 2 × 100/1000 SFP ports
  - 4 × 10/100/1000 Base-T fixed copper ports
  - 6 Combo ports (100/1000 SFP or 10/100/1000 Base-T)

  - 1 management console port
- The 7210 SAS-K 3SFP+ 8C ports supports the following ports:
  - 3 × 10GE SFP+ ports
  - 8 Combo ports (100/1000 SFP or 10/100/1000 Base-T)
  - 1 management console port

The 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C have a set of fixed ports. The software preprovisions the cards on bootup.

The **show card** command lists the cards auto-provisioned on 7210 SAS platforms.

Example

The following **show card** sample output lists the cards auto-provisioned on the 7210 SAS-D.

```
A:dut-b#
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:dut-b#
```

Example

The following **show card** sample output lists the cards auto-provisioned on the 7210 SAS-Dxp.

```
A:dut-m#
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:dut-m#
```

Example

The following **show card** sample output lists the cards auto-provisioned on the 7210 SAS-K 2F1C2T.

```
A:dut-i#
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:dut-i#
```

Example

The following **show card** sample output lists the cards auto-provisioned on the 7210 SAS-K 2F6C4T:

```
A:dut-k#
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:dut-k#
```

Example

The following **show card** sample output lists the cards auto-provisioned on the 7210 SAS-K 3SFP+ 8C.

```
A:dut-l#
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:dut-l#
```

2.2 Digital Diagnostics Monitoring

Some Nokia SFPs, XFPs, and the MSA DWDM transponder support the Digital Diagnostics Monitoring (DDM) capability, which allows the transceiver module to maintain information about its working status in device registers, including:

- temperature
- supply voltage
- transmit (Tx) bias current
- Tx output power
- received (Rx) optical power

Note:
The optical transceiver DDM feature provides real-time values for guidance. For the specific values, the optical power data provides an accuracy of ±3 dB or better. The accuracy of this data is defined in the relevant standard for the transceiver type, such as SFF-8472 for SFP+. Use an

optical power meter where precise optical power data is required. Contact your Nokia technical support representative for further assistance or clarification.

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.

No CLI command configuration is required to support 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 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 wanted 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.

The following table describes supported real-time DDM features.

Table 5: 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 following table describes supported factory-programmed DDM alarms and warnings.

Table 6: 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	parameter dependent	No	Yes	Yes	No

Parameter	SFP/XFP units	SFP	XFP	Required?	MSA DWDM
- High Alarm - Low Alarm - High Warning - Low Warning	(embedded in transceiver)				

2.2.1 SFPs and XFPs

The availability of the DDM real-time information and the warning and alarm status is based on the transceiver. The transceiver may or may not indicate that DDM is supported. Although some Nokia SFPs support DDM, Nokia SFPs support DDM releases later than Release 2.0. Contact a Nokia technical support representative for more information about DDM support for specific 7210 SAS releases. Non-DDM and DDM-supported SFPs are distinguished by a specific value in their EEPROM.

Although DDM data may be available for SFPs that do not indicate DDM support in their EEPROM, Nokia has not validated or verified the accuracy of this information.

DDM information can be displayed for non-Nokia transceivers, but Nokia is not responsible for the formatting, accuracy, and other informational details.

2.2.2 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.

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.

Example

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

2.3 Ports

This section describes 7210 SAS ports.

2.3.1 Port types

The following table lists supported Ethernet port types on the 7210 SAS platforms.

Table 7: Supported Ethernet port types

7210 SAS platforms	Copper ports (10/100/1000 Base-T)	Ethernet SFP ports	10 Gigabit SFP+ ports
7210 SAS-D	✓	✓	
7210 SAS-Dxp[10]	✓	✓[11]	✓
7210 SAS-K 2F1C2T	✓	✓	
7210 SAS-K 2F6C4T	✓	✓	
7210 SAS-K 3SFP+ 8C	✓	✓	✓

2.3.1.1 Port modes

On 7210 SAS devices, a port must be configured as one of the following: access, access uplink, network, or hybrid. The following list describes the significance of the different port modes and the support available on different platforms:

- **access ports**

  Access ports are 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. When 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 QinQ only. 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.

[10] The 7210 SAS-Dxp 24p only supports a port speed of 1 Gb/s for SFP+ ports 17 and 18, and for SFP ports 19 and 20. Port speeds of 10 Mb/s and 100 Mb/s with a copper SFP and 100 Mb/s with a fiber SFP are not supported on ports 19 and 20. The 7210 SAS-Dxp 16p only supports a port speed of 1 Gb/s for SPF+ ports.

[11] The 7210 SAS-Dxp 12p does not support a 10 Mb/s port speed for an SFP port using a copper SFP.

- **network ports (applicable only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C)**

  Network ports are configured for network-facing traffic. These ports participate in the service provider transport or infrastructure network. Dot1q is supported on network ports.

- **hybrid ports (applicable only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C)**

  Hybrid ports are configured for access and network-facing traffic. The default mode of an Ethernet port is "network". The mode of a port cannot be changed unless the port is shut down and the configured SAPs and interfaces are deleted. Hybrid ports allow a single port to operate in both access and network modes. The MTU of a port in hybrid mode is the same as in network mode. The default encapsulation for ports in hybrid mode is dot1q; QinQ encapsulation is also supported at the port level.

  When the port is changed to hybrid, the default MTU of the port is changed to match the value of 9212 bytes, which is used in network mode (higher than in access mode); this ensures that both SAP and network VLANs can be accommodated.

  The only exception is when the port is a 10/100 fast Ethernet port. In this case, the MTU in hybrid mode is set to 1522 bytes, which corresponds to the default access MTU with QinQ, which is larger than the network dot1q MTU or access dot1q MTU for this type of Ethernet port. All parameters in access and network contexts are configured within the port using the same CLI hierarchy as in the existing implementation. A hybrid port allows both ingress and egress contexts to be configured concurrently.

  An Ethernet port configured in hybrid mode can have the following encapsulation type values: dot1q and QinQ. The NULL value is not supported because only a single SAP or network IP interface is allowed, achieved by configuring the port as either access or network, respectively. Hybrid mode can be enabled on a LAG port when the port is part of a single chassis LAG configuration. When the port is part of a multi-chassis LAG (MC-LAG) configuration, only access mode can be configured. MC-LAG is not supported on network ports and consequently cannot be supported on hybrid ports.

The following table describes supported port modes on the 7210 SAS platforms.

Table 8: 7210 SAS platforms supporting port modes

Port mode platforms	Access	Network	Hybrid	Access-uplink
7210 SAS-D	Yes	No	No	Yes
7210 SAS-Dxp	Yes	No	No	Yes[12]
7210 SAS-K 2F1C2T	Yes	No	No	Yes
7210 SAS-K 2F6C4T	Yes	Yes	Yes	Yes
7210 SAS-K 3SFP+ 8C	Yes	Yes	Yes	Yes

2.3.1.2 Port dot1q VLAN Etype on 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

The 7210 SAS 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 non-standard (other than 0x8100) dot1q VLAN Etype.

[12] A limited number of ports can be configured as access-uplink ports at any given time on the 7210 SAS-Dxp.

2.3.1.3 Configuration guidelines for dot1q-Etype for 7210 SAS-D and 7210 SAS-Dxp

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

- Dot1q-Etype configuration is supported for all ports - Access and Access-uplink 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 access port.

2.3.2 Support for power over Ethernet

Note:
Power over Ethernet (PoE) is supported only on the 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p.

The 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p support PoE in accordance with the 802.3af, 802.3at, and 802.3bt standards. This feature allows these platforms to supply power to connected PoE devices, such as telephones, CCTV cameras, and other PoE standard compliant devices.

The following PoE functionalities are available:

- The 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p support 802.3af (PoE), 802.3at (PoE+), and 802.bt (PoE++ and HPoE). All ports support PoE and PoE+. only the first four copper ports support PoE++ and HPoE. The ports can be used to connect PoE, PoE+, PoE++, or HPoE devices, or a combination of both simultaneously, as long as the power drawn is within the device system limits.
- Only Alternative A, as described in the 802.3af and 802.3at standards, is supported on the 7210 SAS.
- The 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p support classification Type 1, Type 2, Type 3, and Type 4 PoE devices (PDs) using the physical layer classification mechanism. The physical layer classification mechanism supports both the single-signature and dual-signature classification mechanisms.
- The user must configure the maximum available PoE power budget using the **configure system poe max-poe-power-budget** command before enabling PoE on any of the ports. See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide* for more information about this command.
- The 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p support the PoE type and class-based power allocation method, which allocates power based on the identified PoE type and class using a physical layer classification mechanism. The 802.3af, 802.3at, and 802.3bt standards define four PoE types (Type 1 (up to 15W, Type 2 (up to 30 W), Type 3 (up to 60W), and Type 4 (up to 90 W)) and the power that can be allocated or requested by a particular class. The standards define eight classes: Class 1, Class 2, Class 3, Class 4, Class 5, Class 6, Class 7, and Class 8. These classes are used to allow PoE devices to request power based on their needs. If there is not enough power available to supply the identified class, power is denied to the connected PoE device. Each 7210 SAS device has a limit on the maximum amount of power it can provide. If the total power requested by the PDs connected to PoE-

enabled ports exceeds this threshold, the 7210 SAS device denies power to the other PD. When power is denied to the PD, the port is operationally up, even though power is not supplied to the port. If power is applied successfully or denied to the port, the system logs an event.

Note:
The software accounts for power requirements based on the PD type and does not consider the PoE class within a type (a PoE device uses 15 W, a PoE+ device uses 30 W, a PoE++ device uses 60 W, and a HPoE device uses 90 W).

For example, if the user configures one PoE port, the software deducts 15 W from the configured **max-poe-power-budget**. If the user configures two PoE ports and two PoE + ports, the software deducts 90 W from the configured **max-poe-power-budget** (assuming the configured *value* is greater than or equal to 90 W). If the user configures a *value* of 100 W and attempts to configure four PoE+ ports, the software deducts 30 W from the configured **max-poe-power-budget** for the first three configured PoE+ ports using a total of 90 W (10 W are remaining). When the user configures the fourth port, the configuration fails because only 10 W are available, which does not meet the power requirement for the fourth PoE+ port.

- Only DC power is supplied to connected PDs. It is supported for PDs that use injectors where an AC/DC wall device is used to power a remote PoE device.
- The software monitors the PoE port, detects faults and events, and raises traps. The software displays this information in the status report. The following events and faults are detected and are notified to the user:
  - **supplying power event**

    This event is generated when power is supplied to a connected PoE device after successful detection and classification.
  - **denied power event**

    This event is generated when power is denied to a connected PoE device after successful detection and classification.
  - **disconnect event**

    This event is generated when a connected PoE device is disconnected from the port and stops drawing power from the node.
  - **fault events**

    These events are generated for overload, short-circuit, and other events. Software clears the fault when the fault no longer exists.
- If a port enabled for PoE is shut down, the power supplied to the port is disabled. It restores power when the **no shutdown** command is executed, if the request does not exceed the power budget.

2.3.2.1 PoE configuration notes

The following configuration notes apply for PoE:

- On the 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p, all ports are available to connect PoE and PoE+ devices, and up to four fixed copper ports are available to connect PoE++ and HPoE devices.
- The 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p can be equipped with the following external power module types to support required PoE devices:
  - 100 W AC

  - 290 W DC
  - 480 W AC
  - 960 W AC
- The user can configure the maximum power budget for PoE devices using the **config>system>poe>max-poe-power-budget** command. See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide* for more information about this command.

2.3.3 MACsec

Note:

- Media Access Control Security (MACsec) is supported only on the 7210 SAS-K 2F6C4T ETR, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p.
- On the 7210 SAS-Dxp 24p, MACsec is available on four ports:
  - 1 GE SFP ports 1/1/19 and 1/1/20
  - 1/10 GE SFP+ ports 1/1/17 and 1/1/18

MACsec is a security technology that provides secure communication for almost all types of traffic on Ethernet links. MACsec provides point-to-point and point-to-multipoint security on Ethernet links between directly connected nodes, or nodes connected using a Layer 2 cloud.

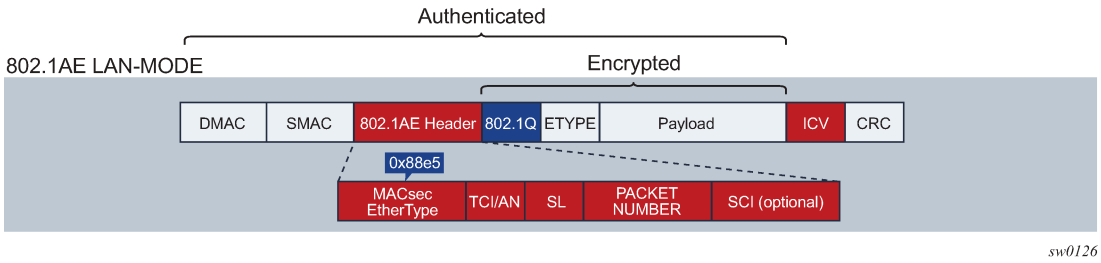
MACsec can identify and prevent most security threats, including:

- denial of service
- intrusion
- man-in-the-middle
- masquerading
- passive wiretapping
- playback attacks

MACsec, defined in IEEE 802.1AE, uses Layer 2 to encrypt MACsec to encrypt anything from the 802.1AE header to the end of the payload, including 802.1Q. MACsec leaves the DMAC and SMAC in cleartext.

The following figure shows the 802.1AE LAN-mode structure.

Figure 1: 802.1 AE LAN-MODE



Forwarding a MACsec packet uses the destination MAC address, which is in cleartext.

2.3.3.1 MACsec 802.1AE header (SecTAG)

The 802.1AE header has a security tag (SecTAG) which includes:

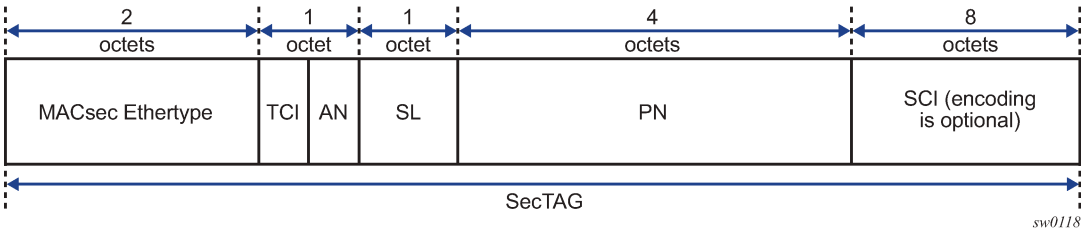
- the association number within the channel
- the packet number to provide a unique initialization vector for encryption and authentication algorithms, as well as protection against replay attack
- an optional LAN-wide secure channel identifier

The SecTAG is identified by the MACsec Ethertype and includes the following fields:

- TAG Control Information (TCI)
- Association Number (AN)
- Short Length (SL)
- Packet Number (PN)
- Optionally-encoded Secure Channel Identifier (SCI)

The following figure shows the format of the SecTAG.

Figure 2: SecTAG format



2.3.3.2 MACsec encryption mode

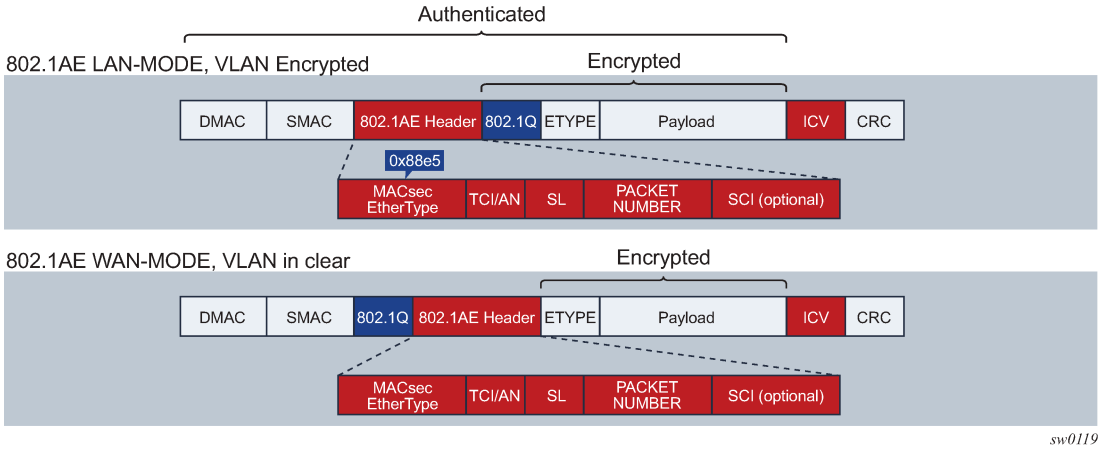
MACsec uses the following main modes of encryption:

- VLAN in cleartext (WAN Mode)
- VLAN encrypted

The 802.1AE standard requires that the 802.1Q VLAN is encrypted. Some vendors provide the option of configuring MACsec on a port with VLAN in cleartext form. The 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p support both modes on both 1GE and 10GE ports.

The following figure shows VLAN in encrypted and cleartext form.

Figure 3: 802.1 AE LAN/WAN modes and VLAN encrypted/clear



2.3.3.2.1 MACsec encryption per traffic flow encapsulation matching

MACsec can be applied to a selected subset of the port traffic based on the type and value of the packet encapsulation. The user can configure the system to match and encrypt all encapsulated traffic arriving on a port, including untagged, single-tagged, and double-tagged. This is the default behavior of MACsec and the only option supported.

MKA PDUs are generated specifically for the matched traffic encapsulation type.

2.3.3.3 MACsec terminology

The following table describes MACsec terminology.

Table 9: MACsec terminology

MACsec term	Description
Connectivity Association (CA)	A security relationship, established and maintained by the MKA, that comprises a fully connected subset of the service access points in stations attached to a single LAN that are to be supported by MACsec.
MACsec Key Agreement Protocol (MKA)	Control protocol between MACsec peers, which is used for peer aliveness and encryption key distribution. MKA is responsible for discovering, authenticating, and authorizing the potential participants in a CA.
MAC Security Entity (SecY)	Operates the MAC security protocol within a system. Manages and identifies the SC and the corresponding active SA.
Port Access Entity (PAE)	The protocol entity associated with a port. May support the functionality of authenticator, supplicant, or both.
Security Channel (SC)	Provides a unidirectional point-to-point or point-to-multipoint communication. Each SC contains a succession of SAs, and each SC has a different SAK.

MACsec term	Description
Security Association Key (SAK)	The key used to encrypt the datapath of MACsec.
Security Association (SA)	A security relationship that provides security guarantees for frames transmitted from one member of a CA to the others. In the case of two SAs per SC, each with a different SAK, each SC comprises a succession of SAs. Each SA has an SC identifier, concatenated with a two-bit association number. The Secure Association Identifier (SAI) that has been created allows the receiving SecY to identify the SA, and consequently, the SAK used to decrypt and authenticate the received frame. The AN (and the SAI) is only unique for the SAs that can be used or recorded by participating SecYs at any time. The MKA creates and distributes SAKs to each of the SecYs in a CA. This key creation and distribution is independent of the cryptographic operation of each of the SecYs. The decision to replace one SA with its successor is made by the SecY that transmits using the SC, after the MKA has informed it that all the other Sec Ys are prepared to receive using that SA. No notification, other than receipt of a secured frame with a different SAI, is sent to the receiver. A SecY must always be capable of storing SAKs for two SAs for each inbound SC, and of swapping from one SA to another without notice. Certain LAN technologies can reorder frames of different priority, so reception of frames on a single SC can use interleaved SA.

2.3.3.4 MACsec key management modes

The following table describes the key management modes in MACsec.

Table 10: MACsec key management modes

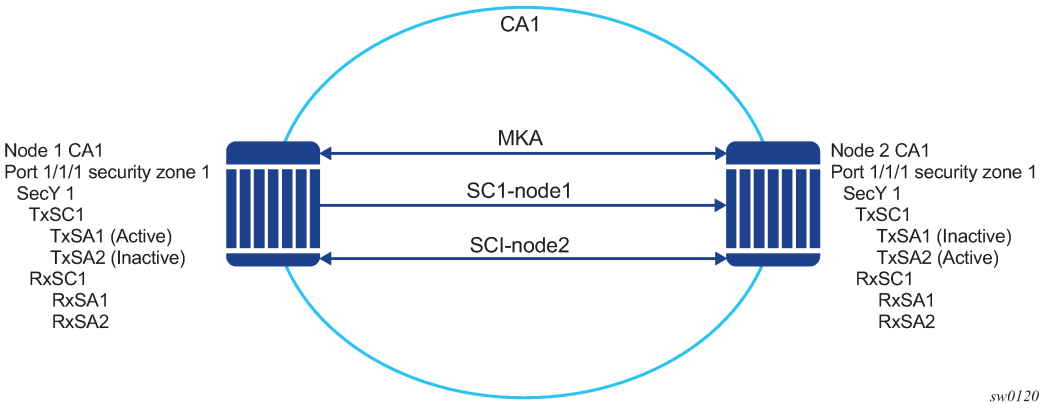
Keying	Explanation	SR OS support	Where used
Static Secure Association Key (SAK)	Manually configures each node with a static SAK using CLI or NSP.	N/A	Switch to switch
Static Connectivity Association Key (CAK) preshared key	Uses dynamic MACsec Key Agreement (MKA) and uses a configured pre-shared key to derive the CAK. The CAK encrypts the SAK between two peers and authenticates the peers.	Supported	Switch to switch
Dynamic CAK EAP Authentication	Uses dynamic MKA and an EAP Master System Key (MSK) to derive the CAK. The CAK encrypts the SAK between two peers and authenticates the peers.	Not Supported	Switch to switch
Dynamic CAK MSK Distribution via RADIUS and EAP-TLS	MSKs are stored in the RADIUS server and distributed to the hosts via EAP-TLS. This is typically used in access networks where there are a large number of hosts using MACsec and connecting to an access	Not Supported	Host to switch

Keying	Explanation	SR OS support	Where used
	switch. MKA uses MSK to derive the CAK. The CAK encrypts the SAK between 2 peers and authenticates the peers.		

2.3.3.5 MACsec static CAK

The following figure shows the main MACsec concepts used in the static CAK scenario.

Figure 4: MACsec concepts for static CAK



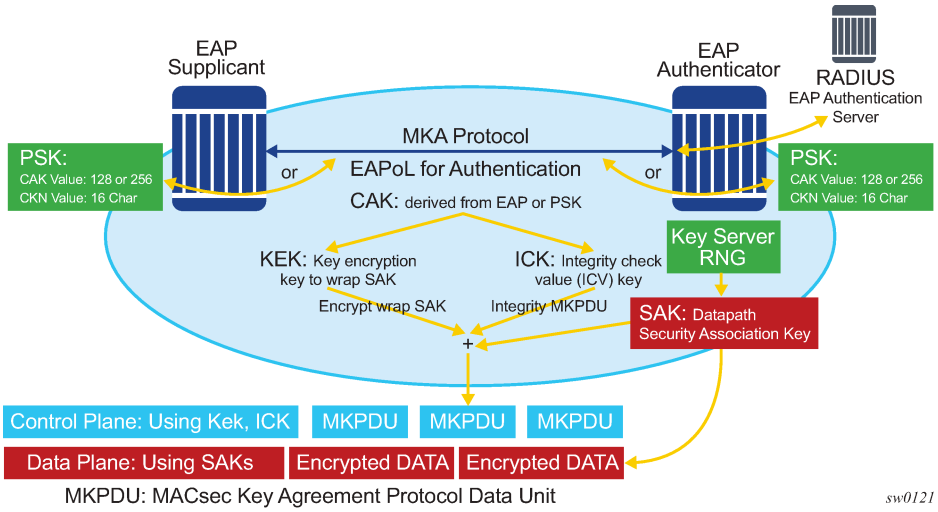
MACsec uses SAs to encrypt packets. Each SA has a single SAK that contains the cryptographic operations used to encrypt the datapath PDUs.

The SAK is the secret key used by an SA to encrypt the channel.

When enabled, MACsec uses a static CAK security mode, which has two security keys: a CAK that secures control plane traffic and a randomly generated SAK that secures data plane traffic. Both keys are used to secure the point-to-point or point-to-multipoint Ethernet link and are regularly exchanged between devices on each end of the Ethernet link.

The following figure shows MACsec generating the CAK.

Figure 5: MACsec generating the CAK



The node initially needs to secure the control plane communication to distribute the SAKs between two or more members of a CA domain.

The control plane is secured using a CAK, which is generated using one of the following methods:

- **EAPoL**
- **preshared key**

  (CAK and CKN values are configured using the CLI). The following CAK and CKN rules apply.

  – CAK uses 32 hexadecimal characters for a 128-bit key, and 64 hexadecimal characters for a 256-bit key, depending on the algorithm used for control plane encryption; for example, **aes-128-cmac** or **aes-256-cmac**.

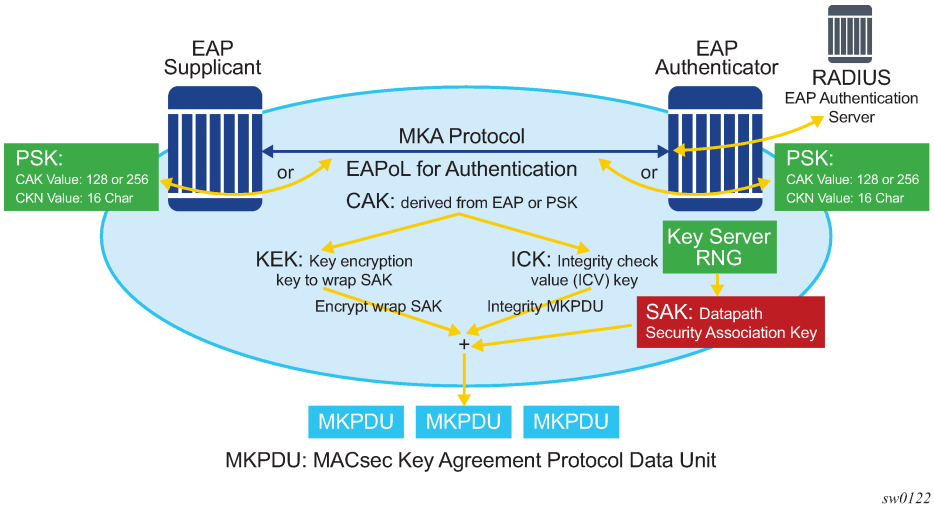
  – CKN is a 32-octet character (64 hex) and is the name that identifies the CAK. This allows each of the MKA participants to select which CAK to use to process a received MKPDU. MKA places the following restrictions on the format of the CKN:

    - it must comprise an integral number of octets, between 1 and 32 (inclusive)
    - all potential members of the CA must use the same CKN

  – CAK and CKN must match on peers to create a MACsec-secure CA.

The following figure shows MACsec control plane authentication and encryption.

Figure 6: MACsec control plane



After the CAK is generated, it can obtain the following additional keys:

- **KEK (Key Encryption Key)**

  The KEK is used to wrap and encrypt the SAKs.

- **ICK (Integrity Connection Value (ICV) Key)**

  The ICK is used for an integrity check of each MKPDU send between two CAs.

The key server then creates a SAK and shares it with the CAs of the security domain, and that SAK secures all data traffic traversing the link. The key server periodically creates and shares a randomly created SAK over the point-to-point link for as long as MACsec is enabled.

The SAK is encrypted using the AES-CMAC, the KEK as the encryption key, and ICK as the integration key.

2.3.3.6 SAK rollover

The SAK is regenerated after the following events:

- when a new host has joined the CA domain and MKA hellos are received from this host
- when the sliding window is reaching the end of its 32-bit or 64-bit length
- when a new PSK is configured and a rollover of PSK is executed

2.3.3.7 MKA

Each MACsec peer operates the MKA. Each node can operate multiple MKAs based on the number of CAs that it belongs to. Each instance of MKA is protected by a distinct secure CAK, that allows each Port Access Entity (PAE), or port, to ensure that information for a specific MKA instance is accepted only from other peers that also possess that CAK, therefore identifying themselves as members or potential members of the same CA. For a description of how the CAK identification is performed using CKN, see MACsec static CAK.

2.3.3.7.1 MKA PDU generation

The following table describes the MKA PDUs generated for different traffic encapsulation matches.

Table 11: MKA PDU generation

Configuration	Configuration example (<s-tag>.<c-tag>)	MKA packet generation	Traffic pattern match/ behavior	Supported on 7210 SAS
All-encap	`config>port>ethernet>dot1x>macsec ca-name 10`	untagged MKA packet	Matches all traffic on port, including untagged, single-tag, and double-tag. Default behavior.	Yes

2.3.3.7.2 Tags in clear behavior by traffic encapsulation types

By default, all tags are encrypted in CA. An MKA can be generated without any tags (untagged), but the data being matched can be based on dot1q or q-in-q.

The following table describes how single or double tags in clear configuration under a CA affect different traffic flow encryptions.

Table 12: Tags in clear behavior

Configuration	Traffic pattern match/behavior	CA configuration: no tag in cleartext form	CA configuration: single-tag in cleartext form	CA configuration: double-tag in cleartext form
Port	Matches all traffic on port, including untagged, single-tagged, double-tagged (default behavior)	MKA PDU: untagged Untagged traffic: encrypted Single-tagged traffic: encrypted, no tag in clear Double-tagged traffic: encrypted, no tag in clear	MKA PDU: untagged Untagged traffic: in clear Single-tagged traffic: encrypted, single-tag in clear Double-tagged traffic: encrypted, single-tagged in clear	MKA PDU: untagged Untagged traffic: in clear Single-tagged traffic: in clear Double-tagged traffic: encrypted, double-tagged in clear

2.3.3.7.3 PSK

A peer may support the use of one or more preshared keys (PSKs). An instance of MKA operates for each PSK that is administratively configured as active.

A preshared key is either created by NSP or configured using the CLI. Each PSK is configured using the following fields:

- CKN
- CAK value

The CKN must be unique for each port among the configured sub-ports, and can be used to identify the key in subsequent management operations.

Each static CAK configuration can have two preshared key entries for rollover. The active PSK index dictates which CAK is being used for encrypting the MKA PDUs.

NSP has additional functionality to rollover and configure the PSK. The rollover using NSP can be based on a configured timer.

2.3.3.7.4 MKA hello timer

MKA uses a member identifier (MI) to identify each node in the CA domain.

A participant proves liveness to each of its peers by including the MI, together with an acceptably recent message number (MN), in an MKPDU.

To avoid a new participant having to respond to each MKPDU from each partner as it is received, or trying to delay its reply until it is likely that MI MN tuples have been received from all potential partners, each participant maintains and advertises both a live peers list and a potential peers list.

The live peers list includes peers that have included the participant MI and a recent MN in a recent MKPDU. The potential peers list includes all other peers that have transmitted an MKPDU that has been directly received by the participant or that were included in the live peers list of a MKPDU transmitted by a peer that has proved liveness. Peers are removed from each list when an interval of between MKA lifetime and MKA lifetime plus MKA Hello Time has elapsed since the participant's recent MN was transmitted. This time is sufficient to ensure that two or more MKPDUs will have been lost or delayed before the incorrect removal of a live peer.

Note:

- The specified use of the live peers and potential peers lists allows rapid removal of participants that are no longer active or attached to the LAN, while reducing the number of MKPDUs transmitted during group formation; for example, a new participant is admitted to an established group after receiving, then transmitting, one MKPDU.
- MKA Hello packets are sent once every 2 seconds with a timeout interval of 3 packets or 6 seconds. These values are not configurable.

The following table lists the MKA participant timer values.

Table 13: MKA participant timer values

Timer use	Timeout (parameter)	Timeout (parameter)
Per participant periodic transmission, initialized on each transmission on expiry	MKA Hello Time or MKA Bounded Hello Time	2.0 0.5
Per peer lifetime, initialized when adding to or refreshing the potential peers list or live peers list, expiry causes removal from the list	MKA Life Time	6.0
Participant lifetime, initialized when participant created or following receipt of an MKPDU, expiry causes participant to be deleted		
Delay after last distributing a SAK, before the key server distributes a fresh SAK following a change in the live peers list while the potential peers list is still not empty		

2.3.3.8 MACsec capability, desire, and encryption offset

The IEEE 802.1x-2010 standard identifies the following fields in the MKA PDU:

- MACsec Capability
- Desire

MACsec capability signals whether MACsec is capable of integrity and confidentiality. For information about the basic settings for MACsec capability, see the encryption-offset command description.

Encryption offset of 0, 30, or 50 starts from the byte after the SecTAG (802.1AE header). Ideally, the encryption offset should be configured for IPv4 (offset 30) and IPv6 (offset 50) to leave the IP header in cleartext. This allows routers and switches to use the IP header for LAG or ECMP hashing.

2.3.3.9 Key server

The participants in an MKA instance that agree on a key server are responsible for the following:

- deciding on the use of MACsec
- cipher suite selection
- SAK generation and distribution
- SA assignment
- identifying the CA when two or more CAs merge

Each participant in an MKA instance uses the key server priority (an 8-bit integer) encoded in each MKPDU to agree on the key server. Each participant selects the live participant advertising the highest priority as its key server whenever the live peers list changes, provided that highest priority participant has not selected another as its key server or is unwilling to act as the key server.

If a key server cannot be selected, SAKs are not distributed. In the event of a tie for highest priority key server, the member with the highest priority SCI is chosen. For consistency with other uses of the SCI MAC address component as a priority, numerically lower values of the key server priority and SCI receive the highest priority.

Note:
Each SC is identified by an SCI that comprises a globally unique MAC address, and a port identifier unique within the system that has been allocated that address.

2.3.3.10 SA limits and network design

Each MACsec device supports 64 Tx-SAs and 64 Rx-SAs. An SA (Security Association) is the key to encrypt or decrypt the data.

As defined in IEEE 802.1AE, each SecY contains an SC. An SC is a unidirectional concept; for example, Rx-SC or Tx-SC. Each SC contains at least one SA for encryption on Tx-SC and decryption on Rx-SC. Also, for extra security, each SC should be able to roll over the SA, therefore, Nokia recommends for each SC to have two SAs for rollover purposes.

MACsec PHY is known as a MACsec security zone. Each MACsec security zone supports 64 Tx-SAs and 64 Rx-SAs. Assuming two SAs for each SC for SA rollover, each zone supports 32 Rx-SCs and 32 Tx-SCs.

The following table describes the port mapping to security zones.

Table 14: Port mapping to security zone

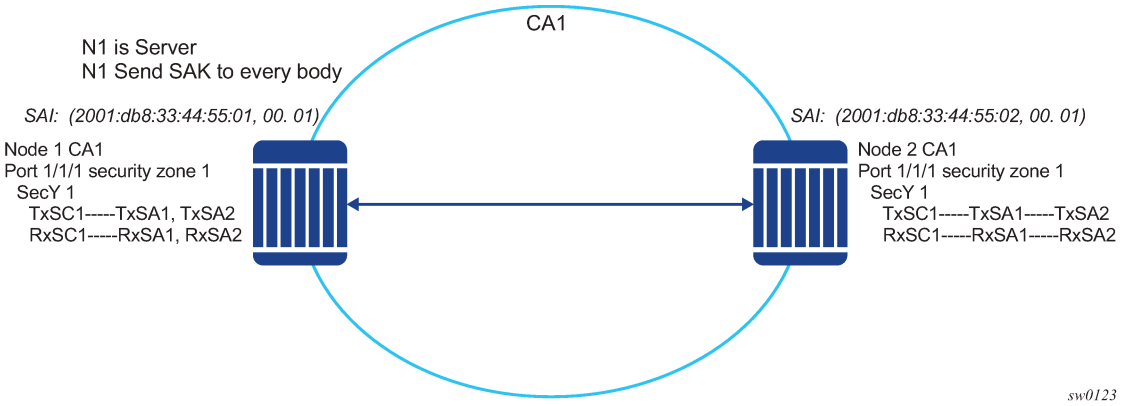
Platform	Ports in security zone 1	Ports in security zone 2	Ports in security zone 3	Ports in security zone 5	SA limit per security zone
7210 SAS-K 2F6C4T	Ports 1, 2, 3, 4	Ports 5, 6, 7, 8	Ports 9, 10, 11, 12	—	Rx-SA = 64 Tx-SA = 64
7210 SAS-K 3SFP+ 8C	Ports 1, 2, 3, 4 (1, 2, and 3 are 10GE ports)	Ports 5, 6, 7, 8	Ports 9, 10, 11	—	Rx-SA = 64 Tx-SA = 64
7210 SAS-Dxp 24p	—	—	—	Ports 1/1/19 and 1/1/20 (1 GE ports) Ports 1/1/17 and 1/1/18 (10 GE ports)	Rx-SA = 64 Tx-SA = 64

2.3.3.11 P2P (switch-to-switch) topology

In a point-to-point topology, each router needs a single security zone, a single Tx-SC for encryption, and a single Rx-SC for decryption. Each SC has two SAs. In total, for point-to-point topology, four SAs are needed: two Rx-SAs for Rx-SC1 and two Tx-SAs for Tx-SC1.

The following figure shows the P2P topology.

Figure 7: P2P (switch-to-switch) topology

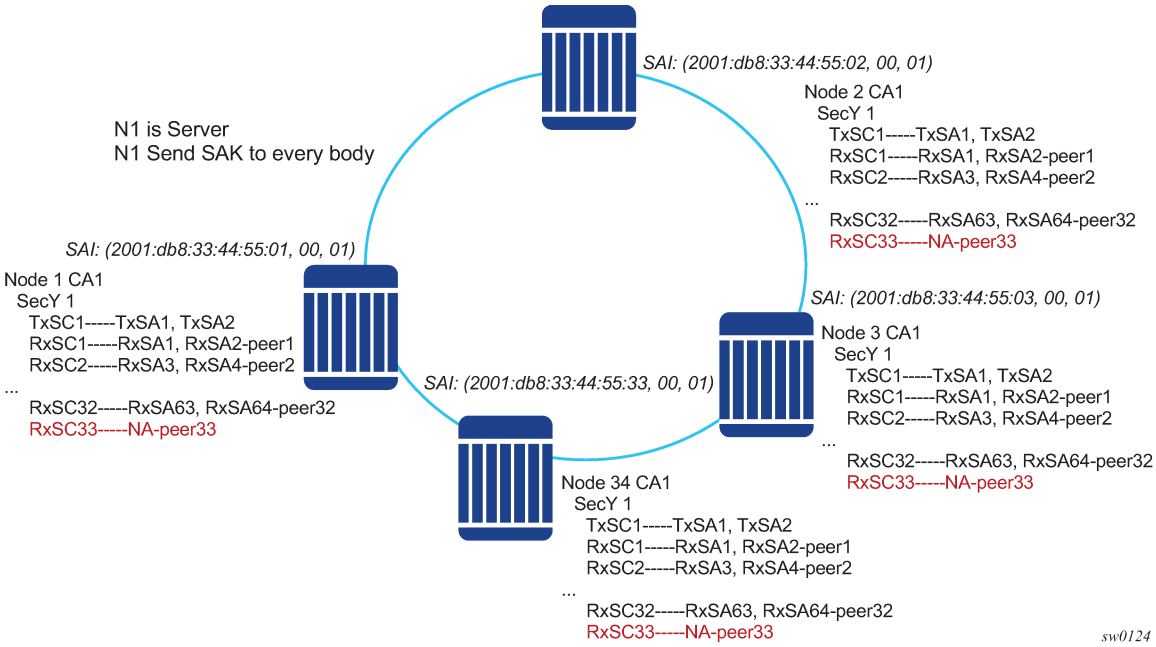


2.3.3.12 P2MP (switch to switch) topology

In a multi-point topology with *N* nodes, each node needs a single Tx-SC and *N* Rx-SC, one for each one of the peers. As such, 64 maximum Rx-SAs for each security zone translates to 32 Rx-SCs, which breaks down to only 32 peers; for example, only 33 nodes in the multipoint topology for each security zone. So from the perspective of each node, there is one Tx-SC and 32 Rx-SCs.

As shown in the following figure, when the 34th node joins the multi-point topology, the other 33 nodes that are already part of this domain do not have SAs to create an Rx-SC for this 34th node; however, the 34th node has a Tx-SC and can accept 32 peers. The 34th node starts to transmit and encrypt the PDUs based on its Tx-SC. However, because all other nodes do not have as SC for this SAI, all Rx PDUs are dropped.

Figure 8: P2MP topology



Nokia recommends that a multicast domain, for a single security zone, should not exceed 32 peers, or the summation of all the nodes in a security zone CA domain should not exceed 33. This is the same as if a security zone has four CAs; the summation of all nodes in the four CAs should be 33 or less.

2.3.3.13 SA exhaustion behavior

A security zone has 64 Rx-SAs and 64 Tx-SAs, as described in SA limits and network design. Two Rx-SAs are used for each Rx-SC for rollover purposes, and two Tx-SAs are used for Tx-SC for rollover purposes. This translates to 32 peers for each security zone.

Under each port, you can configure a **max-peer** command to assign the number of peers allowed on that port.

Note:
Ensure that the number of peers does not exceed the limit of maximum peers per security zone or maximum peers per port.

If the maximum peer is exceeded, the peer connectivity becomes random. In the case of a node failure or packet loss, peers join the CA randomly, on a first-come-first-served basis.

Caution:
Nokia strongly recommends that the maximum peer value is not exceeded per security zone or port.

2.3.3.14 Clear tag mode

In most Layer 2 networks, MAC forwarding is done using a destination MAC address. The 802.1AE standard requires that any field after source and destination MAC address and after the SecTAG must be encrypted. This includes the 802.1Q tags. In some VLAN switching networks, it may be needed to leave the 802.1Q tag in cleartext form.

7210 SAS allows the configuration of 802.1Q tag in cleartext form by placing the 802.1Q tag before the SecTAG, or encrypts it by placing it after the SecTAG.

The following table lists the MACsec encryption of 802.1Q tags when the clear-tag is configured.

Table 15: MACsec encryption of 802.1Q tags with clear-tag configured

Unencrypted format	Clear-tag-mode configuration	Pre-encryption (Tx)	Pre-decryption (Rx)
Single tag (dot1q)	Single-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTAG
Single tag (dot1q)	Double-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTAG
Double tag (q-in-q)	Single-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, SecTAG
Double tag (q-in-q)	Double-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, IPID2, VID2, SecTAG

2.3.3.15 802.1X tunneling and multihop MACsec

MACsec is an Ethernet packet and, as with any Ethernet packet, can be forwarded through multiple switches using Layer 2 forwarding. The encryption and decryption of the packets is done using the 802.1x (MKA) capable ports.

To ensure that the MKA is not terminated on an intermediate switch or router, enable 802.1x tunneling on the corresponding port.

Verify if tunneling is enabled using the following command.

```
*A:SwSim28>config>port>ethernet>dot1x# info
----------------------------------------------
      tunneling
```

By enabling tunneling, the 802.1x MKA packets transit that port without being terminated, because such MKA negotiation does not occur on a port that has 802.1x tunneling enabled.

2.3.3.16 EAPoL destination address

The MKA packets are transported over EAPoL with a multicast destination MAC address.

In cases where a point-to-point connection from the MKA to a peer node over a Layer 2 multihop cloud is required, you can set the EAPoL destination MAC address to the peer MAC address. This forces the MKA to traverse multiple nodes and establish an MKA session with the specific peer.

2.3.3.17 Mirroring consideration

Mirroring is performed before MACsec encryption. Therefore, if a port is MACsec-enabled and is also mirrored, all the mirror packets are in cleartext form.

2.3.4 Ethernet combo ports on 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

The 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C support combo ports. The combo port provides two physical interface options to the user. One option is to configure it as an SFP port allowing for fiber-based connectivity and speeds of 100/1000 Mb/s with the advantages of using suitable optics for longer reach. The other option is to configure it as a fixed copper port, which provides cheaper connectivity for shorter reach. The SFP port support 100/1000 Mb/s speeds and the copper port can support 10/100/1000Mbps speed. The combo port can be configured either as an SFP port or a copper port. Both interfaces cannot be used simultaneously.

- 7210 SAS-K 2F1C2T provide one Combo port
- 7210 SAS-K 2F6C4T provides six Combo ports
- 7210 SAS-K 3SFP+ 8C provides eight Combo ports

2.4 Link Layer Discovery Protocol

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.

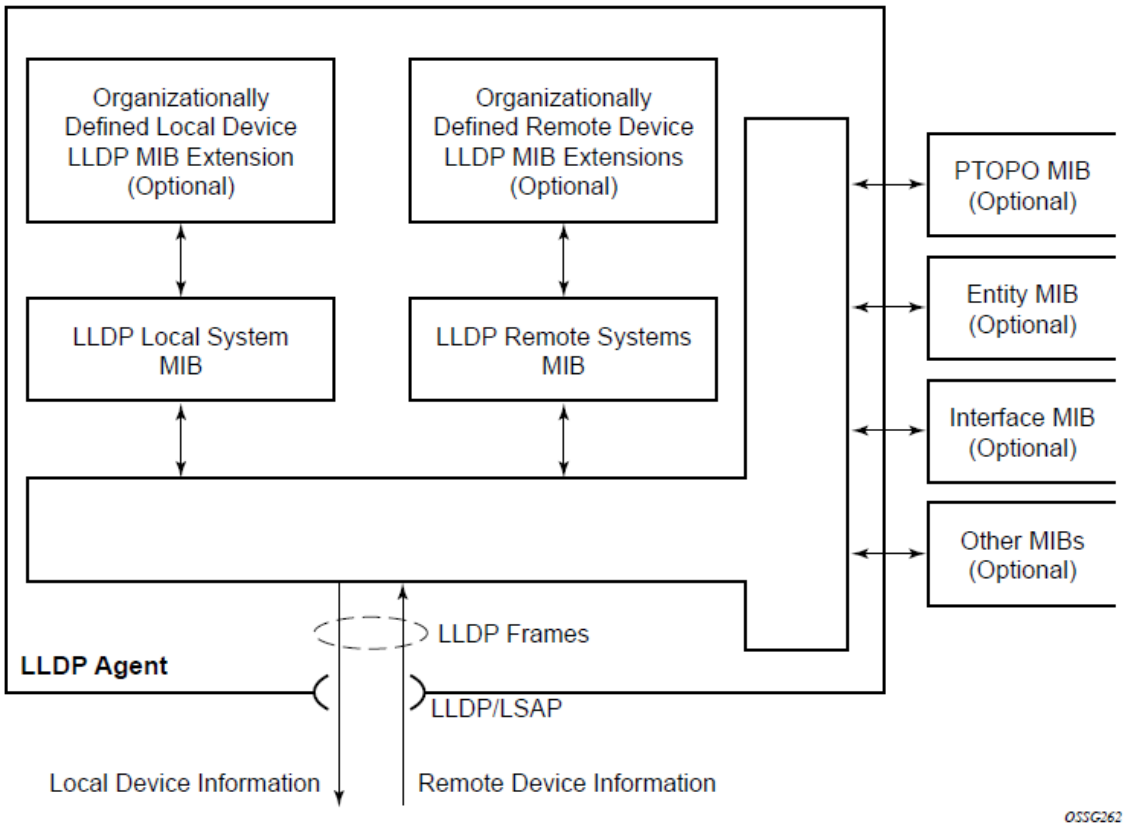
The LLDP helps the network operators to discover topology information. This information is used to detect and resolve network problems and inconsistencies in the configuration.

The following list 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 9: LLDP internal architecture for a network node.

The following figure shows LLDP internal architecture for a network node.

Figure 9: LLDP internal architecture for a network node

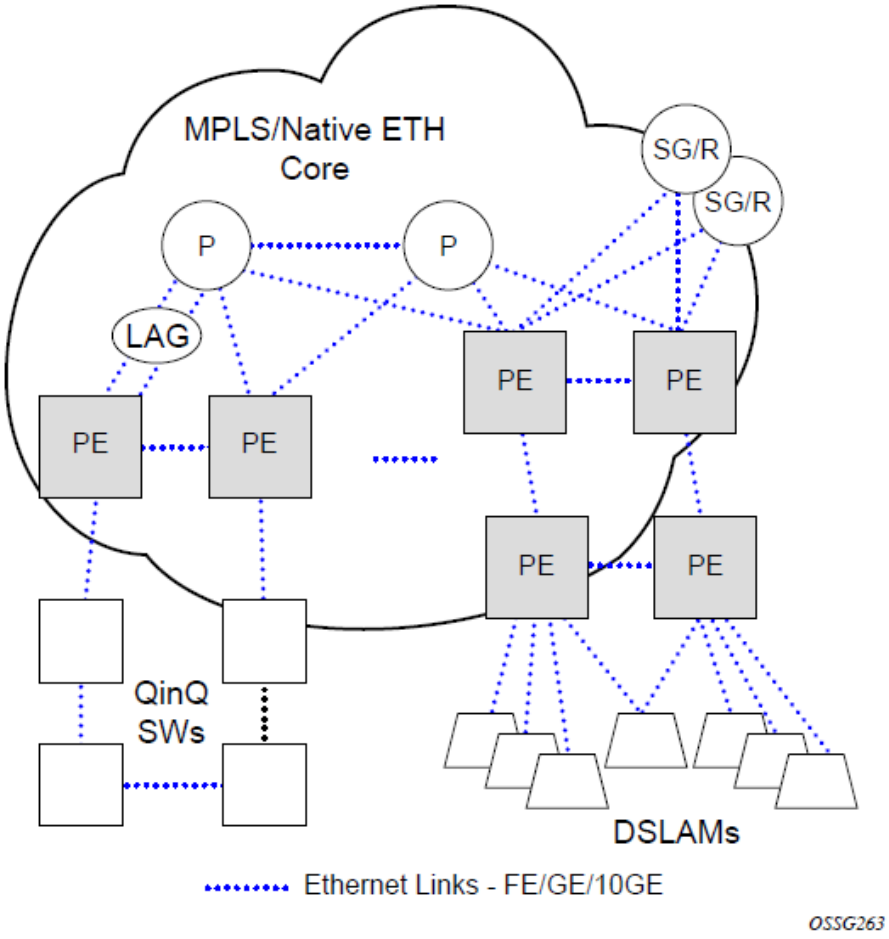


To detect and address network problems and inconsistencies in the configuration, the network operators can discover the topology information using LLDP. The Standard-based tools address the complex network scenarios where multiple devices from different vendors are interconnected using Ethernet interfaces.

The following figure shows an 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 the following figure can be discovered if, IEEE 802.1ab LLDP is running on each of the Ethernet interfaces in network.

Figure 10: Generic customer use case for LLDP



2.4.1 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 MIBs.

LLDP does not contain a mechanism for soliciting specific information from other LLDP agents, nor does it provide a specific means of confirming the receipt of information. LLDP allows the transmitter and the receiver to be 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. When 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 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 identifier is to be discarded immediately.

A TTL value of 0 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-id-subtype:

- **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 (that is,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.

2.4.2 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 **config>port>ethernet>lldp>destmac-nearest-bridge**. If the **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.

2.4.3 LLDP media endpoint discovery

Note:
This feature is only supported on the 7210 SAS-Dxp.

The IEEE standard 802.1AB is designed to provide a multivendor solution for the discovery of elements on an Ethernet Layer 2 data network. The LLDP standard allows nodes, which are attached to an Ethernet LAN or WAN, to advertise their supported functionalities to other nodes attached to the same LAN segment. See Link Layer Discovery Protocol for more information about IEEE 802.1AB.

The ANSI/TIA-1057 standard, *Link Layer Discovery Protocol for Media Endpoint Devices*, provides extensions to IEEE 802.1AB that are specific to media endpoint devices (MEDs), for example, voice phone and video terminal, in an IEEE 802 LAN environment. This standard defines specific usage of the IEEE 802.1AB LLDP base specification and interaction behavior between MEDs and LAN infrastructure elements.

LLDP media endpoint discovery (LLDP-MED) is an extension of LLDP that provides basic provisioning information to connected media endpoint devices. LLDP-MED extends LLDP protocol messages with more information to support voice over IP (VoIP) applications.

On the 7210 SAS, LLDP-MED supports the exchange of network policy information to provide the VLAN ID, dot1p bits, and IP DSCP value to media endpoint devices, such as a VoIP phone.

The following TLVs are supported for LLDP-MED:

- LLDP-MED Capabilities TLV
- Network Policy TLV

2.4.3.1 LLDP-MED reference model

LLDP-MED devices are composed of two primary device types: network connectivity devices and endpoint devices.

The LLDP-MED network connectivity devices provide access to the IEEE 802 LAN infrastructure for LLDP-MED endpoint devices. An LLDP-MED network connectivity device is a LAN access device based on any of the following technologies:

- LAN switch or router
- IEEE 802.1 bridge
- IEEE 802.3 repeater
- IEEE 802.11 wireless access point
- any device that supports the IEEE 802.1AB and MED extensions defined by the standard and that can relay IEEE 802 frames using any method

The LLDP-MED endpoint devices are composed of three subtypes, as defined in ANSI/TIA-1057:

- **generic endpoints (Class I)**

  This endpoint device class is for basic endpoints in LLDP-MED (for example, IP communications controllers).

- **media endpoints (Class II)**

  This endpoint device class supports IP media streams (for example, media gateways and conference bridges).

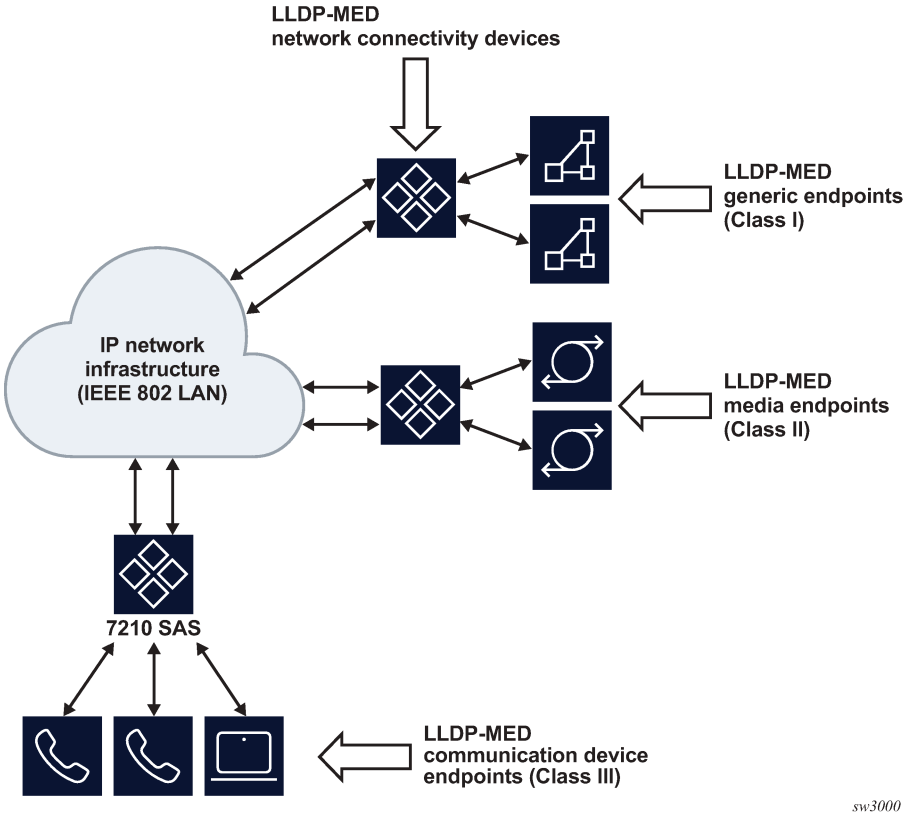
- **communication device endpoints (Class III)**

  This endpoint device class support the IP communication system end user (for example, IP telephones and softphones).

The following figure shows the LLDP-MED reference model.

Note:
Acting as the network connectivity device, the 7210 SAS only supports the configuration of LLDP-MED communication device endpoints (Class III), such as VoIP phone, using the Network Policy TLV.

Figure 11: LLDP-MED reference model



2.4.3.2 LLDP-MED network connectivity device functions

To enable LLDP-MED network connectivity device functions, configure the **config port ethernet lldp dest-mac lldp-med admin-status** command. When this command is configured, the behavior of the node is as follows:

- If **admin-status** is set to **rx-tx**, the LLDP agent transmits and receives LLDP-MED TLVs on the port. The 7210 SAS node includes the LLDP-MED Capabilities TLV and the Network Policy TLV (if configured) in the LLDP message that is generated in response to an LLDP message with the LLDP-MED Capabilities TLV received on the port.
- If **admin-status** is set to **disabled**, the 7210 SAS ignores and does not process the LLDP-MED Capabilities TLV in the LLDP message received on the port.

Note:
The **configure port ethernet lldp admin-status** command must be enabled for LLDP-MED TLV processing. The **admin-status** configuration in the **lldp** context must not conflict with the **admin-status** configuration in the **lldp-med** context.

When LLDP-MED is enabled on the port, the Network Policy TLV is sent out of the port using the parameters configured for the network policy that is associated with the port.

Note:
See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide* for more information about configuring network policy parameters using commands in the **config>system>lldp>lldp-med** context.

2.4.3.3 LLDP-MED endpoint device move notification

The endpoint move detection notification enables VoIP management systems to track the movement of VoIP phones. On the 7210 SAS, the user has the option to generate the lldpXMedTopologyChangeDetected event on detection of movement of the endpoint device. By default, this event is disabled. To enable the event, configure the **config>log>event-control lldp generate** and **config>port>ethernet>lldp> dest-mac>nearest-bridge>notification** commands.

2.4.3.4 Modified use of TLVs defined in LLDP

LLDP-MED modifies the usage of some LLDP base TLVs for network connectivity devices. Specifically, the 7210 SAS supports the transmission of the MAC/PHY Configuration Status TLV when LLDP-MED is enabled. The transmission of this TLV is enabled using the **config>port>ethernet>lldp>dest-mac>lldp-med>tx-tlvs mac-phy-config-status** CLI command option.

2.5 Port loopback for Ethernet ports

The 7210 SAS supports port loopback for Ethernet ports. There are two flavors of port loopback commands - port loopback without mac-swap and port loopback 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 loopback functionality.

2.5.1 Port loopback without MAC swap

Note:
Port loopback without MAC swap is supported on all 7210 SAS platforms as described in this document.

When the port loopback command is enabled, the system enables PHY/MAC loopback on the specified port. All the packets are sent out the port configured for loopback and received back by the system. On ingress to the system after the loopback, 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.

2.5.2 Port loopback with MAC swap

Note:
Port loopback with MAC swap is only supported on the 7210 SAS-D and 7210 SAS-Dxp.

The 7210 SAS provides port loopback support with MAC swap. When the port loopback command is enabled, the system enables PHY/MAC loopback on the specified port. All the packets are sent out the port configured for loopback and received back by the system. On ingress to the system after the loopback, 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.

2.5.3 Per-SAP loopback with MAC swap

Note:
Per-SAP loopback with MAC swap is only supported on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

The 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C provide per-SAP loopback support with MAC swap. When the SAP loopback command is enabled, all the packets that are sent out the SAP configured with loopback 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. The loopback does not affect other SAPs and services configured on the same port. Per-SAP loopback is supported for use with both VPLS and Epipe services.

2.6 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 if one or more links participating in the LAG fail. All physical links in a specific LAG links combine to form one logical interface.

Packet sequencing must be maintained for any specific 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.

2.6.1 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.

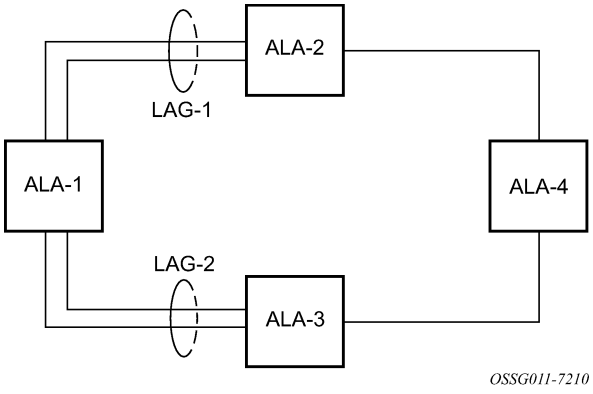
2.6.2 Configuring LAGs

LAG configuration guidelines include:

- The 7210 SAS-D and 7210 SAS-Dxp support up to four 1GE ports in a LAG. The 7210 SAS-Dxp also supports up to two 10GE ports in a LAG.
- The 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T support up to three 1GE ports in a LAG.
- The 7210 SAS-K 3SFP+ 8C supports up to three 1GE ports or two 10GE ports in a LAG.
- 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 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 the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, 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, autonegotiation must be disabled or set to limited mode to ensure only a specific speed is advertised.

The following figure shows traffic routed between ALA-1 and ALA-2 as a LAG consisting of four ports.

Figure 12: LAG configuration



2.6.3 LAG and QoS policies on 7210 SAS-D and 7210 SAS-Dxp

On the 7210 SAS-D and 7210 SAS-Dxp, an 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.

On the 7210 SAS-D and 7210 SAS-Dxp, 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.

2.6.4 LAG and QoS policies on 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, 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 the 7210 SAS-K 2F1C2T,7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, 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.

2.6.5 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 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.

2.6.6 LACP

Generally, link aggregation is used for two purposes: provide an increase in bandwidth and 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.

2.6.7 LAG and ECMP hashing

Note:
See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Router Configuration Guide* for more information about ECMP support for 7210 SAS platforms.

When a requirement exists to increase the available bandwidth for a logical link that exceeds the physical bandwidth or add redundancy for a physical link, typically one of the following methods is applied:

- equal cost multi-path (ECMP)
- Link Aggregation (LAG)

A 7210 SAS can deploy both methods at the same time, meaning it can use ECMP of two or more Link Aggregation Groups (LAG) or single links.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 an ECMP or a LAG, different variables are used as input to the hashing algorithm.

The following tables list the packets used for hashing on 7210 SAS platforms.

2.6.7.1 LAG hashing algorithm for the 7210 SAS-D

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-D.

Note:
The following notes apply to Table 16: LAG hashing algorithm for services configured on 7210 SAS-D:

- The term "learned" corresponds to the Destination MAC.
- the term "Source and Destination MAC" refers to customer source and destination MACs unless otherwise specified.
- The VLAN ID is considered for learned PBB and non-IP traffic in the VPLS service only for traffic ingressing at dot1q, Q.*, Q1.Q2 SAPs.
- Only the outer VLAN tag is used for hashing.

Table 16: LAG hashing algorithm for services configured on 7210 SAS-D

Traffic type	Packet fields used								
						Source and destination			
	BDA	BSA	EtherType	Ingress Port-ID	ISID	MAC	IP	L4 Ports	VLAN
VPLS service **SAP to SAP**									
IP traffic (learned)							✓	✓	
IP traffic (unlearned)				✓			✓	✓	
PBB traffic (learned)	✓	✓							✓
PBB traffic (unlearned)	✓	✓		✓	✓				
Non-IP traffic (learned)			✓			✓			✓
Non-IP traffic (unlearned)			✓	✓		✓			✓
Epipe service **SAP to SAP**									
IP traffic				✓			✓	✓	
PBB traffic	✓	✓		✓	✓				
Non-IP traffic			✓	✓		✓			✓
IES service (IPv4): **IES SAP to IES SAP**									
IPv4 unicast traffic							✓	✓	

2.6.7.2 LAG hashing algorithm for the 7210 SAS-Dxp

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-Dxp.

Note:
The following notes apply to Table 17: LAG hashing algorithm for services configured on 7210 SAS-Dxp:

- The term "learned" corresponds to the Destination MAC.
- The term "Source and Destination MAC" refers to customer source and destination MACs unless otherwise specified.
- The VLAN ID is considered for learned PBB and non-IP traffic in the VPLS service only for traffic ingressing at dot1q, Q.*, Q1.Q2 SAPs.
- Only the outer VLAN tag is used for hashing.

Table 17: LAG hashing algorithm for services configured on 7210 SAS-Dxp

Traffic type	Packet fields used								
						Source and destination			
	BDA	BSA	EtherType	Ingress Port-ID	ISID	MAC	IP	L4 Ports	VLAN
VPLS service **SAP to SAP**									
IP traffic (learned)							✓	✓	
IP traffic (unlearned)				✓		✓			
PBB traffic (learned)	✓	✓							
PBB traffic (unlearned)	✓	✓		✓					
Non-IP traffic (learned)			✓			✓			
Non-IP traffic (unlearned)				✓		✓			
Epipe service									

Traffic type	Packet fields used								
						Source and destination			
	BDA	BSA	EtherType	Ingress Port-ID	ISID	MAC	IP	L4 Ports	VLAN
SAP to SAP									
IP traffic				✓		✓			
PBB traffic	✓	✓		✓					
Non-IP traffic				✓		✓			
IES service (IPv4): **IES SAP to IES SAP**									
IPv4 unicast traffic							✓	✓	

2.6.7.3 LAG hashing algorithm for the 7210 SAS-K 2F1C2T

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-K 2F1C2T.

Note:
The following notes apply to Table 18: LAG hashing algorithm for services configured on 7210 SAS-K 2F1C2T:

- The term "learned" corresponds to the Destination MAC.
- The term "Source and Destination MAC" refers to customer source and destination MACs unless otherwise specified.

Table 18: LAG hashing algorithm for services configured on 7210 SAS-K 2F1C2T

Traffic type	Packet fields used								
					Source and destination			VLAN	
	BDA	BSA	Ingress Port-ID	IP Protocol	MAC	IP	L4 Ports	Outer	Inner
VPLS Service **SAP to SAP**									
IP traffic (learned and unlearned)			✓	✓		✓	✓	✓	
PBB traffic (learned and unlearned)	✓	✓	✓					✓	✓
MPLS traffic (learned and unlearned)			✓		✓			✓	✓
Non-IP traffic (learned and unlearned)			✓		✓			✓	✓
Epipe Service **SAP to SAP**									
IP traffic			✓	✓		✓	✓	✓	
PBB traffic	✓	✓	✓					✓	✓
MPLS traffic			✓		✓[13]			✓	✓
Non-IP traffic			✓		✓			✓	✓

2.6.7.4 LAG hashing algorithm for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

13 The outer MAC of the Ethernet packet that encapsulates an MPLS packet

Note:
The following notes apply to Table 19: LAG hashing algorithm for services configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C:

- The term "learned" corresponds to the destination MAC.
- The term "Source and Destination MAC" refers to customer source an destination MACs unless otherwise specified.
- SAP to SAP and SAP to SDP: Packet fields for IP traffic are used for hashing only if the number of VLAN tags is two or fewer. IP packets with more than two tags use the same hashing parameters as non-IP traffic.
- SDP to SAP and SDP to SDP: Packet fields for IP traffic are used for hashing only if the number of VLAN tags is 1 or 0. IP packets with more than one tag use the same hashing parameters as non-IP traffic.
- RVPLS routed traffic uses the same parameters as traffic in IES service.
- For IPv6 packets, the source and destination IP addresses are XORed and collapsed into a 32-bit value.

Table 19: LAG hashing algorithm for services configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Traffic type	Packet fields used							
				Source and destination			VLAN	
	Ingress Port-ID	IP Protocol	MPLS Label Stack	MAC	IP	L4 Ports	Outer	Inner
VPLS Service **SAP to SAP**								
IP traffic (learned and unlearned)	✓	✓			✓	✓	✓	
MPLS traffic (learned and unlearned)	✓			✓[14]			✓	✓
Non-IP traffic (learned and unlearned)	✓			✓			✓	✓
VPLS Service **SAP to SDP**								

[14] The outer MAC of the Ethernet packet that encapsulates an MPLS packet

Traffic type	Packet fields used							
				Source and destination			VLAN	
	Ingress Port-ID	IP Protocol	MPLS Label Stack	MAC	IP	L4 Ports	Outer	Inner
IP traffic (learned and unlearned)	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓[14]			✓	✓
Non-IP traffic (learned and unlearned)	✓			✓			✓	✓
VPLS Service **SDP to SAP**[15]								
IP traffic (learned and unlearned)	✓	✓			✓	✓		
Non-IP traffic (learned and unlearned)	✓			✓				
VPLS Service **SDP to SDP**[15]								
IP traffic (learned and unlearned)	✓	✓			✓	✓		
Non-IP traffic (learned and unlearned)	✓			✓				
Epipe Service **SAP to SAP**								
IP traffic	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓[14]			✓	✓
Non-IP traffic	✓			✓			✓	✓

15 Traffic in the payload

Traffic type	Packet fields used							
				Source and destination			VLAN	
	Ingress Port-ID	IP Protocol	MPLS Label Stack	MAC	IP	L4 Ports	Outer	Inner
Epipe Service **SAP to SDP**								
IP traffic	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓[14]			✓	✓
Non-IP traffic	✓			✓			✓	✓
Epipe Service **SDP to SAP**[15]								
IP traffic (learned and unlearned)	✓	✓			✓	✓		
Non-IP traffic (learned and unlearned)	✓			✓				
MPLS - LSR								
All traffic	✓		✓[16]				✓	
IES Service (IPv4) **IES SAP to IES SAP**								
—	✓	✓			✓[17]	✓	✓	
IES Service (IPv6) **IES SAP to IES SAP**								
—	✓	✓			✓[17]	✓	✓	
IES Service (IPv4) **IES SAP to IPv4 network port interface**								

16 Four MPLS labels deep

17 IPv4 and IPv6

Traffic type	Packet fields used							
				Source and destination			VLAN	
	Ingress Port-ID	IP Protocol	MPLS Label Stack	MAC	IP	L4 Ports	Outer	Inner
—	✓	✓			✓[17]	✓	✓	
IES Service (IPv6) **IES SAP to IPv6 network port interface**								
—	✓	✓			✓[17]	✓	✓	
IES Service (IPv4) interface **IPv4 network port interface to IES SAP**								
—	✓	✓			✓[17]	✓	✓	
IES Service (IPv6) **IPv6 network port interface to IES SAP**								
—	✓	✓			✓[17]	✓	✓	
Network port (IPv4) interface **IPv4 network interface to IPv4 network interface**								
—	✓	✓			✓[17]	✓	✓	
Network port (IPv6) interface **IPv6 network interface to IPv6 network interface**								
—	✓	✓			✓[17]	✓	✓	
VPRN **SAP to SAP, SDP to SAP, SAP to SDP**								
—	✓	✓			✓[17]	✓	✓	

2.6.7.5 Packet fields used for pseudowire hash-label generation on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

The following table describes the packet fields used by different services and traffic types to generate the PW hash label.

Table 20: Packet fields used for PW hash-label generation on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Traffic type	Packet fields used						
			Source and destination			VLAN	
	Ingress Port-ID	IP Protocol	MAC	IP	L4 Ports	Outer	Inner
VPLS and Epipes services **SAP to SDP**							
IP traffic (learned and unlearned)	✓	✓		✓	✓	✓	
MPLS traffic (learned and unlearned)	✓		✓[18]			✓	✓
Non-IP traffic (learned and unlearned)	✓		✓			✓	✓
VPLS services **SDP to SDP**							
IP traffic (learned and unlearned)	✓	✓		✓	✓		
Non-IP traffic (learned and unlearned)	✓		✓				

2.6.7.6 LDP ECMP hashing algorithm for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

The following table describes the packet fields used for LDP ECMP hashing for label edge router (LER) and label switching router (LSR) devices on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

[18] The outer MAC of the Ethernet packet that encapsulates MPLS packets

Table 21: LDP ECMP hashing algorithm for LER and LSR on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Traffic type	Packet fields used							
				Source and destination			VLAN	
	Ingress Port-ID	IP Protocol	MPLS Label Stack	MAC	IP	L4 Ports	Outer	Inner
VPLS and Epipe services **SAP to SDP (iLER)**								
IP traffic	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓[19]			✓	✓
Non-IP traffic	✓			✓			✓	✓
LSR								
MPLS traffic	✓		✓[20]				✓	

2.6.8 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".

Note:
MC-LAG is supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

Typically, MC-LAG is deployed in a network-wide scenario and provides redundant connection between different end points. The whole scenario is then built by a combination of different mechanisms (for example, MC-LAG and redundant pseudowire to provide end-to-end (e2e) redundant point-to-point (p2p) connection or dual homing of CPE devices in Layer 2/3 VPNs).

2.6.8.1 Overview

MC-LAG is a method of providing redundant Layer 2/3 access connectivity that extends beyond link level protection by allowing two systems to share a common LAG end point.

19 The outer MAC of the Ethernet packet that encapsulates MPLS packets

20 Four MPLS labels deep

The CPE/access node is connected with multiple links toward a redundant pair of Layer 2/3 access aggregation nodes such that both link and node level redundancy is provided. By using a multi-chassis LAG protocol, the paired Layer 2/3 aggregation nodes (referred to as the redundant-pair) appear to be a single node that is utilizing LACP toward the access node. The multi-chassis LAG protocol between the redundant-pair ensures a synchronized forwarding plane to and from the CPE/access node. It is used to synchronize the link state information between the redundant-pair nodes and provide correct LACP messaging to the CPE/access node from both redundant-pair nodes.

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

MC-LAG has the following characteristics:

- Selection of the common system ID, system-priority, and administrative-key are used in LACP messages to ensure that partner systems consider all links part of the same LAG.
- The selection algorithm is extended to allow the selection of the active subgroup.
  - The subgroup definition in the LAG context is still local to the single box. Consequently, even when subgroups configured on two different systems have the same subgroup-id, they are still considered two separate subgroups within the specific LAG.
  - The configuration of multiple subgroups per PE in an MC-LAG is supported.
  - If there is a tie in the selection algorithm, for example, two subgroups with identical aggregate weight (or number of active links), the group that is local to the system with lower system LACP priority and LAG system ID is selected.
- Providing an inter-chassis communication channel allows the inter-chassis communication to support LACP on both systems. The communication channel enables the following functionality:
  - It supports connections at the IP level that do not require a direct link between two nodes. The IP address configured at the neighbor system is one of the addresses of the system (interface or loop-back IP address).
  - The communication protocol provides heartbeat mechanism to enhance robustness of the MC-LAG operation and detect node failures.
  - It supports operator actions that force an operational change on nodes.
  - The LAG group-ids do not have to match between neighbor systems. At the same time, multiple LAG groups between the same pair of neighbors is also allowed.
  - It verifies that the physical characteristics, such as speed and auto-negotiation are configured and initiates operator notifications (traps) if errors exist. Consistency of MC-LAG configuration (system-id, administrative-key and system-priority) is provided. Load-balancing must be consistently configured on both nodes.
  - Traffic over the signaling link is encrypted using a user-configurable message digest key.
- The MC-LAG function provides active/standby status to other software applications to build reliable solutions.

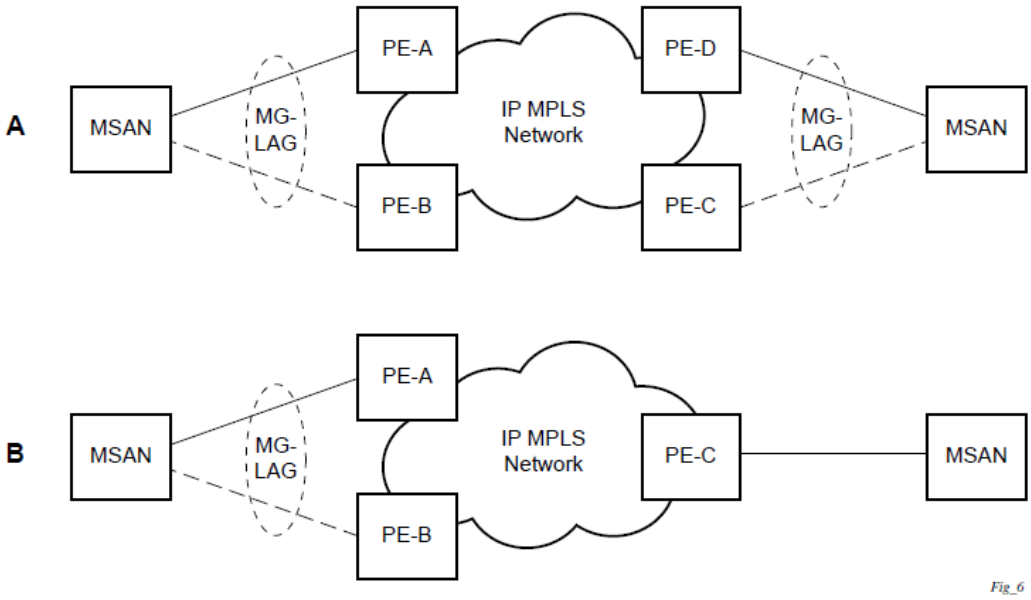
Figure 13: MC-LAG L2 dual homing to remote PE pairs and Figure 14: MC-LAG L2 dual homing to local PE-pairs show different combinations of supported MC-LAG attachments. The supported configurations can be divided into the following subgroups:

- dual-homing to remote PE pairs
  - both end-points attached with MC-LAG

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

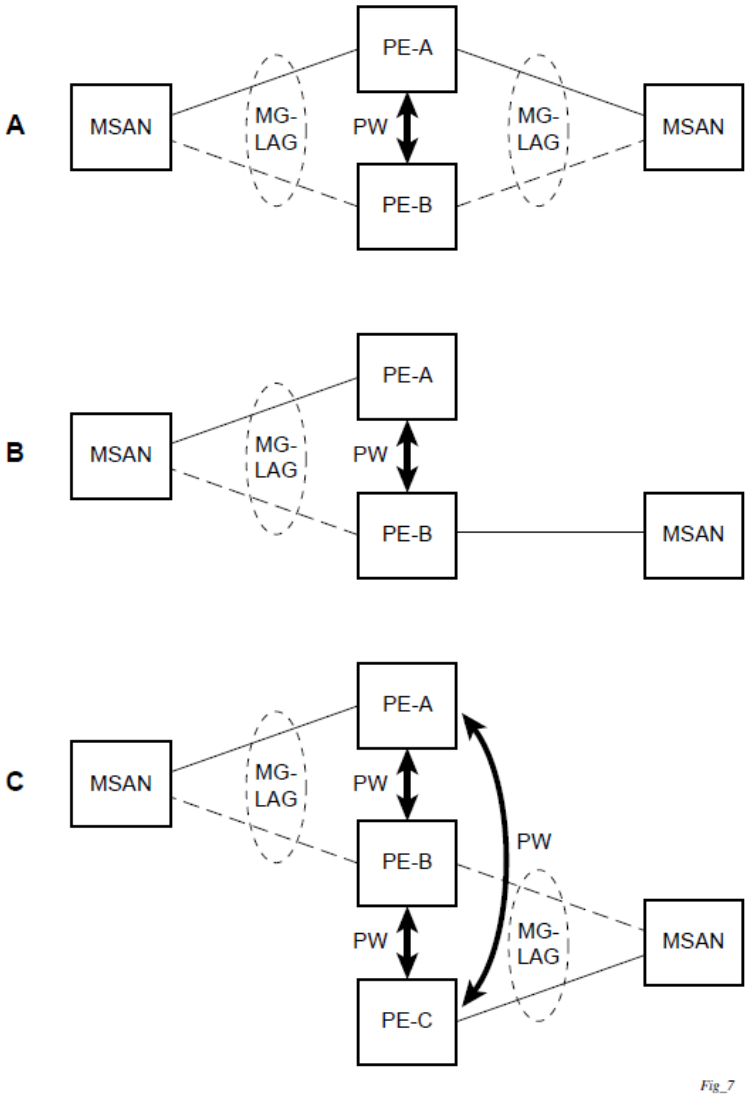
The following figure shows dual homing to remote PE pairs.

Figure 13: MC-LAG L2 dual homing to remote PE pairs



The following figure shows dual homing to local PE pairs.

Figure 14: MC-LAG L2 dual homing to local PE-pairs



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

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

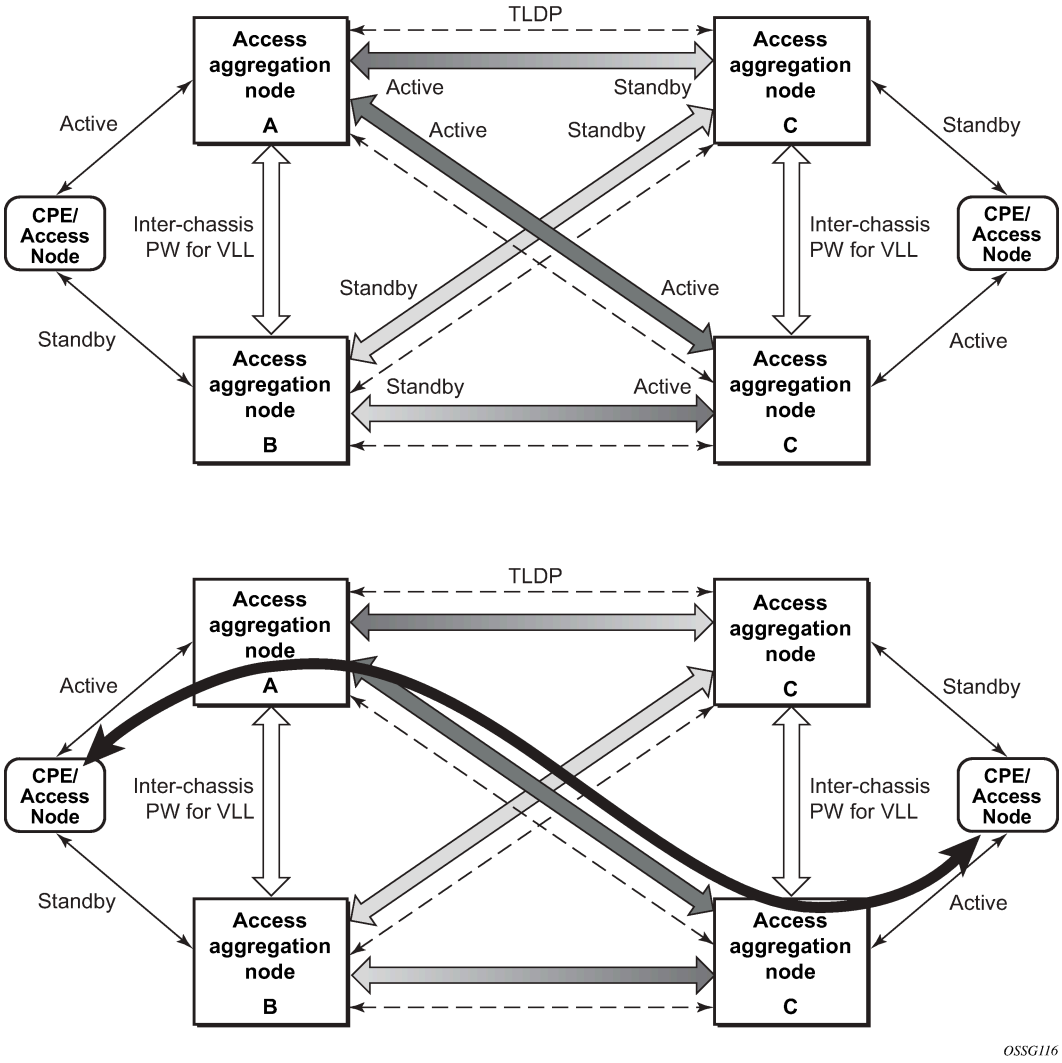
2.6.8.2 Point-to-point redundant connection across Layer 2/3 VPN network

The following figure shows the connection between two CPE/access nodes across network based on Layer 2/3 VPN pseudowires. The connection between a CPE/access node and a pair of access aggregation PE routers is realized by MC-LAG. From the CPE/access node perspective, a redundant pair of access aggregation PE routers acts as a single partner in LACP negotiation. At any point in time, only one of the routers has active links in a specific LAG. The status of LAG links is reflected in the status signaling of pseudowires set between all participating PEs. The combination of active and standby states across LAG links and pseudowires give only one unique path between a pair of MSANs.

Note that the configuration in the following figure shows an example configuration of VLL connections based on MC-LAG. Specifically, it shows a VLL connection where the two ends (SAPs) are located on two different redundant-pairs. However, additional configurations are possible, for example:

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

Figure 15: P2P redundant connection through a Layer 2 VPN network



2.6.8.3 Configuration guidelines

The following guidelines apply to MC-LAG configurations:

- MC-LAG peer nodes must be of the same platform type. For example, 7210 SAS-K 2F6C4T can only peer with another 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C can only peer with another 7210 SAS-K 3SFP+ 8C. 7210 SAS-K 2F6C4T cannot be configured with 7210 SAS-K 3SFP+ 8C as its MC-LAG peer.
- MC-LAG is only supported when using MPLS uplinks with network ports. It is not supported with access-uplink ports.
- The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C can also be MC-LAG clients, with an active/ standby LAG configuration used to dual-home to access-aggregation routers when using access-uplink

ports. In this scenario the user has an option to provision the uplinks as access-uplink ports to dual-home into two aggregation PE routers that are configured as MC-LAG peers.

2.6.8.4 Configuring multi-chassis redundancy

Note:
When configuring associated LAG ID parameters, the LAG must be in access mode and LACP must be enabled.

Use the following syntax to configure multi-chassis redundancy features.

```
config>redundancy
  multi-chassis
     peer ip-address
        authentication-key [authentication-key | hash-key][hash | hash2]
        description description-string
        mc-lag
           hold-on-neighbor-failure duration
           keep-alive-interval interval
           lag lag-id lacp-key admin-key system-id system-id [remotelag lag-
id] system-priority system-priority
           no shutdown
        no shutdown
        source-address ip-address
        sync
           igmp-snooping
           port [port-id | lag-id] [sync-tag]range encap-range sync-tag
           no shutdown
```

```
config>redundancy# multi-chassis
config>redundancy>multi-chassis# peer 10.10.10.2 create
config>redundancy>multi-chassis>peer# description "Mc-Lag peer 10.10.10.2"
config>redundancy>multi-chassis>peer# mc-lag
config>redundancy>mc>peer>mc-lag# lag 1 lacp-key 32666 system-
id 00:00:00:33:33:33 system-priority 32888
config>redundancy>mc>peer>mc-lag# no shutdown
config>redundancy>mc>peer>mc-lag# exit
config>redundancy>multi-chassis>peer# no shutdown
config>redundancy>multi-chassis>peer# exit
config>redundancy>multi-chassis# exit
config>redundancy#
```

Example

The following is a sample configuration output.

```
*7210-SAS>config>redundancy# info
----------------------------------------------
        multi-chassis
            peer 1.1.1.1 create
                shutdown
                sync
                    shutdown
                    port 1/1/1 create
                    exit
                exit
            peer 10.20.1.3 create
```

```
                mc-lag
                    lag 3 lacp-key 1 system-id 00:00:00:aa:bb:cc remote-
lag 1 system-priority 1
                    no shutdown
                exit
                no shutdown
            exit
        exit
-----------------------------------------------
*7210-SAS>config>redundancy#
```

2.6.8.5 MC-LAG support on 7210 SAS-D and 7210 SAS-K 2F1C2T

Multi-Chassis LAG (MC-LAG) is an extension of a LAG concept that provides node-level redundancy in addition to the link-level redundancy provided by "regular LAG". Typically, MC-LAG is deployed network-wide, along with IP/MPLS, providing redundant connections between different access end points. In a typical MC-LAG deployment, a pair of nodes are configured to be MC-LAG peers (also referred to as MC-LAG servers), and access devices are connected to the MC-LAG peers using LAGs with active/standby LAG groups.

The 7210 SAS-D, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C platforms can be connected to an MC-LAG-enabled node, such as an MC-LAG server. In particular, these platforms allow for provisioning of links into subgroups in a LAG and support active/standby links. The MC-LAG solution can be achieved with or without subgroups configured.

2.7 G.8032 protected Ethernet rings

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

See "G.8032 Protected Ethernet Rings" in the 7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Services Guide for more information about Ethernet rings.

2.8 802.1x network access control

The Nokia 7210 SAS supports network access control of client devices (PCs, STBs, and so on) 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.

2.8.1 802.1x modes

The 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 that is described as follows. The port will remain in an unauthorized 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.

2.8.2 802.1x 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 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 therefore a RADIUS client, and the authentication server a RADIUS server.

The router initiates 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 does not 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.

2.8.3 802.1x 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 to 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 to 300.

- **quiet-period**

  Indicates number of seconds between authentication sessions. It is started after logout, after sending an EAP-Failure message or after expiry of the supplicant-timeout timer. The default value is 60. The range is 1 to 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 to 10.

- **server-timeout**

  Indicates how many seconds the authenticator will wait for a RADIUS response message. If the timer expires, the access request message is sent again, up to *max-auth-req* times. The default value is 60. The range is 1 to 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 to 9000 seconds (the default is 3600 seconds, one hour). Note that the port stays in an authorized state during the re-authentication procedure.

2.8.4 802.1x 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 predefined 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.

2.8.5 802.1x 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 applies only to port-based Epipe SAPs because 802.1x runs at the port level not the 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).

Enabling 802.1x tunneling requires the 802.1x mode to be set to force-auth. Enforcement is performed at the CLI level.

2.9 802.3ah OAM

802.3ah Clause 57 (EFM OAM) defines the Operations, Administration, and Maintenance (OAM) sublayer, 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 therefore 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).

2.9.1 OAM events

EFM OAM defines a set of events that may impact link operation. The following critical link events (defined in 802.3ah clause 57.2.10.1) are supported:

- 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.

Note:
The dying gasp event is not supported on the 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p.

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

The 7210 SAS 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.

2.9.2 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.

2.9.3 802.3ah 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. Therefore, 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. That is, on a specific port either 802.3ah tunneling can be enabled or 802.3ah can be enabled, but both cannot be enabled together.

2.9.4 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.

- The access uplink port MTU on the 7210 SAS-D and 7210 SAS-Dxp 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 2F1C2T 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 2F6C4T and 7210 SAS-K 3SFP+ 8C support 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.

2.9.4.1 Default MTU values

The following table describes the default MTU values that are dependent upon the (sub-) port type, mode, and encapsulation.

Table 22: 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
Other Ethernet	uplink	—	9212
Ethernet	hybrid	—	9212

2.9.4.2 Modifying MTU defaults on 7210 SAS-D and 7210 SAS-Dxp

On the 7210 SAS-D and 7210 SAS-Dxp, 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 because of frame size limitations.

2.9.4.3 Modifying MTU defaults on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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 because of frame size limitations.

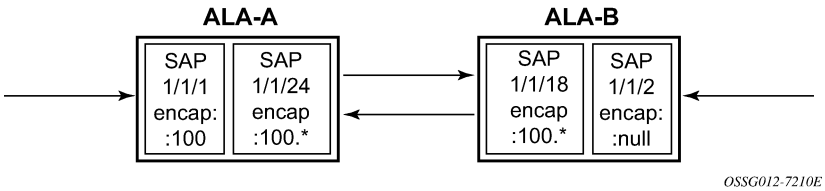
The service MTU must be less than or equal to both the access SAP port MTU and the access-uplink port MTU values. If the service from the 7210 SAS-K 2F1C2T is transported over an SDP in the IP/MPLS network (the SDP is not originating or terminating on the node), the operational path MTU can be less than the service MTU. In this case, user may need to modify the MTU value accordingly.

2.9.4.4 Configuration example for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C 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 the egress SAP is provisioned must be coordinated to accept the maximum frame size the service can forward.

The following figure shows an example of the targeted MTU values to configure for an Epipe service (ALA-A and ALA-B).

Figure 16: MTU configuration example



Because 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 (see the following table for MTU default values). Each of the access uplink port MTU must be set to at least 1518 as well. Finally, the MTU of ALA-B SAP (access port 1/1/2) must be at least 1514, as it uses null encapsulation.

The following table describes sample MTU configuration values.

Table 23: MTU configuration example values (ALA-A with dot1q SAP type, ALA-B with null encap)

	ALA-A		ALA-B	
	Access (SAP)	Access Uplink (SAP)	Access Uplink (SAP)	Access (SAP)

	ALA-A		ALA-B	
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 dot1q-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 the following table for MTU default values). Each of the access uplink port MTU must be set to at least 1522 as well. Finally, the MTU of ALA-B SAP (access port 1/1/2) must be at least 1518, as it uses Dot1q encapsulation.

The following table describes sample MTU configuration values.

Table 24: MTU configuration example Values (ALA-A with dot1q-preserve SAP type, ALA-B with dot1Q encap)

	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

2.9.5 Modifying MTU defaults on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C 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 because of 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-K 2F6C4T or 7210 SAS-K 3SFP+ 8C is transported over an SDP in the IP/MPLS network (the SDP is not originating or terminating on the node), the operational path MTU can be less than the service MTU. In this case, the user may 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, modify the MTU value accordingly.

2.9.6 Deploying preprovisioned components

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

2.10 MAC authentication

Note:
MAC authentication is only supported on 7210 SAS-Dxp.

The 7210 SAS supports the 802.1x EAP standard for authenticating Ethernet devices before they can access the network. However, if a client device does not support 802.1x EAP, MAC authentication can be used to prevent unauthorized traffic from being transmitted through the 7210 SAS.

Because MAC authentication is a fallback mechanism, the user must first enable 802.1x EAP to use MAC authentication on the 7210 SAS. To authenticate a port using MAC authentication, first configure 802.1x authentication on the 7210 SAS by enabling **port-control auto**, and then configure **mac-auth** on the 7210 SAS to enable MAC authentication.

Layer 2 control protocols affect MAC authentication behavior differently depending on the protocol in use; see Layer 2 control protocol interaction with authentication methods for more information.

2.10.1 MAC authentication basics

When a port becomes operationally up with MAC authentication enabled, the 7210 SAS (as the authenticator) performs the following steps.

1. After transmission of the first EAP-Request/ID PDU, the 7210 SAS starts the **mac-auth-wait** timer and begins listening on the port for EAP-Response/ID PDUs. At this point, the 7210 SAS only listens to EAPOL frames. If EAPOL frames are received, 802.1x authentication is chosen.

   Note:
   If it is known that the attached equipment does not support EAP, you can configure **no mac-auth-wait** so that MAC authentication is used as soon as the port is operationally up.

2. If the **mac-auth-wait** timer expires, and no EAPOL frames have been received, the 7210 SAS begins listening on the port for any Ethernet frames.
3. If the 7210 SAS receives an Ethernet frame, the 7210 SAS scans the client source MAC address in the frame and transmits the MAC address to the configured RADIUS server for comparison against the MAC addresses configured in its database.

   The following attributes are contained in the RADIUS message:

   - **User-Name**

     This attribute specifies the source MAC address of the client device.

   - **User-Password**

     This attribute specifies the source MAC address of the client device in an encrypted format.

- **Service-Type**

  This attribute specifies the type of service that the client has requested; the value is set to 10 (call-check) for MAC authentication requests.

- **Calling-Station-Id**

  This attribute specifies the source MAC address of the client device.

- **NAS-IP-Address**

  This attribute specifies the IP address of the device acting as the authenticator.

- **NAS-Port**

  This attribute specifies the physical port of the device acting as the authenticator.

- **Message-Authenticator**

  This attribute is used to authenticate and protect the integrity of Access Request messages to prevent spoofing attacks.

4. If the MAC address is approved by the RADIUS server, the 7210 SAS enables the port for traffic transmission by that particular MAC address, which is successfully authenticated.

   If the MAC address is rejected by the RADIUS server, the 7210 SAS will not authenticate the port using either 802.1x or MAC authentication. If an Ethernet frame with the same MAC address is received, the 7210 SAS returns to step3 and reattempts approval of the MAC address.

5. If a port that was previously authenticated with MAC authentication receives an EAPOL-Start frame, the port will not reauthenticate using 802.1x EAPOL.

While the port is unauthenticated, the port will be down to all upper layer protocols or services.

When a MAC address is authenticated, only packets whose source MAC address matches the authenticated MAC address are forwarded when the packets are received on the port, and only packets whose destination MAC address matches the authenticated MAC address are forwarded out of the port.

Broadcast and multicast packets at ingress are sent for source MAC address authentication. Broadcast and multicast packets at egress are forwarded as normal.

Unknown destination packets at ingress are copied to the CPU and MAC authentication is attempted. Unknown destination packets at egress are dropped.

2.10.2 MAC authentication limitations

MAC authentication is subject to the following limitations:

- If MAC authentication is configured on ports that are part of a LAG, the authenticated MAC address is forwarded in the egress direction out of any port in the LAG.
- If MAC authentication is configured on a port and the port is added to or removed from a LAG, all previously authenticated MACs are reauthenticated by the system.

Caution:
A small amount of traffic loss may occur while MAC reauthentication is in progress.

2.11 VLAN authentication

Note:
VLAN authentication is only supported on 7210 SAS-Dxp.

The 7210 SAS supports VLAN authentication, which operates similarly to 802.1x network access control but only uses VLAN-tagged EAPOL frames to trigger the authentication process on a per-VLAN basis, or uses null-tagged EAPOL frames to authenticate and authorize processing of service traffic received in the context of a Dot1q explicit null SAP. See 802.1x network access control for information about 802.1x network access control and authentication.

To authenticate a port using VLAN authentication, you must first configure 802.1x authentication on the 7210 SAS by enabling **port-control auto**, and then configure **vlan-auth** on the 7210 SAS to enable VLAN authentication and allow VLAN authentication functionality to supersede that of basic 802.1x authentication.

VLAN authentication and MAC authentication are mutually exclusive. MAC authentication cannot be configured on a port while VLAN authentication is already configured on the same port. See MAC authentication for information about MAC authentication.

Layer 2 control protocols affect VLAN authentication behavior differently depending on the protocol in use; see Layer 2 control protocol interaction with authentication methods for more information.

2.11.1 VLAN authentication basics

When a port becomes operationally up with VLAN authentication enabled, the 7210 SAS (as the authenticator) performs the following steps.

1. After transmission of the first EAP-Request/ID PDU, the 7210 SAS begins listening on the port for VLAN-tagged EAPOL Start, Request-Identity frames from the access device connected to the port. Null-tagged EAPOL frames also trigger the authentication process if a Dot1q explicit null SAP is configured.
2. If the 7210 SAS receives a VLAN-tagged EAPOL frame (or a null-tagged EAPOL frame if a Dot1q explicit null SAP is configured), the 7210 SAS transmits the frame to the configured RADIUS server for comparison of the VLAN against the usernames configured in its database.

   The User-Name attribute is contained in the RADIUS message. This attribute specifies the username received in the EAPOL frame from the client device.
3. If the VLAN is approved by the RADIUS server, the 7210 SAS maps all traffic received from the VLAN to a SAP and processes it in the context of the configured service.

   If the VLAN is rejected by the RADIUS server, all traffic from the VLAN is dropped. The 7210 SAS enters a quiet period, configured using the **quiet-period** command, and will not authenticate the port using VLAN authentication. After the quiet period expires, the 7210 SAS returns to step1.

While the port is unauthenticated, the port will be down to all upper layer protocols or services.

2.11.2 VLAN authentication limitations

VLAN authentication is subject to the following limitations:

- VLAN authentication is only supported on Dot1q-encapsulated ports. It is not supported on NULL or QinQ-encapsulated ports.

- VLAN authentication only uses the outermost VLAN tag received in the packets. Packets with more than one tag are processed only if the outermost tag matches the SAP tag.
- Restrictions on processing of SAP tags also apply to VLAN authenticated frames. VLAN authentication does not change the current behavior for frames mapped to different SAPs and services.
- VLAN range SAPs are not supported on a port with VLAN authentication enabled.
- Dot1q default SAPs configured on a port with Dot1q encapsulation do not support VLAN authentication.
- Dot1q explicit null SAPs can be configured on a port with Dot1q encapsulation, which requires authentication of null-tagged EAPOL frames.

2.11.3 Dynamic VLAN assignment using dot1x RADIUS authentication with EHS

Note:
Dynamic VLAN assignment using dot1x RADIUS authentication with EHS is only supported on the 7210 SAS-Dxp.

On the 7210 SAS, users can assign a VLAN using the RADIUS tunnel attribute. Only the VLAN is returned by RADIUS, while other policies (such as QoS, ACLs, or accounting) are not. The locally configured policies can be applied when the VLAN ID is used to configure the SAP after a successful authentication of the host using dot1x (including MAC authentication).

See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Services Guide* and *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C System Management Guide* for more information and configuration guidelines on dynamic VLAN assignment using dot1x RADIUS authentication with the event handling system (EHS).

2.12 Layer 2 control protocol interaction with authentication methods

The following table describes the interactions of Layer 2 control protocols with 802.1x authentication, MAC authentication, and VLAN authentication.

Table 25: Layer 2 control protocol interaction with authentication methods

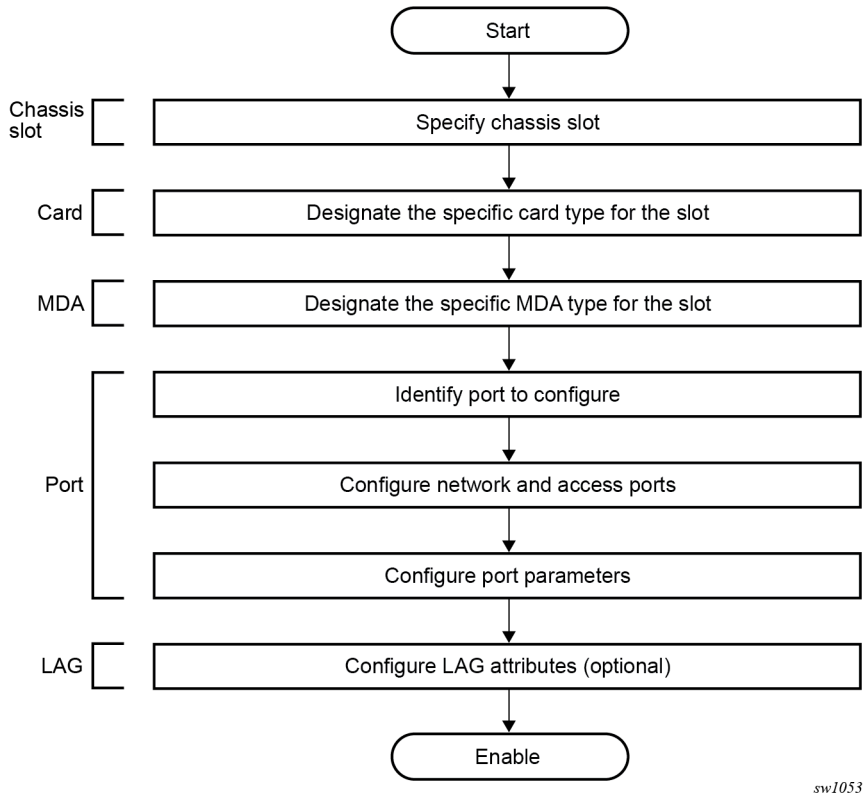
Layer 2 control protocol	802.1x port authentication enabled	MAC authentication enabled	VLAN authentication enabled	
			Dot1q explicit null SAP not configured	Dot1q explicit null SAP configured
EFM OAM	Allow	Allow	Allow	Allow
LLDP	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	Allow	Allow
LACP	Block if port is unauthenticated	Block if MAC is unauthenticated	LAG and LACP are not supported on	LAG and LACP are not supported on

Layer 2 control protocol	802.1x port authentication enabled	MAC authentication enabled	VLAN authentication enabled	
			Dot1q explicit null SAP not configured	Dot1q explicit null SAP configured
	Allow if port is authenticated	Allow if MAC is authenticated	ports with VLAN authentication enabled	ports with VLAN authentication enabled
CFM	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	Block if VLAN (SAP) is unauthenticated Allow only if specific VLAN is authenticated	Block if null SAP is unauthenticated Allow if null SAP is authenticated
xSTP (STP/ RSTP/MSTP)	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	Block if VLAN (SAP) is unauthenticated Allow if VLAN (SAP) is authenticated	Block if null SAP is unauthenticated Allow if null SAP is authenticated

2.13 Configuration process overview

The following figure shows the process to provision chassis slots, line cards, MDAs, and ports.

Figure 17: Slot, card, MDA, and port configuration and implementation flow



2.14 Configuring physical ports with CLI

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

2.15 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.

2.15.1 Predefining entities

The 7210 SAS auto-provisions card and MDA types.

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

You can:

- Preprovision ports and interfaces after the line card and MDA types are specified.
- Install line cards in slots with no preconfiguration parameters specified. When the card is installed, the card and MDA types must be specified. This is required on 7210 SAS chassis based platforms or on those platforms that support expansion slots. Typically, on 7210 SAS platforms that do not support any removable cards and MDAs, the cards are preprovisioned 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 on those platforms that support expansion slots. Typically, on 7210 SAS platforms that do not support any removable cards and MDAs, the MDAs are preprovisioned for all fixed ports.

2.15.2 Preprovisioning a port

It is recommended to configure an access Ethernet port for customer-facing traffic on which services are configured.

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

To configure an Ethernet access port, see Configuring Ethernet port parameters.

2.16 Basic configuration

On 7210 SAS platforms that do not support any removable cards and 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.

2.17 Common configuration tasks

This section describes common configuration tasks.

2.17.1 Configuring Ethernet port parameters

This section describes Ethernet port configuration.

2.17.1.1 Ethernet network port

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

Example

The following is a sample network port configuration output.

```
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 the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

2.17.1.2 Ethernet access-uplink port

An 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.

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.

Example

The following is a sample network port configuration output.

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

Access uplink port configuration is supported on the 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

2.17.1.3 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. When a port has been configured for access mode, multiple services may be configured on the port.

Example

The following is a sample Ethernet access port configuration (for 7210 SAS-D) output.

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

Access port configuration is supported on the 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

2.17.1.4 Configuring 802.1x authentication port parameters

Example

The following is a sample of an 802.1x port configuration output.

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

2.17.1.5 Configuring MAC authentication port parameters

Note:
MAC authentication is only supported on 7210 SAS-Dxp.

The 7210 SAS supports a fallback MAC authentication mechanism for client devices (for example, PCs and cameras) on an Ethernet network that do not support 802.1x EAP.

MAC authentication provides protection against unauthorized access by forcing the device connected to the 7210 SAS to have its MAC address authenticated by a RADIUS server before the device is able to transmit packets through the 7210 SAS.

Use the following CLI syntax to configure MAC authentication for an Ethernet port.

```
port port-id ethernet
         dot1x
             mac-auth
             mac-auth-wait seconds
             port-control auto
             quiet-period seconds
             radius-plcy name
```

Example: Command usage to configure MAC authentication for an Ethernet port

```
config# port 1/1/2 ethernet dot1x
config>port>ethernet>dot1x# mac-auth
config>port>ethernet>dot1x# mac-auth-wait 20
config>port>ethernet>dot1x# port-control auto
config>port>ethernet>dot1x# quiet-period 60
config>port>ethernet>dot1x# radius-plcy dot1xpolicy
```

Example: Sample port configuration output

Use the **info detail** command to display port configuration information.

```
SAS-T>config>port>ethernet>dot1x# info detail
-----------------------------------------------
             port-control auto
             radius-plcy dot1xpolicy
             re-authentication
             re-auth-period 3600
             max-auth-req 2
             transmit-period 30
             quiet-period 60
             supplicant-timeout 30
             server-timeout 30
```

```
            mac-auth
            mac-auth-wait 20
-----------------------------------------
SAS-T>config>port>ethernet>dot1x#
```

2.17.1.6 Configuring VLAN authentication port parameters

Note:
VLAN authentication is only supported on 7210 SAS-Dxp.

The 7210 SAS supports VLAN authentication for client devices (for example, PCs and STBs) on an Ethernet network.

VLAN authentication provides protection against unauthorized access by forcing the device connected to the 7210 SAS to be authenticated by a RADIUS server before the device is able to transmit packets through the 7210 SAS.

Use the following CLI syntax to configure VLAN authentication for an Ethernet port.

```
port port-id ethernet
         dot1x
             vlan-auth
             port-control auto
             quiet-period seconds
             radius-plcy name
```

Example: Command usage to configure VLAN authentication for an Ethernet port

```
config# port 1/1/2 ethernet dot1x
config>port>ethernet>dot1x# vlan-auth
config>port>ethernet>dot1x# port-control auto
config>port>ethernet>dot1x# quiet-period 60
config>port>ethernet>dot1x# radius-plcy dot1xpolicy
```

Example: Sample port configureation output

Use the **info detail** command to display port configuration information.

```
SAS-T>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
            vlan-auth
-----------------------------------------
SAS-T>config>port>ethernet>dot1x#
```

2.17.2 Configuring LAG parameters

The following are general rules for configuring LAGs:

- The 7210 SAS-D and 7210 SAS-Dxp support up to four 1GE ports in a LAG. The 7210 SAS-Dxp also supports up to two 10GE ports in a LAG.
- The 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T support up to three 1GE ports in a LAG.
- The 7210 SAS-K 3SFP+ 8C supports up to three 1GE ports or two 10GE ports in a LAG.
- All ports in the LAG must share the same characteristics (speed, duplex, hold-timer, and so on). The port characteristics are inherited from the primary port.
- Autonegotiation must be disabled or set to limited mode for ports that are part of a LAG to guarantee a specific port speed.
- Ports in a LAG must be configured as full duplex.

Example

The following is a sample 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#
```

2.18 CRC error monitoring

Note:
This feature is supported on all 7210 SAS platforms as described in this document, except the 7210 SAS-K 2F1C2T.

This feature allows the user to track CRC (cyclic redundancy check) errors received on a specific 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**.

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 (the preceding computation) 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.

2.19 Service management tasks

This section describes basic procedures of the service management tasks:

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 syntax to modify an MDA.

```
config> port port-id
     shutdown
```

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

2.19.1 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.

2.19.2 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.

2.19.3 Deleting port parameters

Use the following syntax to delete a port provisioned for a specific card.

```
config>port port-id
     shutdown
     no port port-id
```

2.20 Card, MDA, and port command reference

2.20.1 Command hierarchies

- Configuration commands
- Show commands
- Monitor commands
- Clear commands
- Debug commands

2.20.1.1 Configuration commands

- Hardware commands
- Port buffer pool configuration commands for 7210 SAS-D and 7210 SAS-Dxp
- Port configuration commands
- Port configuration commands for PTP Port-based timestamp
- Port-based split horizon group configuration commands for 7210 SAS-D and 7210 SAS-Dxp
- Port commands for reserving resources of ports on 7210 SAS-Dxp
- MACsec commands for 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p
- Ethernet commands
- LAG commands for 7210 SAS-D and 7210 SAS-Dxp
- LAG commands for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
- Multi-chassis redundancy commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
- Ethernet ring commands

2.20.1.1.1 Hardware commands

```
config
    - [no] card slot-number
        - card-type card-type
        - mda mda-slot
            - mda-type mda-type
```

```
            - no mda-type
            - [no] shutdown
            - [no] sync-e
        - [no] shutdown
```

2.20.1.1.2 Port buffer pool configuration commands for 7210 SAS-D and 7210 SAS-Dxp

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

2.20.1.1.3 Port configuration commands

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

2.20.1.1.4 Port configuration commands for PTP Port-based timestamp

```
config
    - port port-id
    - no port
       - [no] ptp-hw-timestamp
```

2.20.1.1.5 Port-based split horizon group configuration commands for 7210 SAS-D and 7210 SAS-Dxp

Port Configuration Commands

```
config
    - port
    - no port
       - split-horizon-group group-name
       - no split-horizon-group
```

LAG Commands

```
config
    - [no] lag [lag-id]
       - [no] split-horizon-group group-name
```

2.20.1.1.6 Port commands for reserving resources of ports on 7210 SAS-Dxp

```
configure
    - system
        - loopback-no-svc-port [mirror | mac-swap | testhead] port-id
        - no loopback-no-svc-port
```

2.20.1.1.7 MACsec commands for 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

```
config
    - macsec
        - connectivity-association  ca-name [create]
        - no connectivity-association  ca-name
            - cipher-suite {cipher-suite}
            - no cipher-suite
            - clear-tag-mode clear-tag-mode
            - no clear-tag-mode
            - description description-string
            - no description
            - encryption-offset encryption-offset
            - no encryption-offset
            - [no] macsec-encrypt
            - [no] replay-protection
            - replay-window-size number-of-packets
            - no replay-window-size
            - [no] shutdown
            - [no] static-cak
                - active-psk active-pre-shared-key
                - no active-psk
                - mka-key-server-priority priority
                - no mka-key-server-priority
                - pre-shared-key pre-shared-key-index [encryption-type encryption-type]
 [create]
                - no pre-shared-key pre-shared-key-index
                    - cak  hex-string [hash | hash2]
                    - no cak
                    - ckn hex-string
                    - no ckn
```

2.20.1.1.8 Ethernet commands

2.20.1.1.8.1 Port Ethernet QoS commands

```
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
        - [no] enable-dei
        - network
            - accounting-policy policy-id
            - no accounting-policy
            - [no] collect-stats
            - nw-egr-agg-shaper-rate rate
            - no nw-egr-agg-shaper-rate
            - qos policy-id
            - no qos
            - queue-policy name
            - no queue-policy
        - statistics
            - egress
```

2.20.1.1.8.2 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 value
            - no dot1q-etype
            - encap-type {dot1q | null | qinq}
            - no encap-type
            - [no] eth-bn-egress-rate-changes
            - eth-cfm
                - [no] mep  mep-id domain md-index association ma-index
                    - eth-bn
                        - [no] receive
                        - rx-update-pacing seconds
            - frame-based-accounting
            - no frame-based-accounting
            - hold-time {[up hold-time up] [down hold-time down] [seconds| centiseconds]}
            - no hold-time
            - [no] lacp-tunnel
            - [no] loopback {internal} [service svc-id sap sap-id src-mac SA dst-mac DA]
            - mac ieee-address
            - no mac
            - mode access [uplink]
            - mode hybrid
            - mode network
            - no mode
            - monitor-oper-group name
```

```
            - no monitor-oper-group
            - mtu mtu-bytes
            - no mtu
            - no oper-group
            - oper-group name
            - poe  [plus] [plusplus] [hpoe]
            - no poe
            - qinq-etype value
            - no qinq-etype
            - speed {10 | 100 | 1000}
            - [no] shutdown
```

2.20.1.1.8.3 Port Ethernet CRC monitoring commands for 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

2.20.1.1.8.4 Port Ethernet 802.1x commands

```
config
    - [no] port {port-id}
        - ethernet
            - dot1x
                - guest-service service-id [vlan-id vlan-id]
                - no guest-service
                - [no] mac-auth
                - mac-auth-wait seconds
                - no mac-auth-wait
                - 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
                - restricted-service service-id [vlan-id vlan-id]
                - no restricted-service
                - server-timeout seconds
                - no server-timeout
                - supplicant-timeout seconds
                - no supplicant-timeout
                - transmit-period seconds
                - no transmit-period
                - [no] tunneling
                - [no] vlan-auth
```

2.20.1.1.8.5 Port Ethernet 802.1x MACsec commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
config
    - [no] port {port-id}
        - ethernet
            - dot1x
                - [no] macsec
                    - ca-name ca-name
                    - no ca-name
                    - eapol-destination-address mac
                    - no eapol-destination-address
                    - [no] exclude-protocol  {protocol-name}
                    - max-peer max-peer
                    - no max-peer
                    - [no] rx-must-be-encrypted
                    - [no] shutdown
```

2.20.1.1.8.6 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
```

2.20.1.1.8.7 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
```

2.20.1.1.8.8 Port Ethernet LLDP commands

```
config
    - [no] port {port-id}
        - ethernet
            - lldp
                - [no] tunnel-nearest-bridge-dest-mac
                - dest-mac {nearest-bridge | nearest-non-tpmr | nearest-customer}
```

```
                    - admin-status {rx | tx | tx-rx | disabled}
                    - lldp-med
                        - admin-status  {tx-rx | disabled}
                        - no admin-status
                        - network-policy  policy-id [policy-id...(up to 4 max)]
                        - no network-policy
                        - tx-tlvs  [network-policy] [mac-phy-config-status]
                        - no tx-tlvs
                    - [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
```

2.20.1.1.8.9 Port Ethernet sync commands for 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

2.20.1.1.9 LAG commands for 7210 SAS-D and 7210 SAS-Dxp

```
config
    - [no] lag [lag-id]
        - description long-description-string
        - no description
        - [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
        - 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
```

2.20.1.1.10 LAG commands for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
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]
        - mode network
        - no mode
        - monitor-oper-group
        - no monitor-oper-group
        - 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
```

2.20.1.1.11 Multi-chassis redundancy commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
config
    - redundancy
        - multi-chassis
            - [no] peer  ip-address [create]
                - authentication-key  [authentication-key | hash-key] [hash | hash2]
                - no authentication-key
                - description  description-string
                - no description
                - [no] mc-lag
                    - hold-on-neighbor-failure  multiplier
                    - no hold-on-neighbor-failure
                    - keep-alive-interval  interval
                    - no keep-alive-interval
                    - lag  lag-id lacp-key admin-key system-id system-id [remote-lag remote-
lag-id] system-priority system-priority
                    - lag  remote-lag remote-lag-id]
                    - no lag  lag-id
                    - [no] shutdown
```

```
                - peer-name
                - no peer-name
                - [no] shutdown
                - source-address  ip-address
                - no source-address
                - [no] sync
                    - [no] igmp-snooping
                    - port  [port-id | lag-id] [sync-tag sync-tag] [create]
                    - no port  [port-id | lag-id]
                    - range  encap-range [sync-tag sync-tag]
                    - no range  encap-range
                    - [no] shutdown
```

2.20.1.1.12 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} 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
```

2.20.1.2 Show commands

```
show
    - chassis [environment] [power-supply]
    - 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 poe [detail]
    - port port-id dot1x [detail]
    - port port-id ethernet [efm-oam | detail]
    - port port-id optical
    - port [A1] [detail] [statistics] [description]
        - ethernet
            - lldp [nearest-bridge | nearest-non-tpmr | nearest-customer] [remote-info]
 [detail] [lldp-med]
    - redundancy
        - multi-chassis  all
            - mc-lag  peer ip-address [lag lag-id]
            - mc-lag  [peer ip-address [lag lag-id]] statistics
            - sync  peer [ip-address]
            - sync  peer [ip-address] detail
    - sync  peer [ip-address] statistics
    - system
        - internal-loopback-ports [detail]
        - lldp
        - lldp neighbor
        - poe [detail]
```

2.20.1.2.1 MACsec show commands for 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

```
show
    - macsec
        - connectivity-association [ca-name] [detail]
        - mka-session [port port-id]
        - mka-session [port port-id] detail
        - mka-session [port port-id] statistics
```

2.20.1.3 Monitor commands

```
Monitor
    - port port-id [port-id...(up to 5 max)] [interval seconds] [repeat repeat] [absolute |
 rate]
    - port all-ethernet-rates [interval seconds] [repeat repeat]
```

2.20.1.4 Clear commands

```
clear
    - lag lag-id statistics
    - port port-id statistics
```

2.20.1.5 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]
```

2.20.2 Command descriptions

- Configuration commands
- Show commands
- Port monitor commands
- Clear commands
- Debug commands

2.20.2.1 Configuration commands

- Generic commands
- Card commands
- MDA commands
- Interface QoS commands
- General port commands
- Port loopback commands
- MACsec commands for 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p
- Ethernet port commands
- 802.1x port commands
- LLDP port commands
- Access-uplink port commands
- LAG commands
- Ethernet ring commands

2.20.2.1.1 Generic commands

description

Syntax

description *long description-string*

no description

Context

config>port

config>lag

config>split-horizon-group

config>macsec>connectivity-association

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

Parameters

long-description-string

The description character string. Strings can be up to 160 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), 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

config>redundancy>multi-chassis>peer

config>redundancy>multi-chassis>peer>mc-lag

config>redundancy>multi-chassis>peer>sync

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

Default

the default state for a card is **no shutdown**

the default state for an mda is **no shutdown**

the default state for a Link Aggregation Group (LAG) is **shutdown**

the default state for a port is **shutdown**

2.20.2.1.2 Card commands

card

Syntax

card *slot-number*

Context

config

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This mandatory command enables the context to access 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. The IOM card is equipped and provisioned for slot 1.

Parameters

slot-number

Specifies the slot number of the card in the chassis.

card-type

Syntax

card-type *card-type*

Context

config>card

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This mandatory command adds a card type 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

Specifies the type of card to be configured and installed in that slot.

2.20.2.1.3 MDA commands

mda

Syntax

mda *mda-slot*

no mda *mda-slot*

Context

config>card

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This mandatory command enables the MDA CLI context to configure MDAs.

Default

1

Parameters

mda-slot

Specifies 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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 when the MDA is properly provisioned.

7210 SAS-D and 7210 SAS-Dxp (all platform variants) support only a fixed MDA. These platforms do not support an expansion slot. The fixed MDA (addressed as mda 1) is auto-equipped and auto-provisioned on bootup. It cannot be deleted.

The **no** form of this command displays an error message if performed on fixed MDAs.

Default

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

Parameters

mda-type

Specifies the type of MDA selected for the slot position.

Values m4-tx+6-sfp (7210 SAS-D)
m6-tx+4-sfp+2-sfpp (7210 SAS-Dxp)
m2-tx+2-sfp+1-combo (7210 SAS-K 2F1C2T)
m4-tx+2-sfp+6-combo (7210 SAS-K 2F6C4T)
m3-10gb-sfp+8-combo (7210 SAS-K 3SFP+ 8C)

sync-e

Syntax

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

Context

config>card>mda

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide* for more information about Synchronous Ethernet.

The **no** form of this command disables Synchronous Ethernet on the MDA.

Default

no sync-e

2.20.2.1.4 Interface QoS commands

access

Syntax

access

Context

config>port

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure QoS policy parameters on an access port.

uplink

Syntax

uplink

Context

config>port>access

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure QoS policy parameters on an access-uplink port.

egress

Syntax

egress

Context

config>port>access

config>port>access>uplink

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure QoS egress policy parameters for the access port on 7210 SAS-D and 7210 SAS-Dxp, and for the access-uplink port on 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C respectively.

pool

Syntax

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

Context

config>port>access>egress

config>port>access>uplink>egress

Platforms

7210 SAS-D, 7210 SAS-Dxp

Description

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 composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), 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

Platforms

7210 SAS-D, 7210 SAS-Dxp

Description

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.

Parameters

name

Specifies the policy name, a string up to 32 characters.

qos

Syntax

qos *policy-id*

no qos

Context

config>port>ethernet>access>egress

Platforms

7210 SAS-D, 7210 SAS-Dxp

Description

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

The **no** form of this 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 to 65535

qos

Syntax

qos *policy-id*

no qos

Context

config>port>ethernet>access>uplink

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

Parameters

policy-id

Specifies an existing QoS policy to be assigned to the port.

Values 1 to 65535

nw-egr-agg-shaper-rate

Syntax

nw-egr-agg-shaper-rate *rate*

no nw-egr-agg-shaper-rate

Context

config>port>ethernet>network

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the network egress aggregate shaper rate for port queues. The shaper value limits the maximum bandwidth that port queues can receive from the total port bandwidth, with remaining port bandwidth shared by SAPs on the port. This command is only supported on hybrid ports.

The **no** form of this command removes the configured egress aggregate shaper rate.

Default

no nw-egr-agg-shaper-rate

Parameters

rate

Specifies the egress aggregate shaper rate in kb/s.

Values 64 to 1000000 (7210 SAS-K 2F6C4T)
64 to 10000000 (7210 SAS-K 3SFP+ 8C)

qos

Syntax

qos *policy-id*

no qos

Context

config>port>ethernet>network

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

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 to 65535

2.20.2.1.5 General port commands

port

Syntax

port *port-id*

no port

Context

config

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures 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.) 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

[**no**] **enable-dei**

Context

config>port>ethernet

config>lag

Platforms

7210 SAS-D, 7210 SAS-Dxp

Description

This command enables 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 initial 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.

That is, 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.

See the *7210 SAS-D, Dxp Quality of Service Guide* for more information.

Default

no enable-dei

egress-scheduler-policy

Syntax

egress-scheduler-policy *port-scheduler-policy-name*

no egress-scheduler-policy

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-Dxp

Description

This command configures the scheduling behavior to the one specified in the policy (Strict, RR, WRR, WDRR, WRR/WDRR + Strict).

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

Parameters

port-scheduler-policy-name

Specifies a port scheduler policy for the port.

mode

Syntax

mode access [**uplink**]

mode hybrid

mode network

no mode

Context

config>port>ethernet

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

The following modes are supported on the 7210 SAS platforms:

- The 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-K 2F1C2T support only access and access-uplink mode.
- The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C support access, access-uplink, hybrid, 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. When 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.
- Hybrid — A hybrid Ethernet port allows the combination of network and access modes of operation on a per-VLAN basis and must be configured as either dot1q or QinQ encapsulation. When the hybrid port is configured with dot1q encapsulation, SAPs are configured in a service by providing the SAP ID, which must include the *port-id* value of the hybrid port and an unused VLAN tag value in the format *port-id*:*qtag1*. A SAP with the format *port-id:** is also supported. Network IP interfaces are configured in the **config>router>interface>port** context by providing the port name, which consists of the *port-id* value of the hybrid port and an unused VLAN tag value in the format *port-id:qtag1*.

  A valid value must be entered for *qtag1*. The *port-id:** format is not supported on a network IP interface. The 4096 VLAN tag space on the port is shared among VLAN SAPs and VLAN network IP interfaces. When the hybrid port is configured with QinQ encapsulation, SAPs are configured in a service by providing the SAP ID, which must include the *port-id* value of the hybrid port and the outer and inner VLAN tag values in the format *port-id:qtag1.qtag2*. SAPS with the format *port-id:qtag1.** are also supported. The outer VLAN tag value must not have been used to create an IP network interface on this port. In addition, the *qtag1.qtag2* value combination must not have been used by another SAP on this port.

  Network IP interfaces are configured in the **config>router>interface>port** context by providing the port name, which consists of the *port-id* value of the hybrid port and a VLAN tag value in the format *port-id:qtag1.**. An outer VLAN tag *qtag2* of * is used to create a network IP interface. In addition, the *qtag1.qtag2* value combination must not have been used by another SAP or network IP interface on this port.

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

Default

access (7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-K 2F1C2T)

network (7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C)

Parameters

access

Specifies the Ethernet port as service access.

access uplink

Specifies the Ethernet port for transport (Ethernet uplinks available only in access-uplink mode). A limited number of ports can be configured as access-uplink ports at any specified time on the 7210 SAS-Dxp.

hybrid

Specifies the Ethernet port for hybrid use (available only in network mode).

network

Specifies 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

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

Description

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 this 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 maximum

mac

Syntax

mac *ieee-address*

no mac

Context

config>port>ethernet

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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 BPDUs are sent with the new MAC address. A default MAC address is assigned by the system from the chassis MAC address pool.

The **no** form of this command reverts the MAC address to the default value.

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the maximum transmission unit (MTU) size for an Ethernet 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 that are larger than the MTU value are 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 reverts to the default values.

Default

The following table describes the default MTU values that are dependent on the (sub-)port type, mode, and encapsulation.

Table 26: Default MTU values

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

Specifies the maximum allowable size of the MTU, expressed as an integer.

Values 512 to 9212

ptp-hw-timestamp

Syntax

[**no**] **ptp-hw-timestamp**

Context

config>port

Platforms

7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

Description

This command enables Precision Time Protocol (PTP) port-based hardware timestamping on the port in both egress and ingress directions. For more information about PTP port-based hardware timestamping, including configuration guidelines, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide*.

The **no** version of this command disables PTP port-based hardware timestamping on the port.

Default

ptp-hw-timestamp

2.20.2.1.6 Port loopback commands

loopback-no-svc-port

Syntax

[**no**] **loopback-no-svc-port** [**mirror** | **mac-swap** | **testhead**] *port-id*

Context

config>system

Platforms

7210 SAS-Dxp

Description

This command specifies the port to assign for system use when using port loopback or for the mac-swap, mirroring, or testhead OAM tools. The system uses the resources of the port and the port is not available for configuring services.

The user cannot share a single port between multiple tools or applications if they intend to use the tools simultaneously. 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 this command disables the use of this port by the specified OAM tool.

Note:

- On 7210 SAS-Dxp, the user needs to configure this command to dedicate one front-panel port for use with the mirroring applications.
- On 7210 SAS-D (ETR and non-ETR variants), the user has the three internal ports (that is, port 1/1/11, 1/1/12, and 1/1/13) available for use with mac-swap, mirroring, or testhead OAM tools. The user does not need to configure this command; internal port resources are automatically allocated to the ports by software to different OAM tools.
- The **loopback-no-svc-port** command must be used to associate the port resources with the applications. A port can be used with a single application and cannot be shared by multiple applications. The following internal ports can be used on the 7210 SAS-Dxp platforms:
  - On the 7210 SAS-Dxp 12p, internal ports 1/1/13, 1/1/14, and 1/1/15 can be used for loopback with mac-swap, mirroring, or testhead OAM tools. Port 1/1/13 is a 1GE port and is recommended for applications with traffic up to 1 Gb/s. Ports 1/1/14 and 1/1/15 are 10GE ports and are recommended for applications with traffic greater than 1 Gb/s but less than 10 Gb/s.
  - On the 7210 SAS-Dxp 16p, internal ports 1/1/17, 1/1/18, and 1/1/19 can be used for loopback with mac-swap, mirroring, or testhead OAM tools. Port 1/1/17 is a 1GE port and is recommended for applications with traffic up to 1 Gb/s. Ports 1/1/18 and 1/1/19 are

10GE ports and are recommended for applications with traffic greater than 1 Gb/s but less than 10 Gb/s.

– On the 7210 SAS-Dxp 24p, internal ports 1/1/25, 1/1/26, and 1/1/27 can be used for loopback with mac-swap, mirroring, or testhead OAM tools. Port 1/1/25 is a 1GE port and is recommended for applications with traffic up to 1 Gb/s. Ports 1/1/26 and 1/1/27 are 10GE ports and are recommended for applications with traffic greater than 1 Gb/s but less than 10 Gb/s.

Parameters

mac-swap

Specifies that the port is dedicated for use by the mac-swap application/OAM tool.

mirror

Specifies that the port is dedicated for use by the mirroring application/OAM tool.

testhead

Specifies that the port is dedicated for use by the testhead application/OAM tool.

port-id

Specifies the physical port ID in the *slot/mda/port* format.

2.20.2.1.7 MACsec commands for 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

macsec

Syntax

macsec

Context

config

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command enables the context for MACsec configuration. The MACsec MKA profile can be configured in this context.

Note: See SA limits and network design for more information about security zones and ports where MACsec can be enabled.

connectivity-association

Syntax

connectivity-association *ca-name* [**create**]

no connectivity-association *ca-name*

Context

config>macsec

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command configures a connectivity association (CA). MACsec CAs are applied to a port dot1x configuration to enable MACsec on that port.

The **no** form of this command removes the CA.

Parameters

ca-name

Specifies the name of the CA using a string of up to 32 characters.

create

Specifies a mandatory keyword when creating an entry.

cipher-suite

Syntax

cipher-suite *cipher-suite*

no cipher-suite

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command configures encryption of datapath PDUs. When all parties in the CA have the security association key (SAK), they use the algorithm specified by the *cipher-suite* parameter, in conjunction with the SAK, to encrypt the datapath PDUs.

The **no** form of this command disables encryption of datapath PDUs.

Default

cipher-suite gcm-aes-128

Parameters

cipher-suite

Specifies the algorithm to use for control plane encryption.

Values gcm-aes-128
gcm-aes-256

clear-tag-mode

Syntax

clear-tag-mode *clear-tag-mode*

no clear-tag-mode

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command puts 802.1Q tags in clear before SecTAG. The following modes are available: single-tag and dual-tag.

The following table describes the encrypted dot1q and QinQ packet format when **clear-tag-mode** (**single-tag** or **dual-tag**) is configured.

Table 27: Encrypted dot1q and QinQ packet format

Unencrypted format	Clear-tag-mode	Pre-encryption (Tx)	Pre-decryption (Rx)
Single tag (dot1q)	single-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTag
Single tag (dot1q)	dual-tag	DA, SA, TPID, VID, Etype	DA, SA, TPID, VID, SecTag
Double tag (q-in-q)	single-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, SecTag
Double tag (QinQ)	dual-tag	DA, SA, TPID1, VID1, IPID2, VID2, Etype	DA, SA, TPID1, VID1, IPID2, VID2, SecTag

The **no** form of this command puts all dot1q tags after SecTAG and encrypts the tags.

Default

no clear-tag-mode

Parameters

clear-tag-mode

Specifies the clear tag mode.

Values single-tag, dual-tag

description

Syntax

description *description-string*

no description

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command enters a description for the CA.

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

Parameters

description-string

Specifies a brief description of the CA using a string of up to 80 characters.

encryption-offset

Syntax

encryption-offset *encryption-offset*

no encryption-offset

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command specifies the offset of the encryption in MACsec packets.

The encryption offset is distributed by the MKA to all parties and is signaled via MACsec capabilities.

The following table describes the basic settings.

Table 28: MACsec basic settings

Setting	Description
0	MACsec is not implemented
1	Integrity without confidentiality
2	The following are supported: • integrity without confidentiality • integrity and confidentiality with a confidentiality offset of 0
3 [21]	The following are supported: • integrity without confidentiality • integrity and confidentiality with a confidentiality offset of 0, 30, or 50

The **no** form of this command rejects all arriving traffic regardless of whether it is MACsec-secured.

Default

encryption-offset 0

Parameters

encryption-offset

Specifies the encryption offset.

Values 0 — encrypts the entire payload
30 — leaves the IPv4 header in clear
50 — leaves the IPv6 header in clear

macsec-encrypt

Syntax

[**no**] **macsec-encrypt**

[21] 7210 SAS supports setting 3: Integrity without confidentiality and Integrity and confidentiality with a confidentiality offset of 0, 30, or 50.

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command enables encryption and authentication (ICV payload) for all PDUs.

The **no** form of this command specifies that all PDUs are transmitted in cleartext form but still authenticated and have the trailing ICV.

Default

macsec-encrypt

replay-protection

Syntax

[**no**] **replay-protection**

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command configures the size of the replay protection window.

This command must be configured to force packet discard when the system detects a packet that is not within the parameters configured for the replay-window-size command.

When this command is enabled, the sequence of the ID number of the received packets is checked. If the packet arrives out of sequence, and the difference between the packet numbers exceeds the replay window size, the packet is counted by the receiving port and then discarded. For example, if the replay protection window size is set to 5 and a packet assigned the ID of 1006 arrives on the receiving link immediately after the packet assigned the ID of 1000, the packet that is assigned the ID of 1006 is counted and discarded because it falls outside the parameters of the **replay-window-size** command.

Replay protection is especially useful for fighting man-in-the-middle attacks. A packet that is replayed by a man-in-the-middle attacker on the Ethernet link arrives on the receiving link out of sequence, so replay protection helps ensure the replayed packet is dropped instead of forwarded through the network.

Note:
Replay protection should not be enabled in cases where packets are expected to arrive out of order.

Default

replay-protection

replay-window-size

Syntax

replay-window-size *number-of-packet*s

no replay-window-size

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command specifies the size of the replay protection window.

This command must be configured to enable the replay-protection command.

When the *number-of-packets* parameter is set to 0, all packets that arrive out of order are dropped.

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

Default

replay-window-size 0

Parameters

number-of-packets

Specifies the window that the packets can arrive out of order.

Values 0 to 4294967294

shutdown

Syntax

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

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command shuts down the CA profile. All ports using this profile do not transmit PDUs because this command shuts down MACsec for this profile.

The **no** form of this command enables the CA profile.

Default

shutdown

static-cak

Syntax

[**no**] **static-cak**

Context

config>macsec>connectivity-association

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

Commands in this context configure a Connectivity Association Key (CAK). A CAK is responsible for managing the MACsec key agreement (MKA).

active-psk

Syntax

active-psk *active-pre-shared-key*

no active-psk

Context

config>macsec>conn-assoc>static-cak

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command specifies which preshared key is the active transmitting preshared key. If there are two preshared keys configured, the arriving MACsec MKA can be decrypted using CAKs of both preshared keys; however, only the active PSK is used for Tx encryption of MKA PDUs.

Default

active-psk 1

Parameters

active-pre-shared-key

Specifies the value of the preshared key.

Values 1 or 2

mka-key-server-priority

Syntax

mka-key-server-priority *priority*

no mka-key-server-priority

Context

config>macsec>conn-associ>static-cak

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command specifies the key server priority used by the MKA protocol to select the key server when MACsec is enabled using the static CAK security mode.

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

Default

mka-key-server-priority 16

Parameters

priority

Specifies the priority of the server.

Values 0 to 255

pre-shared-key

Syntax

pre-shared-key *pre-shared-key-index* [**encryption-type** *encryption-type*] [**create**]

no pre-shared-key *pre-shared-key-index*

Context

config>macsec>conn-assoc>static-cak

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command specifies the preshared key used to enable MACsec using the static CAK security mode. This command also specifies the encryption algorithm used for encrypting the SAK.

A preshared key includes a connectivity association key name (CKN) and a CAK. The preshared key (the CKN and CAK) must match on both ends of a link.

A preshared key is configured on both devices at each end of a point-to-point link to enable MACsec using static CAK security mode. The MKA protocol is enabled after the successful MKA liveliness negotiation.

The *encryption-type* parameter is used to encrypt SAK and authentication of the MKA packet. The symmetric encryption key SAK needs to be encrypted (wrapped) using the encryption algorithm specified with the *encryption-type* parameter. The AES key is derived using the preshared key.

The **no** form of this command removes the index.

Parameters

pre-shared-key-index

Specifies the index of this preshared key.

Values 1, 2

encryption-type

Specifies the type of encryption.

Values aes-128-cmac, aes-256-cmac

create

Specifies a mandatory keyword when creating an entry.

cak

Syntax

cak *hex-string* [**hash** | **hash2**]

no cak

Context

config>macsec>conn-assoc>static-cak>pre-shared-key

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command configures the CAK for a preshared key. The following values are derived from the CAK:

- **KEK (Key Encryption Key)**

KEK is used to encrypt the MKA and SAK (symmetric key used for datapath PDUs) to be distributed between all members.

- **ICK (Integrity Check Value)**

  ICK is used to authenticate the MKA and SAK PDUs to be distributed between all members.

The **no** form of this command removes the CAK hexidecimal string value.

Parameters

hex-string

Specifies the value of the CAK using up to 64 hexadecimal characters, 32 hexadecimal characters for a 128-bit key, and 64 hexadecimal characters for a 256-bit key.

hash

Specifies the hash scheme.

hash2

Specifies the hash scheme.

ckn

Syntax

ckn *hex-string*

no ckn

Context

config>macsec>conn-assoc>static-cak>pre-shared-key

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command specifies the connectivity association key name (CKN) for a preshared key.

The CKN is appended to the MKA for identification of the CAK by the peer.

The **no** form of this command removes the CKN.

Parameters

hex-string

Specifies the value of the CKN.

Values 32 octets char (64 hex)

2.20.2.1.8 Ethernet port commands

ethernet

Syntax

ethernet

Context

config>port

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

There are three possible settings for autonegotiation:

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

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

When autonegotiation is disabled on a port, the port does not attempt to autonegotiate and will only operate at the **speed** and **duplex** settings configured for the port. Note that disabling autonegotiation on

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

If the **autonegotiate limited** keyword option is specified, the port will autonegotiate 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

Specifies tht 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 and commands.

connection-type

Syntax

connection-type *connection-type*

Context

config>port>ethernet

Platforms

7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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 allows 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. That is, 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 2F1C2T)

auto (7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C)

Parameters

connection-type

Specifies the type of Ethernet combo port.

Values sfp, copper, auto

crc-monitor

Syntax

crc-monitor

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command configures Ethernet CRC Monitoring parameters.

sd-threshold

Syntax

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

Context

config>port>ethernet>crc-monitor

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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.

The **no** form of this command reverts to the default value of 1. If the multiplier keyword is omitted, the multiplier will return to the default value of 1.

Default

no sd-threshold

Parameters

threshold

Specifies the rate of CRC errored Ethernet frames.

Values 1 to 9

multiplier

Specifies the multiplier used to scale the CRC error ratio.

Values 1 to 9

sf-threshold

Syntax

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

Context

config>port>ethernet>crc-monitor

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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 **no** form of this command reverts to the default value of 1. If the multiplier keyword is omitted, the multiplier will return to the default value of 1.

Default

no sf-threshold

Parameters

threshold

Specifies the rate of CRC errored Ethernet frames.

Values 1 to 9

multiplier

Specifies the multiplier used to scale the CRC error ratio.

Values 1 to 9

window-size

Syntax

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

Context

config>port>ethernet>crc-monitor

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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

Parameters

seconds

Specifies the size of the sliding window in seconds over which the errors are measured.

Values 5 to 60

down-on-internal-error

Syntax

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

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command brings 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 *value*

no dot1q-etype

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command specifies the Ethertype expected when the port's encapsulation 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.

Note:

- 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. That is, if this

command is configured on a port configured for QinQ encapsulation, then it is ignored and 0x8100 is used always.

- This command is supported 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. That is, 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

value

Specifies the Ethertype to expect, in decimal or hexadecimal format.

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

Values 1536 to 65535, or 0x0600 to 0xffff

duplex

Syntax

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

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables the context 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the rate of traffic leaving the network.

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

Note:
For 7210 SAS-D and 7210 SAS-Dxp devices, the *max-burst* parameter configures a maximum-burst (in kilobits) associated with the **egress-rate**. This is an optional parameter; if not defined then, by default, it is set to 64 kbits for a 1G port and 98 kbits for a 10G port. The user cannot configure *max-burst* without configuring **egress-rate**. 7210 SAS-D devices do not support 10G ports. See the *7210 SAS-D, Dxp Quality of Service Guide* for more information.

Default

no egress-rate

Parameters

sub-rate

The egress rate in Kbps.

Values 1 to 10000000

max-burst *size-in-kbits*

Specifies the maximum egress burst in kilobits. This parameter is configurable only on 7210 SAS-D and 7210 SAS-Dxp.

Values 32 to 16384, default

efm-oam

Syntax
efm-oam

Context
config>port>ethernet

Platforms
Supported on all 7210 SAS platforms as described in this document

Description
Commands in this context configure EFM-OAM attributes.

accept-remote-loopback

Syntax
[**no**] **accept-remote-loopback**

Context
config>port>ethernet>efm-oam

Platforms
Supported on all 7210 SAS platforms as described in this document

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 activities (such as loopback) with the peer.

Default

active

Parameters

active

Specifies that the port has the capability to initiate negotiation and monitoring activities.

passive

Specifies that the port relies on peer to initiate negotiation and monitoring activities.

transmit-interval

Syntax

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

Context

config>port>ethernet>efm-oam

Platforms

Supported on all 7210 SAS platforms as described in this document

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 for the 7210 SAS-D. On the 7210 SAS-D, the minimum transmit interval is 500 msec and multiplier is 4.

Default

transmit-interval 10 multiplier 5

Parameters

interval

Specifies the transmit interval, in 100 milliseconds.

Values 1 to 600

multiplier *multiplier*

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

Values 2 to 5

tunneling

Syntax

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

Context

config>port>ethernet>efm-oam

Platforms

Supported on all 7210 SAS platforms as described in this document

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 this command disables tunneling.

Default

no tunneling

encap-type

Syntax

encap-type {**dot1q** | **null** | **qinq**}

no encap-type

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

Note:

- On the 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, the **qinq** encapsulation type can be configured for both access and access-uplink ports. The **null** and **dot1q** encapsulation types can be specified only for access ports.
- On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C, the **null** and **dot1q** encapsulation types can be specified for network ports. The **dot1q** and **qinq** encapsulation types can be specified for hybrid ports.

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

Default

encap-type null

Parameters

dot1q

Specifies that the ingress frames carry 802.1Q tags where each tag signifies a different service.

null

Specifies that the 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 for QinQ access SAPs.

eth-bn-egress-rate-changes

Syntax

[**no**] **eth-bn-egress-rate-changes**

Context

config>port>ethernet

Platforms

7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

Description

This command allows rate changes received in ETH-BN messages on a port-based MEP to update the egress rate used on the port. The egress rate is capped by the minimum of the configured **egress-rate** and the maximum port rate.

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

Default

no eth-bn-egress-rate-changes

eth-cfm

Syntax

eth-cfm

Context

config>port>ethernet

Platforms

7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

Description

Commands in this context configure 802.1ag CFM parameters.

mep

Syntax

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

Context

config>port>ethernet>eth-cfm

Platforms

7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

Description

This command provisions the maintenance endpoint (MEP).

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

Default

no mep

Parameters

mep-id

Specifies the maintenance association endpoint identifier.

Values 1 to 8191

md-index

Specifies the maintenance domain (MD) index value.

Values 1 to 4294967295

ma-index

Specifies the MA index value.

Values 1 to 4294967295

eth-bn

Syntax

eth-bn

Context

config>port>ethernet>eth-cfm>mep

Platforms

7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

Description

Commands in this context configure ETH-BN message handling.

receive

Syntax

[**no**] **receive**

Context

config>port>ethernet>eth-cfm>mep>eth-bn

Platforms

7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

Description

This command enables the reception and processing of ETH-BN messages, and the retrieval and processing of the current bandwidth field for inclusion in dynamic egress rate adjustments.

The received rate is a Layer 2 rate, and is expected to be in Mb/s. If this rate is a link rate (including preamble, start frame delimiter, and inter-frame gap), it requires the configuration of frame-based accounting in the **config>port>ethernet** context.

The **no** form of this command disables the reception and processing of ETH-BN messages.

Default

no receive

rx-update-pacing

Syntax

rx-update-pacing *seconds*

Context

config>port>ethernet>eth-cfm>mep>eth-bn

Platforms

7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

Description

This command sets the pace for update messages to and from the ETH-CFM subsystem to the QoS subsystem. The most recent update messages are held by the ETH-CFM subsystem, but the most recent update is held until the expiration of the pacing timer.

Default

rx-update-pacing 5

Parameters

seconds

Specifies the time to wait before sending subsequent updates (in seconds).

Values 1 to 600

frame-based-accounting

Syntax

frame-based-accounting

no frame-based-accounting

Context

config>port>ethernet

Platforms

7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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. That is all ingress queue shaper rates, egress queue shaper rates and aggregate SAP shaper rate account for the Ethernet overhead.

The **no** form of this command disables frame-based-accounting.

Default

no frame-based-accounting

hold-time

Syntax

hold-time {[**up** *hold-time* **up**] [**down** *hold-time*] [**seconds** | **centiseconds**]}

no hold-time

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

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

hold-time up 0 down 0 seconds

Parameters

up *hold-timeup*

Specifies 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 to 900 (seconds)

0, 10 to 90000 (centiseconds in 5-centisecond increments)

Values 0 to 900

down *hold-time down*

Specifies 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 to 900 (seconds)

0, 10 to 90000 (centiseconds in 5-centisecond increments)

seconds | centiseconds

Specifies the units of the hold time in seconds or centiseconds.

Values 0 to 900

lacp-tunnel

Syntax

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

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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

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

Default

no lacp-tunnel

oper-group

Syntax

no oper-group

oper-group *name*

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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 this command removes the association.

Parameters

name

Specifies a character string of maximum 32 ASCII characters identifying the group instance.

Values 32 chars maximum

poe

Syntax

poe [**plus**] [**plusplus**] [**hpoe**]

no poe

Context

config>port>ethernet

Platforms

7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p

Description

This command enables PoE on the specified port and allows the user to configure the PoE device (PD) type that can be connected to the port.

This command must be used to enable PoE on a port before connecting a PD to the port. When a PD is connected to an enabled port, the software attempts to detect the type of device (that is, PoE, PoE+, PoE ++, or HPoE) and the power it is requesting. If the detection is successful and the power request is within the maximum PoE power budget configured, power is supplied to the connected device. Otherwise, the request is denied and no power is provided to the port.

Note:
The user must configure the maximum PoE power budget for the system using the **configure system poe max-poe-power-budget** command before enabling PoE on any port. See the 7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide for more information about this command.

The **no** form of this command disables PoE, PoE+, PoE++, and HPoE capabilities on the specified port. If PoE is disabled, the software does not attempt to detect the characteristics of the connected PD.

Default

poe

Parameters

plus

Keyword to support PoE+ and allow 802.3at (Type-2) PoE devices to be connected to the port and request up to 30 W.

plusplus

Keyword to support PoE++ and allow 802.3bt (Type-3) PoE devices to be connected to the port and request up to 60 W.

hpoe

Keyword to support HPoE and allow 802.3bt (Type-4) PoE devices to be connected to the port and request up to 90 W.

qinq-etype

Syntax

qinq-etype *value*

no qinq-etype

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

When the qinq-etype is configured to a value other than the default value 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 the default value. If there is a match, 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.

Note:

- This command is supported 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. That is, the number of unique dot1q-etypes allowed decreases if the number of unique qinq-etype configured is more. The reverse 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 value. The default value is not user configurable.

Default

0x8100

Parameters

value

Specifies the qinq-etype to expect, in hexadecimal or decimal notation.

Values 1536 to 65535, or 0x0600 to 0xffff. Ensure that the values do not match any of the IEEE reserved Ethertype values such as 0x8a88, 0x9100, and 0x9200.

statistics

Syntax

statistics

Context

config>port>ethernet

Platforms

7210 SAS-D, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure the counters associated with the egress port.

egress

Syntax

egress

Context

config>port>ethernet>statistics

Platforms

7210 SAS-D, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure egress per queue statistics counter, which counts the total number of packets forwarded.

port-clock

Syntax

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

Context

config>port>ethernet

Platforms

7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command forces 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.

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 autonegotiation of the link parameters and is automated; there is no management intervention in this process. When this process is complete, the master port 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.

For copper ports, when port-clock is set to **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 this 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. That is, depending on the peer setting, the local end could end up as either a master or a slave when the no form of this command is used.

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

- Autonegotiation (or autonegotiation 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.
- The port clock must be set to slave, if the port is used as a source-port for any reference. On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C platform, when using combo ports, the connection-

type must be set to **copper**. The port-clock parameter is ignored if the connection-type is set to **sfp** or **auto**.

Default

automatic

Parameters

master

Specifies 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

Specifies that the local node is a synchronous Ethernet slave. A synchronous Ethernet slave port uses the incoming timing information.

automatic

Specifies that 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the port speed of a fast Ethernet port when autonegotiation is disabled. If the port is configured to **autonegotiate**, the **speed** parameter is ignored. Speed cannot be configured for ports that are part of a LAG.

Note:
On the 7210 SAS-Dxp, the 10 Mb/s port speed is not supported for an SFP port using a copper SFP.

Default

speed 100

Parameters

10

Keyword to set the link to 10 Mb/s.

100

Keyword to set the link to 100 Mb/s.

1000

Keyword to set the link to 1000 Mb/s.

loopback

Syntax

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

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This configures simple port loopback and port loopback with MAC swap. When the optional parameter **internal** is specified, it provides the port loopback without the mac-swap functionality. It enables physical layer loopback of the packets that egress on the SAPs created on an 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.

Note:
The 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C only support port loopback without MAC swap (that is, only the **config>port>ethernet> loopback** internal command applies). Port loopback with MAC swap is not supported on these platforms.

This 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 an Ethernet 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 is 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, the user may 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 SAS platforms.

The following information describes guidelines 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 caused by timeout and so on.When port loopback feature is to be used for multicast traffic with IGMP snooping enabled in the service, the corresponding datapath has to be statically created using static IGMP groups.
- For loopback 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 loopback command is enabled, ensure that Ethernet parameters such as speed, duplex, autonegotiation and so on are not modified.

The following information describes guidelines 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 caused by timeout and so on.When port loopback feature is to be used for multicast traffic with IGMP snooping enabled in the service, the corresponding datapath has to be statically created using static IGMP groups.
- When using 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 as the forwarding of these packets after loopback can potentially cause network wide problems.
- For loopback 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 loopback is enabled, ensure that Ethernet parameters such as, speed, duplex, autonegotiation 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 because 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 bidirectional 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 because 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 caused by 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. When the loopback configuration is removed for the port, then the software enables learning and aging for specified SAP. Therefore, 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 this command disables physical layer loopback on the Ethernet port.

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

The following list is the recommended sequence of commands to be executed to perform loopback:

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

Enable the port, execute the command config>port> no shutdown.Enable the required services. The following list is the recommended sequence of commands to be executed to perform loopback 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 **config>port>no shutdown** command.
3. Disable the port and execute the **config>port>shutdown** command. Enable loopback and execute the **config>port>ethernet>loopback internal** command.
4. Enable the port and execute the **config>port>no shutdown** command.Perform the required tests.
5. Disable the port and execute the **config>port>shutdown** command. Disable loopback and execute the **config>port>ethernet>no loopback internal** command.
6. Enable the port and execute the **config>port>no shutdown** command.Enable the required services.

The following list is the sequence of commands to be executed to perform loopback when SFP or XFPs are changed:

1. Disable the port, execute the **config>port>shutdown** command.

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

Parameters

internal

Sets 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 *svc-id*

Specifies 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 1 to 2147483648

sap *sap-id*

Specifies the physical port identifier portion of the SAP.

Values **null** — *port-id*
dot1q — *port-id:qtag1*
qinq — *port-id:qtag1.qtag2*
port-id — *slot/mda/port*[.*channel*]
id — 1 to 1000
qtag1 — 0 to 4094
qtag2 — *, 1 to 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

Platforms

7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command enables Ethernet Synchronous Status Message (SSM) capability on a synchronous Ethernet port. Synchronous Ethernet must be enabled on the MDA (using the sync-e command) before SSM can be enabled.

code-type

Syntax

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

Context

config>port>ethernet>ssm

Platforms

7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

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. 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.

esmc-tunnel

Syntax

[**no**] **esmc-tunnel**

Context

config>port>ethernet>ssm

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command allows ESMC frames that are received into the Ethernet port to be tunneled in an Epipe or VPLS service. This configuration is only required for compliance to MEF 6.1.1 EPL Option 2. The port where **esmc-tunnel** is enabled cannot be used for Synchronous Ethernet.

The **no** form of this command extracts the ESMC frames on reception by the port. The ESMC frames are not tunneled through the service.

Default

no esmc-tunnel

tx-dus

Syntax

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

Context

config>port>ethernet>ssm

config>port>sonet-sdh (not supported on 7210 SAS-Dxp)

Platforms

7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command forces the QL value transmitted from the SSM channel of the SONET/SDH port or the Synchronous Ethernet port to be set to QL-DUS/QL-DNU. This capability is provided to block the use of the interface for timing purposes from the 7210 SAS.

Default

no tx-dus

2.20.2.1.9 802.1x port commands

dot1x

Syntax

dot1x

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure port-specific 802.1x authentication attributes. This context can only be used when configuring Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet LAN ports on an appropriate MDA.

guest-service

Syntax

guest-service *service-id* [**vlan-id** *vlan-id*]

no guest-service

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-Dxp

Description

This command configures the guest VLAN that must be configured on the port when there is no response from the RADIUS server or when dot1x authentication is enabled on a port but no EAPOL packets are received from the connected device.

Users must specify the EHS script to be invoked when the logEvent_PORT_tmnxPortDot1xAuthLostGRvC event is raised and configure the guest VLAN in the script using the parameter passed to the script.

The **no** form of this command disables the guest VLAN assignment.

Default

no guest-service

Parameters

service-id

Specifies the service under which the SAP must be configured using the EHS script. The EHS script must use the NULL (":0") tag to configure a NULL SAP if the optional *vlan-id* parameter is not configured. If *vlan-id* is configured, it is used as the SAP tag.

Values service-id: 1 to 2147483647

svc-name: 64 characters maximum

vlan-id

Specifies the VLAN ID. The configured *vlan-id* cannot be modified if the **config>port>ethernet>dot1x>port-control** command is set to **auto**. To modify the service and VLAN ID information, users must set the **config>port>ethernet>dot1x>port-control** command to either **force-auth** or **force-unauth**.

Values 0 to 4049

mac-auth

Syntax

[**no**] **mac-auth**

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-Dxp

Description

This command enables MAC-based authentication. To use MAC-based authentication, 802.1x authentication must first be enabled using the **port-control auto** command.

When MAC-based authentication is enabled, and the **mac-auth-wait** timer expires, the 7210 SAS begins listening on the port for valid Ethernet frames. The source MAC address of a received frame is used for MAC-based authentication.

MAC authentication and Dot1x authentication or VLAN authentication are mutually exclusive and cannot be configured on the same port.

The **no** form of this command disables MAC-based authentication.

Default

no mac-auth

mac-auth-wait

Syntax

mac-auth-wait *seconds*

no mac-auth-wait

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-Dxp

Description

This command configures the delay period before MAC authentication is activated.

The **no** form of this command disables the delay and allows MAC authentication to be used immediately.

Default

no mac-auth-wait

Parameters

seconds

Specifies the MAC authentication delay period, in seconds.

Values 1 to 3600

max-auth-req

Syntax

max-auth-req *max-auth-request*

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

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 reverts to the default value.

Default

2

Parameters

max-auth-request

Specifies the maximum number of RADIUS retries.

Values 1 to 10

port-control

Syntax

port-control [**auto** | **force-auth** | **force-unauth**]

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the 802.1x authentication mode.

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

Default

force-auth

Parameters

force-auth

Specifies that 802.1x authentication will be disabled 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

Specifies that the port will 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

Specifies that 802.1x authentication will be enabled. 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 an unauthorized 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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 reverts to the default value.

Default

30

Parameters

seconds

Specifies the quiet period in seconds.

Values 1 to 3600

radius-plcy

Syntax

radius-plcy *name*

no radius-plcy

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

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 with 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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 reverts to the default value.

Default

3600

Parameters

seconds

Specifies the re-authentication delay period in seconds.

Values 1 to 9000

re-authentication

Syntax

[**no**] **re-authentication**

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables or 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 this command reverts to the default value.

Default

re-authentication

restricted-service

Syntax

restricted-service *service-id* [**vlan-id** *vlan-id*]

no restricted-service

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-Dxp

Description

This command configures the restricted VLAN that must be configured on the port when the RADIUS server returns an authentication failure.

Users must specify the EHS script to be invoked when the logEvent_PORT_tmnxPortDot1xAuthLostGRvC event is raised and configure the restricted VLAN in the script using the parameter passed to the script.

The **no** form of this command disables the restricted VLAN assignment.

Default

no restricted-service

Parameters

service-id

Specifies the service under which the SAP must be configured using the EHS script. The EHS script must use the NULL (":0") tag to configure a NULL SAP if the optional *vlan-id* parameter is not configured. If *vlan-id* is configured, it is used as the SAP tag.

Values service-id: 1 to 2147483647

svc-name: 64 characters maximum

vlan-id

Specifies the VLAN ID. The configured *vlan-id* cannot be modified if the **config>port>ethernet>dot1x>port-control** command is set to **auto**. To modify the service and VLAN ID information, users must set the **config>port>ethernet>dot1x>port-control** command to either **force-auth** or **force-unauth**.

Values 0 to 4049

server-timeout

Syntax

server-timeout *seconds*

no server-timeout

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

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 reverts to the default value.

Default

30

Parameters

seconds

Specifies the server timeout period in seconds.

Values 1 to 300

supplicant-timeout

Syntax

supplicant-timeout *seconds*

no supplicant-timeout

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

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 reverts to the default value.

Default

30

Parameters

seconds

Specifies the server timeout period in seconds.

Values 1 to 300

transmit-period

Syntax

transmit-period *seconds*

no transmit-period

Context

config>port>ethernet>dot1x

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the period after which the 7210 SAS sends a new EAPOL request message.

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

Default

30

Parameters

seconds

Specifies the server transmit period in seconds.

Values 1 to 3600

tunneling

Syntax

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

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command enables 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. If dot1x tunneling is enabled, then the user cannot configure either force-unauth or auto.

The **no** form of this command disables dot1x tunneling.

Default

no tunneling

vlan-auth

Syntax

[**no**] **vlan-auth**

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-Dxp

Description

This command enables VLAN-based authentication. To use VLAN-based authentication, 802.1x authentication must first be enabled using the **port-control auto** command.

When VLAN-based authentication is enabled, all traffic for all VLANs on the port is blocked. VLAN-tagged EAPOL messages are forwarded to the RADIUS server for authentication. If authentication is successful, the VLAN corresponding to the successfully authenticated VLAN-tagged EAPOL message is unblocked and traffic is processed for the configured service. If authentication fails, the VLAN continues to be blocked.

VLAN authentication and MAC authentication are mutually exclusive and cannot be configured on the same port.

The **no** form of this command disables VLAN-based authentication.

Default

no vlan-auth

down-when-looped

Syntax

down-when-looped

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures Ethernet loop detection attributes.

keep-alive

Syntax

keep-alive *timer*

no keep-alive

Context

config>port>ethernet>dwl

Platforms

Supported on all 7210 SAS platforms as described in this document

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 to 120

retry-timeout

Syntax

retry-timeout *timer*

no retry-timeout

Context

config>port>ethernet>dwl

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the minimum wait time before re-enabling the 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 to 160

2.20.2.1.10 802.1x port MACsec commands

macsec

Syntax

[**no**] **macsec**

Context

config>port>ethernet>dot1x

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures MACsec functionality for the port.

Note:
When MACsec is configured on an Ethernet port, the oper MTU of the port is reduced by 32 bytes; for example, a configured MTU of 9212 results in an oper MTU of 9180 for a MACsec-enabled port. When a service or IP interface uses a MACsec-enabled port, an appropriate MTU value must be manually configured.

The **no** form of this command disables MACsec functionality for the port.

ca-name

Syntax

ca-name *ca-name*

no ca-name

Context

config>port>ethernet>dot1x>macsec

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures the CA linked to the MACsec port. The CA provides the MACsec parameter that is used or is negotiated with other peers.

The **no** form of this command removes the CA from the MACsec port.

Parameters

ca-name

Specifies the CA to use for the MACsec port, up to 32 characters.

eapol-destination-address

Syntax

eapol-destination-address *mac*

no eapol-destination-address

Context

config>port>ethernet>dot1x>macsec

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures the destination MAC address of the EAPoL to the unicast address of the MACsec peer, so that the EAPoL and MKA signaling is unicast between two peers.

The EAPoL destination MAC address uses a destination multicast MAC address of 01:80:C2:00:00:03. Some networks cannot tunnel these packets over the network or consume them, causing the MKA session to fail.

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

Default

no eapol-destination-address

Parameters

mac

Specifies the destination MAC address used by the EAPoL MKA packets of the specified port. The 48-bit MAC address is 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.

exclude-protocol

Syntax

[**no**] **exclude-protocol** {*protocol-name*}

Context

config>port>ethernet>dot1x>macsec

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures the protocols for which packets are not secured with MACsec when MACsec is enabled on a port. When this command is enabled in a CA that is attached to an interface, MACsec is not enabled for all packets of the specified protocols that are sent and received on the link.

When this command is enabled on a port where MACsec is configured, packets of the specified protocols are sent and received in clear text.

Default

no exclude-protocol

Parameters

protocol-name

Specifies the protocol name.

Values cdp, lacp, lldp, eapol-start

max-peer

Syntax

max-peer *max-peer*

no max-peer

Context

config>port>ethernet>dot1x>macsec

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures the maximum number of peers allowed for the specified MACsec instance.

Note:
The peer establishment is a race condition and operates on a first-come-first-served basis. For a security zone, only 32 peers are supported.

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

Default

no max-peer

Parameters

max-peer

Specifies the maximum number of peers supported on this port.

Values 0 to 32

rx-must-be-encrypted

Syntax

[**no**] **rx-must-be-encrypted**

Context

config>port>ethernet>dot1x>macsec

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies that all non-MACsec-secured traffic that is received on the port is dropped.

When this command is disabled, all arriving traffic is accepted, regardless of whether traffic is MACsec-secured.

Note:
This command is available only at the NULL port level and does not have per-VLAN granularity.

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

Default

rx-must-be-encrypted

shutdown

Syntax

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

Context

config>port>ethernet>dot1x>macsec

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command shuts down MACsec functionality, including MKA negotiation, for the port. In the shutdown state, the port is not MACsec capable and all PDUs are transmitted and expected without encryption and authentication.

A valid CA that is different from another CA configured on a sub-port of this port, and also a *max-peer* value larger than 0, must be configured. In MACsec-enabled mode, packets are sent in clear text until the MKA session is up, and if the **rx-must-be-encrypted** command is configured on the port, all incoming packets without MACsec are dropped.

The **no** form of this command sets the port to MACsec-enabled mode.

Default

shutdown

2.20.2.1.11 LLDP port commands

lldp

Syntax

lldp

Context

config>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context 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

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command configures tunneling for LLDP frames that use the nearest-bridge-dest-mac as destination MAC address. If enabled using the *tunnel-nearest-bridge-dest-mac* command, 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.

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 describes the behavior for LLDP with different values set in use for admin-status and when tunneling is enabled or disabled.

Table 29: LLDP behavior

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 this command disable LLDP tunneling for frames using nearest-bridge destination MAC address.

Default

no tunnel-nearest-bridge-dest-mac

dest-mac

Syntax

dest-mac {**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**}

Context

config>port>ethernet>lldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures destination MAC address parameters to use by LLDP.

Parameters

nearest-bridge

Specifies to use the nearest bridge

nearest-non-tmpr

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 transmits 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.

lldp-med

Syntax

lldp-med

Context

config>port>ethernet>lldp>dest-mac

Platforms

7210 SAS-Dxp

Description

Commands in this context configure the administrative status of the local LLDP-MED agent.

admin-status

Syntax

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

no admin-status

Context

config>port>ethernet>lldp>dest-mac>lldp-med

Platforms

7210 SAS-Dxp

Description

This command configures the administrative status of the local LLDP-MED agent.

The **no** form of this command disables the ability to specify the administrative status of the local LLDP-MED agent.

Default

admin-status disabled

Parameters

tx-rx

Keyword to configure the LLDP agent to transmit and receive LLDP-MED TLVs on the configured port.

disabled

Keyword to indicate that the LLDP-MED agent does not transmit or receive LLDP frames with LLDP-MED TLVs on the configured port. If no remote systems information is received on the configured port and stored in other tables before the port administrative status becomes disabled, the information ages out.

network-policy

Syntax

network-policy *policy-id* [*policy-id...*(up to 4 max)]

no network-policy

Context

config>port>ethernet>lldp>dest-mac>lldp-med

Platforms

7210 SAS-Dxp

Description

This command configures the network policy information that the node transmits in the Network Policy TLV.

Up to four policies can be configured, as long as the configured **application-type** for each policy is different. The system includes multiple Network Policy TLVs (if multiple policies are configured), with the policy for each **application-type** included in its own Network Policy TLV. The Network Policy TLV order in the LLDP message matches the policy order configured in the CLI. If the system cannot fit all configured Network Policy TLVs into the LLDP frame because of size constraints, a log message is generated for the last network policy that exceeds the frame size. The error notification allows the user to adjust the configuration appropriately.

The user must explicitly configure a network policy (with values assigned to the endpoint device) before the transmission and reception of LLDP-MED TLVs on the port is allowed. If a port is configured to transmit the LLDP-MED Network Policy TLV but the user has not configured a network policy, the node will not transmit the Network Policy TLV. The node processes the received Network Policy TLV and displays the TLV values in the LLDP message received from the peer provided that the LLDP-MED receiving processing and Network Policy TLV processing is enabled, regardless of whether **network-policy** is configured.

The **no** form of this command removes the association of all network policies with the port.

Default

no network-policy

Parameters

policy-id

Specifies network policy ID.

Values 1 to 65535

tx-tlvs

Syntax

tx-tlvs [**network-policy**] [**mac-phy-config-status**]

no tx-tlvs

Context

config>port>ethernet>lldp>dest-mac>lldp-med

Platforms

7210 SAS-Dxp

Description

This command configures the specific transmit TLV from the network connectivity TLV set to be transmitted on the port if LLDP-MED TLV transmission is enabled on the port.

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

Default

no tx-tlvs

Parameters

network-policy

Keyword to enable the transmission of the network policy TLV.

mac-phy-config-status

Keyword to enable the transmission of the MAC-PHY Configuration and Status TLV.

notification

Syntax

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

Context

config>port>ethernet>lldp>dstmac

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables LLDP notifications.

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

port-id-subtype

Syntax

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

no port-id-subtype

Context

config>port>ethernet>lldp>dest-mac

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command specifies how to encode the PortID TLV transmit to the peer. Some versions of the NSP NFM-P require the default **tx-local** (if Index value) setting to properly build the Layer Two topology map using LLDP. Changing this setting to transmit the ifName (**tx-if-name**) or ifAlias (**tx-if-alias**), instead of the ifIndex (**tx-local**), may affect the ability of the NSP NFM-P to build the Layer 2 topology map using LLDP.

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

Default

portid-subtype tx-local

Parameters

tx-if-alias

Keyword to transmit the ifAlias String (subtype 1) that describes the port as stored in the IF-MIB, either user configured or the default entry (for example, 10/100/Gig Ethernet SFP).

tx-if-name

Keyword to transmit the ifName string (subtype 5) that describes the port as stored in the IF-MIB ifName information.

tx-local

Keyword to specify 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

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

This command specifies which management address to transmit. The operator can choose to send the system IPv4 IP Address, system IPv6 address, or both.

Note:
The system address is sent only once. When both options are configured, both system addresses are sent. The system address must be configured for the specific version of the protocol to send the management address.

Default

no tx-mgmt-address

Parameters

system

Keyword to transmit the system IPv4 address.

system-ipv6

Keyword to transmit the system IPv6 address. This 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command specifies which LLDP TLVs to transmit.

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

Default

no tx-tlvs

Parameters

port-desc

Specifies that the LLDP agent should transmit port description TLVs.

sys-name

Specifies that the LLDP agent should transmit system name TLVs.

sys-desc

Specifies that the LLDP agent should transmit system description TLVs.

sys-cap

Specifie that the LLDP agent should transmit system capabilities TLVs.

2.20.2.1.12 Access-uplink port commands

network

Syntax

network

Context

config>port>ethernet

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure network port parameters.

uplink

Syntax

uplink

Context

config>port>access

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

Description

Commands in this context 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

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; the network context applies only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures an accounting policy that can apply to an interface.

An accounting policy must be configured before it can be associated with an interface. If the accounting *policy-id* does not exist, an error is returned.

Accounting policies associated with service billing can only be applied to SAPs. Accounting policies associated with network ports can only be associated with interfaces. Only one accounting policy can be associated with an interface at a time.

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

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

Values 1 to 99

collect-stats

Syntax

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

Context

config>port>ethernet>access>uplink

config>port>ethernet>access

config>port>ethernet>network

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; the network context applies only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

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

The **no** form of this command ensures that the statistics are still accumulated by the IOM cards, however, the CPU does not obtain the results and write them to the billing file.

If the **collect-stats** command is issued again (enabled), then the counters written to the billing file will include the traffic collected while the **no collect-stats** command was in effect.

Default

no collect-stats

queue-policy

Syntax

queue-policy *name*

no queue-policy

Context

config>port>ethernet>network

config>port>ethernet>access>uplink

Platforms

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; the network context applies only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the existing network queue policy which defines queue parameters such as CIR and PIR rates, as well as forwarding-class to queue mappings. The network-queue policy is defined in the **config>qos>network-queue** context.

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

Default

default

Parameters

name

Specifies an existing network-queue policy name.

2.20.2.1.13 LAG commands

lag

Syntax

[**no**] **lag** [*lag-id*]

Context

config

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables the context for configuring Link Aggregation Group (LAG) attributes.

A LAG can be used to group multiple ports into one logical link. The aggregation of multiple physical links allows for load sharing and provides seamless redundancy. If one of the links fails, traffic will be redistributed over the remaining links.

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 autonegotiate 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.

Parameters

lag-id

The LAG identifier, expressed as a decimal integer.

Values 1 to 3 (7210 SAS-K 2F1C2T)
1 to 5 (7210 SAS-D)
1 to 6 (7210 SAS-Dxp, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C)

dynamic-cost

Syntax

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

Context

config>lag

Platforms

Supported on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command enables OSPF costing of a Link Aggregation Group (LAG) based on the available aggregated operational bandwidth.

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

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

For example:

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

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

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

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

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

Default

no dynamic-cost

encap-type

Syntax

encap-type {**dot1q** | **null** | **qinq**}

no encap-type

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

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. All traffic on the port belongs to a single service or VLAN.

Note:

- On the 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, the **qinq** encapsulation type can be configured for both access and access-uplink port LAGs. The **null** and **dot1q** encapsulation types can be specified only for access port LAGs.
- On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C, the **null** and **dot1q** encapsulation types can be specified for network port LAGs. The **dot1q** and **qinq** encapsulation types can be specified for hybrid port LAGs.

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

Default

null

Parameters

dot1q

Specifies that the ingress frames will carry 802.1Q tags where each tag signifies a different service.

null

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

qinq

Specifies QinQ encapsulation.

hold-time

Syntax

hold-time down *hold-down-time*

no hold-time

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

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 signaling 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 to 2000

lacp

Syntax

lacp [*mode*] [**administrative-key** *admin-key*] [**system-id** *system-id*] [**system-priority** *priority*]

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables the Link Aggregation Control Protocol (LACP) mode for aggregated Ethernet interfaces only. Per the IEEE 802.3ax standard (formerly 802.3ad), the LACP provides a standardized means for exchanging information between Partner Systems on a link. This 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.

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 to 65535

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

priority

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

Values 0 to 65535

lacp-xmit-interval

Syntax

[**no**] **lacp-xmit-interval** {**slow** | **fast**}

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

Default

fast

Parameters

slow

Specifies that packets will transmit every 30 seconds.

fast

Specifies that packets will transmit every second.

lacp-xmit-stdby

Syntax

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

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables LACP message transmission on standby links.

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

Default

lacp-xmit-stdby

monitor-oper-group

Syntax

monitor-oper-group *name*

no monitor-oper-group

Context

config>lag

Platforms

7210 SAS-K 2F1C2T, 7210 SAS-K 3SFP+ 8C

Description

This command specifies the operational group to monitor. The state of the operational group affects the state of this LAG. When the operational group is inactive, the state of the LAG goes down, and the LAG uses the configured **lag>standby-signaling** mechanism (**lacp** or **power-off**) to signal its unavailability to the CE.

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

Default

no monitor-oper-group

Parameters

name

Specifies the name of the operational group, up to 32 characters.

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command adds ports (links) 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 is not added to the LAG.

The maximum number of ports allowed in a LAG depends on the platform. The following are the limits per platform:

- On the 7210 SAS-D and 7210 SAS-Dxp, a maximum of four 1 GE ports can be added to or removed from the LAG. The 7210 SAS-Dxp also supports up to two 10 GE ports in a LAG.
- On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, a maximum of three 1 GE ports can be added to or removed from the LAG.
- On the 7210 SAS-K 3SFP+ 8C, a maximum of two 10 GE ports can be added to or removed from a LAG.

All ports added to a LAG must share the same characteristics (speed, duplex, and so on). An error message is displayed when adding ports that do not share the same characteristics. Hold timers must be 0. Ports that are part of a LAG must be configured with autonegotiation set to limited mode or disabled. No ports are defined as members of a LAG.

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

Parameters

port-id

Specifies the port ID configured or displayed in the *slot/mda/port* format.

priority *priority*

Specifies the 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 to 65535

subgroup *sub-group-id*

Specifies a LAG subgroup. Subgroups in a LAG must be configured on only one side of the LAG, not both. Having only one side perform the active/standby selection guarantees a consistent selection and fast convergence. The active/standby selection is signaled 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 the case where no links are usable for a short time, especially in case a subgroup consists of one member.

Values 1 to 2

port-threshold

Syntax

port-threshold *value*[**action** {**down**}]

no port-threshold

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Specifies 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 to 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.

selection-criteria

Syntax

selection-criteria [{**highest-count** | **highest-weight** | **best-port**}] [**slave-to-partner**]

no selection-criteria

Context

config>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Specifies the 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

Specifies that, together with the selection criteria, the slave-to-partner keyword 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command specifies how the state of a member port is signaled to the remote side when the status corresponding to this member port has 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.

2.20.2.1.14 Multi-chassis redundancy commands

redundancy

Syntax

redundancy

Context

config

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure redundancy operations.

multi-chassis

Syntax

multi-chassis

Context

config>redundancy

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure multi-chassis parameters.

peer

Syntax

[**no**] **peer** *ip-address* **create**

Context

config>redundancy>multi-chassis

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures the MC-LAG peer.

Parameters

ip-address

Specifies the IP address.

Values ipv4-address: a.b.c.d

create

Specifies the mandatory keyword to create the peer.

authentication-key

Syntax

authentication-key [*authentication-key*| *hash-key*] [**hash** | **hash2**]

no authentication-key

Context

config>redundancy>multi-chassis>peer

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures the authentication key used between this node and the multi-chassis peer. The authentication key can be any combination of letters or numbers.

Parameters

authentication-key

Specifies the authentication key. Allowed values are any string up to 20 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed within double quotes.

hash-key

Specifies the hash key. The key can be any combination of ASCII characters up to 33 (hash1-key) or 55 (hash2-key) characters (encrypted). If spaces are used in the string, enclose the entire string in quotation marks.

hash

Specifies that the key is entered in an encrypted form. If the **hash** or **hash2** parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the **hash** or **hash2** parameter specified.

hash2

Specifies that the key is entered in a more complex encrypted form that involves more variables then the key value alone, this means that the **hash2** encrypted variable cannot be copied and pasted. If the **hash** or **hash2** parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the **hash** or **hash2** parameter specified.

description

Syntax

description *long-description-string*

no description

Context

config>redundancy>multi-chassis>peer

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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.

2.20.2.1.15 MC Endpoint commands

hold-on-neighbor-failure

Syntax

hold-on-neighbor-failure *multiplier*

no hold-on-neighbor-failure

Context

config>redundancy>multi-chassis>peer>mc-ep

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the number of keep-alive intervals that the local node waits for packets from the MC-EP peer before assuming failure. After this time interval, all the mc-endpoints configured in the service revert to single chassis behavior, activating the best local pseudowire.

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

Default

3

Parameters

multiplier

Specifies the hold time applied on neighbor failure.

Values 2 to 25

2.20.2.1.16 MC-LAG commands

mc-lag

Syntax

[**no**] **mc-lag**

Context

config>redundancy>multi-chassis>peer>mc-lag

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure multi-chassis LAG operations and related parameters.

The **no** form of this command administratively disables multi-chassis LAG. MC-LAG can be issued only when MC-LAG is shutdown.

hold-on-neighbor-failure

Syntax

hold-on-neighbor-failure *multiplier*

no hold-on-neighbor-failure

Context

config>redundancy>multi-chassis>peer>mc-lag

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the standby node wait interval to receive packets from the active node before assuming a redundant-neighbor node failure. This delay in switchover operation is required to accommodate different factors influencing node failure detection rate, such as IGP convergence or HA switch-over times, and to prevent the standby node from taking action prematurely.

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

Default

3

Parameters

multiplier

Specifies the time interval that the standby node waits for packets from the active node before assuming a redundant-neighbor node failure.

Values 2 to 25

keep-alive-interval

Syntax

keep-alive-interval *interval*

no keep-alive-interval

Context

config>redundancy>multi-chassis>peer>mc-lag

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command sets the interval at which keep-alive messages are exchanged between two systems participating in MC-LAG. These keep-alive messages are used to determine remote-node failure and the interval is set in deciseconds.

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

Default

10

Parameters

interval

Specifies the time interval expressed in deciseconds.

Values 5 to 500

lag

Syntax

lag *lag-id* **lacp-key** *admin-key* **system-id** *system-id* [**remote-lag** *remote-lag-id*] **system-priority** *system-priority*

lag [**remote-lag** *remote-lag-id*]

no lag *lag-id*

Context

config>redundancy>multi-chassis>peer>mc-lag

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command defines a LAG that forms a redundant-pair for MC-LAG with a LAG configured on the specific peer. The same LAG group can be defined only in the scope of 1 peer. In order for MC-LAG to become operational, all configured parameters (**lacp-key**, **system-id**, **system-priority**) must be the same on both nodes of the same redundant pair.

In the partner system (the system connected to all links forming MC-LAG), all ports using the same **lacp-key**, **system-id**, **system-priority** are considered part of the same LAG. To achieve this in MC operation, both redundant-pair nodes must be configured with the same values. In case of a mismatch, MC-LAG is kept in the oper-down state.

The **no** form of this command disables MC-LAG for the specific LAG (regardless of the mode).

Note:
The correct CLI command to enable MC-LAG for a LAG in **standby-signaling power-off mode** is **lag lag-id [remote-lag remote-lag-id]**. In the CLI **help** output, the first three forms are used to enable MC-LAG for a LAG in LACP mode.

Parameters

lag-id

Specifies the LAG identifier, expressed as a decimal integer. Specifying the *lag-id* allows mismatch between lag-id on a redundant-pair. If no **lag-id** is specified, it is assumed that the neighbor system uses the same *lag-id* as a part of the specific MC-LAG. If no matching MC-LAG group can be found between neighbor systems, the individual LAGs will operate as usual (no MC-LAG operation is established).

Values 1 to 6 (for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C)

lacp-key *admin-key*

Specifies a 16-bit key that needs to be configured in the same manner on both sides of the MC-LAG for the MC-LAG to come up.

Values 1 to 65535

system-id *system-id*

Specifies a 6-byte value expressed in the same notation as MAC address.

Values xx:xx:xx:xx:xx:xx — xx (00 to FF)

remote-lag *lag-id*

Specifies the LAG ID on the remote system.

Values 1 to 6

system-priority *system-priority*

Specifies the system priority to be used in the context of the MC-LAG. The partner system will consider all ports using the same *lacp-key*, *system-id*, and **system-priority** as part of the same LAG.

Values 1 to 65535

source-address

Syntax

source-address *ip-address*

no source-address

Context

config>redundancy>multi-chassis>peer

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the source address used to communicate with the multi-chassis peer.

Parameters

ip-address

Specifies the source address used to communicate with the multi-chassis peer.

peer-name

Syntax

peer-name *name*

no peer-name

Context

config>redundancy>multi-chassis>peer

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the peer name used to communicate with the multi-chassis peer.

Parameters

name

Specifies the name used to communicate with the multi-chassis peer.

sync

Syntax

[**no**] **sync**

Context

config>redundancy>multi-chassis>peer

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context configure synchronization parameters.

igmp-snooping

Syntax

[**no**] **igmp-snooping**

Context

config>redundancy>multi-chassis>peer>sync

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies whether IGMP snooping information should be synchronized with the multi-chassis peer.

Default

no igmp-snooping

port

Syntax

port [*port-id* | *lag-id*] [**sync-tag** *sync-tag*]

no port [*port-id* | *lag-id*]

Context

config>redundancy>multi-chassis>peer>sync

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command specifies the port when synchronized with the multi-chassis peer and the synchronization tag to be use when synchronizing the port with the multi-chassis peer.

Parameters

port-id

Specifies the port to synchronize with the multi-chassis peer.

lag-id

Specifies the LAG ID to synchronize with the multi-chassis peer.

sync-tag *sync-tag*

Specifies the synchronization tag to use while synchronizing this port with the multi-chassis peer.

range

Syntax

range *encap-range* **sync-tag** *sync-tag*

no range *encap-range*

Context

config>redundancy>multi-chassis>peer>sync>port

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command configures a range of encapsulation values.

Parameters

encap-range

Specifies a range of encapsulation values on a port to be synchronized with a multi-chassis peer.

Values

Dot1Q	*start-qtag-end-qtag*
start-qtag	*0 to 4094*
end-qtag	*0 to 4094*
QinQ	- <qtag1>.<start-qtag2>-<qtag1>.<end-qtag2>
	- <start-qtag1>.*-<end-qtag1>.*
qtag1	1 to 4094
start-qtag1	1 to 4094
end-qtag1	1 to 4094
start-qtag2	1 to 4094
end-qtag2	1 to 4094

sync-tag *sync-tag*

Specifies a synchronization tag, up to 32 characters, to use when synchronizing this encapsulation value range with the multi-chassis peer.

2.20.2.1.17 Ethernet ring commands

eth-ring

Syntax

eth-ring *ring-id*

no eth-ring

Context

config

Platforms

Supported on all 7210 SAS platforms as described in this document

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 to 128

guard-time

Syntax

guard-time *time*

no guard-time

Context

config>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the guard time for an Eth-Ring. The guard timer is standard and is configurable from 100 ms to 2 seconds

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

Default

5 deciseconds

Parameters

value

Specifies the guard-time.

Values 1 to 20 deciseconds

revert-time

Syntax

revert-time *time*

no revert-time

Context

config>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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 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, in seconds.

Values 60 to 720

ccm-hold-time

Syntax

ccm-hold-time {**down** *down-timeout* | **up** *up-timeout*}

no ccm-hold-time

Context

config>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures eth-ring dampening timers.

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 *down-timeout* parameter applies only to ring path CCM. It does NOT apply to the ring port link state. To dampen ring port link state transitions, use hold-time parameter from the physical member port.

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 dampen member port link state transitions, use hold-time parameter from the physical member port.

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

Parameters

down-timeout

Specifies the down timeout, in deciseconds.

Values 0 to 5000

up-timeout

Specifies the hold-time for reporting the recovery, in deciseconds.

Values 0 to 5000

rpl-node

Syntax

rpl-node <**owner** | **nbr**>

no rpl-node

Context

config>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the G.8032 Ring Protection Link (RPL) type as owner or neighbor. 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 connection to the RPL link.

Default

no rpl-node

Parameters

owner

Specifies a G.8032 RPL type of owner.

nbr

Specifies a G.8032 RPL type of neighbor.

node-id

Syntax

node-id *mac*

no node-id

Context

config>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

Specifies a MAC address in the format 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

Default

2

Parameters

version

Specifies the Ethernet ring version.

Values 1 to 2

path

Syntax

path {**a** | **b**} [{*port-id*} **raps-tag** *qtag* [.*qtag*]]

[**no**] **path** {**a** | **b**}

Context

config>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

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

path

Specifies the path.

Values a, b

port-id

Specifies the port ID.

Values *slot/mda/port*

qtag[.qtag]

Specifies the qtag. For Dot1q, only the first qtag is used. For QinQ, both qtags can be used.

Values 1 to 4094

description

Syntax

description *long-description-string*

no description

Context

config>eth-ring>path

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command adds a text description for the ring path.

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

Parameters

string

Specifies the text description up to 160 characters.

rpl-end

Syntax

rpl-end

no rpl-end

Context

config>eth-ring>path

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure ETH-CFM parameters.

mep

Syntax

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

Context

config>eth-ring>path>eth-cfm

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

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

Parameters

mep-id

Specifies the maintenance association (MA) end point identifier.

Values 1 to 81921

md-index

Specifies the maintenance domain (MD) index value.

Values 1 to 4294967295

ma-index

Specifies the MA index value.

Values 1 to 4294967295

ccm-enable

Syntax

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

Context

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables the generation of CCM messages.

The **no** form of this 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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

The **no** form of this 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 to 7

control-mep

Syntax

no control-mep

Context

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables the context 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

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

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

Default

all-zeros

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

Specifies that a CRC checksum will be generated.

bit-error-threshold

Syntax

bit-error-threshold *bit-errors*

Context

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 to 11840

mac-address

Syntax

mac-address *mac-address*

no mac-address

Context

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 to 600

shutdown

Syntax

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

Context

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command administratively enables/disables the Ethernet ring.

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

Default

shutdown

description

Syntax

description *long-description-string*

no description

Context

config>eth-tunnel

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

split-horizon-group

Syntax

split-horizon-group *group-name*

no split-horizon-group

Context

config>lag

config>port

Platforms

7210 SAS-D and 7210 SAS-Dxp

Description

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

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, and so on).
- 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. The string must be composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed within double quotes.

2.20.2.2 Show commands

2.20.2.2.1 Hardware commands

chassis

Syntax

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

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Note:
The environment option is not supported on the 7210 SAS-D.

This command displays general chassis status information.

Parameters

environment

Displays chassis environmental status information.

power-supply

Displays chassis power supply status information.

Output

The following output is an example of chassis information, and Table 30: Output fields: chassis describes the output fields.

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

```
A:7210-SAS> show chassis
===============================================================================
Chassis Information
===============================================================================
    Name                          : STU2597
    Type                          : 7210 SAS-D-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>

A:7210-SAS> show chassis
===============================================================================
Chassis Information
===============================================================================
    Name                          : STU2597
    Type                          : 7210 SAS-D-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>

*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#
```

Table 30: Output fields: chassis

Label	Description
Name	The system name for the router.
Type	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:

Label	Description
	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 specific 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 slots 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.
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 part number.
CLEI code	The code used to identify the router.
Serial number	The CPM part number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Administrative state	Up The card is administratively up.
	Down The card is administratively down.
Operational state	Up The card is operationally up.
	Down The card is operationally down.

Label	Description
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Number of fan trays	The total number of fan trays installed in this chassis.
Number of fans	The total number of fans installed in this chassis.
Operational status	Current status of the fan tray.
Fan speed	Half speed The fans are operating at half speed.
	Full speed The fans are operating at full speed.
Number of power supplies	The number of power supplies installed in the chassis.
Power supply number	The ID for each power supply installed in the chassis.
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

card

Syntax

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

card state

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

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

detail

Displays detailed card information.

Default displays summary information only

Output

The following outputs are examples of card information, and the associated tables describe the output fields.

- Sample output for 7210 SAS-K 2F1C2T, Table 31: Output fields: card
- Output sample for 7210 SAS-K 2F1C2T card detail, Table 32: Output fields: card detail
- Sample output for CPM card, Table 33: Output fields: CPM card
- Output fields for card state, Table 34: Output fields: card state

Sample output for 7210 SAS-K 2F1C2T

```
*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#
```

Table 31: Output fields: card

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.

Output sample for 7210 SAS-K 2F1C2T card detail

```
*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#
```

Table 32: Output fields: card detail

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 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.

Label	Description
Base MAC address	Displays the base MAC address of the hardware component.
Memory Capacity	Displays the memory capacity of the card.

Sample output for CPM card
The following output is an example of CPM card information, and Table 33: Output fields: CPM card describes the output fields.

```
*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#
```

Table 33: Output fields: CPM card

Label	Description
Slot	The slot of the card in the chassis.
Card Provisioned	The SF/CPM type that is configured for the slot.
Card Equipped	The SF/CPM type that is actually populated in the slot.
Admin State	Up The SF/CPM is administratively up.
	Down The SF/CPM is administratively down.
Operational State	Up The SF/CPM is operationally up.
	Down The SF/CPM is operationally down.
BOF last modified	The date and time of the most recent BOF modification.
Config file version	The configuration file version.
Config file last modified	The date and time of the most recent config file modification.

Label	Description
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.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Administrative state	Up The card is administratively up. Down The card is administratively down.

Label	Description
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 to indicate that the temperature is critical.
Software boot version	The version of the boot image.
Memory capacity	The total amount of memory.

Output fields for card state
The following table describes the output fields.

Table 34: Output fields: card state

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 preconfigured.
Num Ports	The number of ports available on the MDA.
Num MDA	The number of MDAs installed.

Label	Description
Comments	Indicates whether the SF/CPM is the active or standby.

mda

Syntax

mda [*slot* [*lmda*]] [**detail**]

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Specifies the slot number for which to display MDA information.

mda

Specifies the MDA number in the slot for which to display MDA information.

detail

Displays detailed MDA information.

Output

The following outputs are an example of MDA information, and Table 35: Output fields: MDA and Table 36: Output fields: MDA detail describe the output fields.

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-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
*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#
```

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#
```

Table 35: Output fields: MDA

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

Label	Description
	Operationally up.
	Down Operationally down.

Table 36: Output fields: MDA detail

Label	Description
Slot	The chassis slot number.
Slot	The MDA slot number.
Provisioned Provisioned-type	The provisioned MDA type.
Equipped Mda-type	The MDA type that is physically inserted into this slot in this chassis.
Admin State	Up The MDA is administratively up.
	Down The MDA is administratively down.
Operational State	Up The MDA is operationally up.
	Down The MDA is operationally down.
Maximum port count	The maximum number of ports that can be equipped on the MDA card.
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 queuing structure for this object.
Capabilities	Specifies the minimum size of the port that can exist on the MDA.
Part number	The hardware part number.

Label	Description
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.

pools

Syntax

pools *mda-id* [*/port*] [**access-app** *pool-name*]

pools *mda-id* [*/port*] [**network-app** *pool-name*]

Context

show

Platforms

7210 SAS-D and 7210 SAS-Dxp

Description

This command displays pool information.

Parameters

mda-id[/port]

Displays the pool information of the specified MDA.

access-app pool-name

Displays the pool information of the specified QoS policy.

Values access-ingress, access-egress

network-app *pool-name*

Displays the pool information of the specified QoS policy.

Values network-egress

Output

The following outputs are examples of pool information, and Table 37: Output fields: pool describes show the output fields.

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#
```

Sample 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#
```

Table 37: Output fields: pool

Label	Description
Type	Specifies the pool type.
ID	Specifies the card/mda or card/MDA/port designation.
Application/Type	Specifies the nature of usage the pool would be used for. The pools could be used for access or 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 used after which the drop probability starts to rise above 0.
Actual ResvCBS	Specifies the actual percentage of pool size reserved for CBS.

Label	Description
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 and 7210 SAS-Dxp	
Max-Avg	Specifies the percentage of the buffer used after which the drop probability is 100%.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.

2.20.2.2.2 Port show commands

port

Syntax

port *port-id* [**count**] [**detail**]

port *port-id* **description**

port *port-id* **associations**

port *port-id* **poe** [**detail**]

port *port-id* **ethernet** [**efm-oam** | **detail**]

port *port-id* **optical**

port *port-id* **dot1x** [**detail**]

port *port-id* **vport** [*vport-name*] **associations**

port [**A1**] [**detail**] [**statistics**] [**description**]

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document.

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.

Note:
The out-of-band Ethernet port is not supported on 7210 SAS-D and 7210 SAS-Dxp platforms.

Parameters

port-id

Specifies the physical port ID in the form *slot/mda/port*.

Values 1 to 60 (depending on the MDA type)

associations

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

poe

Displays PoE information for a specified port. This parameter is only supported on the 7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p.

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.

optical

Displays optical port DDM information retrieved from the cache, which is updated periodically only for ports that are operationally up or operationally down because of loss of Rx signal.

Output

The following outputs are examples of port information, and the associated tables describe the output fields.

- Sample output for 7210 SAS-D, Table 38: Output fields: show general port
- Sample output for 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T, Table 38: Output fields: show general port
- Sample output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, Table 38: Output fields: show general port
- Sample output Ethernet , Table 39: Output fields: show specific port and Table 40: Output fields: show port detail

- Sample output for 7210 SAS-D, Table 39: Output fields: show specific port and Table 40: Output fields: show port detail
- Sample output for 7210 SAS-D Ethernet, Table 39: Output fields: show specific port and Table 40: Output fields: show port detail
- Sample output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, Table 39: Output fields: show specific port and Table 40: Output fields: show port detail
- Sample output port associations, Table 41: Output fields: port associations
- Sample output A1 detailed, Table 42: Output fields: show A1 detailed
- Sample output for dot1x detail, Sample output - optical , Table 43: Output fields: optical
- Sample output for PoE, Table 44: Output fields: PoE

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-K 2F1C2T and 7210 SAS-K 2F6C4T

```
*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 output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
*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 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#
```

Table 38: Output fields: show general port

Label	Description
Port ID	Displays the port ID configured or displayed in the *slot/mda/port* format
Admin State	Up — The administrative state is up Down — The administrative state is down
Link	Yes — A physical link is present No — A physical link is not present
Port State	Up — The port is physically present and has a physical link present Down — The port is physically present but does not have a link Ghost — The port is not physically present None — The port is in its initial creation state or about to be deleted Link Up — The port is physically present and has a physical link present Link Down — The port is physically present but does not have a link
Cfg MTU	Displays the configured MTU
Oper MTU	Displays the negotiated size of the largest packet which can be sent on the port specified in octets
LAG ID	Displays 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 do 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	Displays the type of port or optics installed
SFP/MDI MDX	GIG3 — Indicates the GigE SFP type FASTE — Indicates the Fast Ethernet SFP type MDI — Indicates that the Ethernet interface is of type MDI (Media Dependent Interface)

Label	Description
	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 Ethernet

```
*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
===============================================================================
```

Sample output for 7210 SAS-D Ethernet

```
*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 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
*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#
```

Table 39: Output fields: show 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.

Label	Description
	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.
Configured Mode	network The port is configured for transport network use.
	access The port is configured for service access.

Label	Description
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 The collection of accounting and statistical data for the network Ethernet port is disabled. Statistics are still accumulated by the IOM cards, however, the CPU will not obtain the results and write them to the billing file.

Label	Description
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sublayer.
Transceiver Type	Type of the transceiver.
Model Number	The model number of the transceiver.
Transceiver Code	The code for the transmission media.
Laser Wavelength	The light wavelength transmitted by the transceiver's laser.
Connector Code	The vendor organizationally unique identifier field (OUI) contains the IEEE company identifier for the vendor.
Diag Capable	Indicates if the transceiver is capable of doing diagnostics.
Vendor OUI	The vendor-specific identifier field (OUI) contains the IEEE company identifier for the vendor.
Manufacture date	The manufacturing date of the hardware component in the mmddyyyy ASCII format.
Media	The media supported for the SFP.
Serial Number	The vendor serial number of the hardware component.
Part Number	The vendor part number contains ASCII characters, defining the vendor part number or product name.
Input/Output	When the collection of accounting and statistical data is enabled, the 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 sublayer to a higher (sub)layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which

Label	Description
	were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub)layer, which were addressed to a multicast address at this sublayer. 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 sublayer, 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 sublayer to a higher (sub)layer, which were addressed to a broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sublayer, 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 because of 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.

Label	Description
Frame Based Acc	Indicates if frame-based-accounting is enabled or disabled on the port

Table 40: Output fields: show port detail

Label	Description
Description	Provides a text description of the port
Interface	Displays the port ID in the *slot/mda/port* format
Speed	Displays the speed of the interface
Link-level	Ethernet — The port is configured as Ethernet
MTU	Displays the size of the largest packet which can be sent or 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	Displays the link up dampening time in seconds. The port link dampening timer value reduces the number of link transitions reported to upper layer protocols.
Hold time down	Displays the link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
IfIndex	Displays the interface 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	Displays 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

Label	Description
Encap Type	Null — Ingress frames do 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	Displays 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	Displays 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 does not obtain the results and write them to the billing file.
Down-When-Looped	Displays whether the feature is enabled or disabled
Down On Int. Error	Indicates whether down-on-internal-error is enabled
CRC Mon SD Thresh	Indicates whether signal-degrade threshold is configured
CRC Mon SF Thresh	Indicates whether signal-fail threshold is configured
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	Displays the maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate
Configured Address	Displays the base chassis Ethernet MAC address.
Hardware Address	Displays the interface hardware or system assigned MAC address at its protocol sublayer
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

Label	Description
	transmission units that could not be transmitted because of errors.
Unicast Packets Input/ Output	The number of packets, delivered by this sublayer to a higher (sub)layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sublayer to a higher (sub)layer, which were addressed to a multicast address at this sublayer. 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 sublayer, 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 sublayer to a higher (sub)layer, which were addressed to a broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sublayer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Discards Input/Output	Displays 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

Label	Description
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
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 port associations

```
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#
```

Table 41: Output fields: port associations

Label	Description
Svc ID	Displays the service identifier
Name	Displays the name of the IP interface
Encap Value	Displays the dot1q or qinq encapsulation value on the port for this IP interface

Sample output A1 detailed

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

Table 42: Output fields: show A1 detailed

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

Label	Description
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 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.
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.

Label	Description
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 hardware or system assigned MAC address at its protocol sublayer.
Traffic Statistics	Octets input/output — Specifies the total number of octets received and transmitted on the port Packets input/output, or the number of packets, delivered by this sublayer to a higher (sub)layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent. Errors input/output — For packet-oriented interfaces, this field specifies 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, this field specifies 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 sublayer to a higher (sub)layer, which were not addressed to a unicast or multicast address at this sublayer. The total number

Label	Description
	of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sublayer, including those that were discarded or not sent.

Sample output 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
```

Sample output - optical

The following output is an example of optical information, and Table 43: Output fields: optical describes the output fields.

```
A:SAS# show port 1/1/1 optical force
===============================================================================
Optical Interface
===============================================================================
Transceiver Data
Transceiver Status : operational
Transceiver Type   : SFP
Model Number       : 3HE04824AAAA01  ALA  IPU3ANLEAA
TX Laser Wavelength: 850 nm                Diag Capable         : yes
Connector Code     : LC                    Vendor OUI           : 00:01:9c
Manufacture date   : 2016/04/10            Media                : Ethernet
Serial Number      : CG15KT0TF
Part Number        : PLRXPLSCS43AL1
Optical Compliance : 10GBASE-SR
Link Length support: 80m for OM2 50u MMF; 30m for OM1 62.5u MMF; 300m for OM3*
===============================================================================
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
===============================================================================
                             Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)              +41.1     +80.0      +75.0       -5.0      -10.0
Supply Voltage (V)            3.30      3.70       3.63       2.97       2.85
Tx Bias Current (mA)           5.0      10.0        8.5        3.0        2.6
Tx Output Power (dBm)        -2.15     -1.00      -1.30      -7.50      -8.00
Rx Optical Power (avg dBm)   -26.02      1.50       1.00     -12.00!    -14.00!
===============================================================================
```

Table 43: Output fields: optical

Label	Description
Transceiver Data	
Transceiver Status	Displays the status of the transceiver
Transceiver Type	Displays the type of the transceiver
Model Number	Displays the model number of the transceiver
TX Laser Wavelength	Indicates the transceiver laser wavelength
Connector Code	Displays the vendor Organizationally Unique Identifier field (OUI) contains the IEEE company identifier for the vendor
Manufacture date	Displays the manufacturing date of the hardware component in the mmddyyyy ASCII format

Label	Description
Serial Number	Displays 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
Optical Compliance	Specifies the optical compliance code of the transceiver
Link Length support	Specifies the link length support for the transceiver
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated	
Temperature (C)	Displays the temperature of the transceiver
Supply Voltage (V)	Displays the supply voltage of the transceiver
Tx Bias Current (mA)	Displays the transmitted bias current of the transceiver
Tx Output Power (d Bm)	Displays the transmitted output power of the transceiver
Rx Optical Power (avg dBm)	Displays the received optical power of the transceiver

Sample output for PoE

```
A:7210SAS>show port 1/1/2 poe
===============================================================================
PoE Port Information              Port 1/1/2
===============================================================================
PoE Power pair                    : Alt-A and Alt-B
PoE Admin status                  : enabled
PoE Power Level Configured        : HPoE
PoE Power Level Delivered         : HPoE
PoE Detection status              : DeliveringPower
PoE Oper Status                   : On
PoE Classification status         : Class 5D (90 W)
PoE Fault status                  : Detok
PoE event time                    : 07/19/2022 16:02:32
===============================================================================
```

Table 44: Output fields: PoE

Label	Description
PoE Port Information	Displays the PoE device connected to the port
PoE Power pair	Displays the standard mechanism used to deliver power to the connected device. The value is displayed as Alternative A, Alternative B, or Alt A and Alt B (for a dual-signature device).
PoE Admin status	enabled — The PoE admin status is enabled disabled — The PoE admin status is disabled

Label	Description
PoE Power Level Configured	Displays the user configured maximum amount of PoE power that can be provided to a connected device on this port. The value is displayed as PoE (15 W), PoE+ (30 W), PoE++ (60 W), or HPoE (90 W).
PoE Power Level Delivered	Displays the system delivered PoE power to the connected device. The value is displayed as PoE (15 W), PoE+ (30 W), PoE ++ (60 W), or HPoE (90 W).
PoE Detection status	Displays the status of the PoE physical layer classification and allocation of PoE power
PoE Oper Status	Displays the operational status of the PoE On — PoE power is being delivered Off — PoE power is not being delivered
PoE Classification status	Displays the status of the power class detected and alloted for the connected device after the PoE physical layer classification is completed. It can be one of the following values: • Class-0 (15 W) • Class-1 (4 W) • Class-2 (7 W) • Class-3 (15 W) • Class-4 (30 W) • Class-5 (45 W) • Class-6 (60 W) • Class-7 (75 W) • Class-8 (90 W)
PoE Fault status	Detok — The PoE power request detected is correct and power is supplied to connected device Open — The PoE device is not connected to port Tcut — PoE device connected to the port has generated some faults such as current overload, short circuit, and so on Pdeny — The PoE request is denied to the connected device (for example, a request for more power than what is available, and so on) Dis — The PoE device connected to the port has been disconnected and is no longer drawing any power
PoE event time	Displays the wall clock time when the last PoE event was logged for the port

lldp

Syntax

lldp [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**] [**lldp-med**]

Context

show>port>ethernet

Platforms

Supported on all 7210 SAS platforms as described in this document

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 about the bridge MAC.

detail

Displays more information.

lldp-med

Displays LLDP-MED information. This keyword is supported only on the 7210 SAS-Dxp.

Output

The following output is an example of LLDP information, and Table 45: Output fields: port Ethernet LLDP describes the output fields.

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:

*A:Dut-A# /show port 1/1/11 ethernet lldp lldp-med remote-info detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/1/11 Bridge nearest-bridge Remote Peer Information
-------------------------------------------------------------------------------
Remote Peer Index 2 at timestamp 08/06/2020 11:08:52:
Supported Caps        : bridge telephone
Enabled Caps          : bridge telephone
Chassis Id Subtype    : 5 (networkAddress)
Chassis Id            : 01:C0:A8:02:02
PortId Subtype        : 3 (macAddress)
Port Id               : C0:74:AD:09:C1:4C
Port Description      : eth0
System Name           : GXP1625_c0:74:ad:09:c1:4c
System Description    : GXP1625 1.0.4.138
Remote Peer Index 2 management addresses at time 08/06/2020 11:08:52:
No remote management addresses found
Enabled Caps          : capabilities network-policy location extended-pd
                        inventory
LLDP Med Rem Device Type: Endpoint Class III
LLDP Med Rem App Type*: 1
LLDP Med Rem vlan-tag*: True           LLDP Med Rem Vlan Tag*: 444
LLDP Med Rem Dot1p 1  : 4              LLDP Med Rem Ip Dscp 1: 44
```

Table 45: Output fields: port Ethernet LLDP

Label	Description
Admin State	Displays the LLDP transmission/reception frame handling
Notifications	Displays whether LLDP notifications are enabled
Tunnel Nearest Bridge	n/a
Transmit TLVs	Displays the optional TLVs that are transmitted by this port
PortID TLV Subtype	Displays the setting for the port ID subtype: tx-if-alias, tx-fi-name, or tx-local
Management Address Transmit Configuration	
Index 1 (system) Index 2 (IPv6 system)	Displays details of the management address configuration. The 7705 SAR can only be configured to send or not send the system address Enabled — the management address TLV is included in LLDPDUs sent by the port Disabled — the management address TLV is not included in LLDPDUs sent by the port
Address	Displays the address transmitted by the port when tx-mgmt-address command is enabled
Supported Caps	Displays the system capabilities supported by the remote peer
Enabled Caps	Displays the system capabilities enabled on the remote peer
Chassis ID Subtype	Displays an integer value and text definition that indicates the basis for the chassis ID entity listed in the chassis ID field
Chassis ID	Displays the chassis identifier of the chassis containing the Ethernet port that sent the LLDPDU
PortId Subtype	Displays an integer value and text definition that indicates the basis for the port ID entity listed in the port ID field
Port ID	Displays the port identifier of the Ethernet port that sent the LLDPDU

Label	Description
Port Description	Displays a description of the port that sent the LLDPDU and indicates that the description is the ifDescr object text string from RFC 2863 - IF MIB
System Name	Displays the name of the system that sent the LLDPDU
System Description	Displays the description of the system that sent the LLDPDU
LLDP Med Rem Device Type	Displays the LLDP-MED remote device type (endpoint Class III)
LLDP Med Rem App Type	Displays the **application-type** value in the Network Policy TLV of the LLDP-MED message received from the remote device
LLDP Med vlan-tag-present	Displays the value of the vlan-tag-present flag in the Network Policy TLV of the LLDP-MED message received from the remote device True — The VLAN tag is present False — The VLAN tag is not present
LLDP Med Rem Vlan Tag	Displays the VLAN value in the LLDP-MED message received from the remote device
LLDP Med Rem Dot1p	Displays the dot1p value in the Network Policy TLV of the LLDP-MED message received from the remote device
LLDP Med Rem IP DSCP	Displays the IP DSCP value in the Network Policy TLV of the LLDP-MED message received from the remote device

internal-loopback-ports

Syntax

internal-loopback-ports [**detail**]

Context

show>system

Platforms

7210 SAS-D and 7210 SAS-Dxp

Description

This command displays information about internal loopback ports .

Parameters

detail

Displays application information

Output

The following output is an example of internal loopback port information, and Table 46: Output fields: show MAC swap application describes the output fields.

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#
```

Table 46: Output fields: show MAC swap application

Label	Description
Port ID	Displays the port ID.
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.
Loopback Src Addr	The source MAC address that is used in the configuration of port loopback mac-swap test.

Label	Description
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

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Output

The following output is an example of system LLDP information.

Sample output

```
*A:hw_sas_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_sas_duta
```

```
System Description     : TiMOS-B-9.0.B1-12 both/mpc Nokia 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_sas_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
===============================================================================
```

poe

Syntax

poe [**detail**]

Context

show>system

Platforms

7210 SAS-Dxp 16p and 7210 SAS-Dxp 24p

Description

This command displays the PoE support status.

Parameters

detail

Displays detailed PoE information.

Output

The following output is an example of PoE information, and Table 47: Output fields: PoE describes the output fields.

Sample output

```
A:Dut-A# show system poe detail

===========================================================
PoE Information        (Existing)
===========================================================
PSE Maximum Power Budget     : 540 watts
PSE Power Provisioned        : 30 watts
PSE Power Committed          : 0 watts
PSE Power Available          : 540 watts
-------------------------------------------------------------------------------
PoE provisioned       (New)
===============================================================================
PSE Power Provisioned H-PoE  : 0 watts
PSE Power Provisioned PoE++  : 0 watts
PSE Power Provisioned PoE+   : 0 watts
PSE Power Provisioned PoE    : 0 watts
-------------------------------------------------------------------------------
PoE committed
===============================================================================
PSE Power Committed H-PoE    : 0 watts
PSE Power Committed PoE++    : 0 watts
PSE Power Committed PoE+     : 0 watts
PSE Power Committed PoE      : 0 watts

===============================================================================
PoE Port Information
===============================================================================
Port-Id     PoE Admin     PoE Oper      PoE Type      PoE Class     PoE Power
            State         State         Provisioned#  Detected      Committed
-------------------------------------------------------------------------------
1/1/1       Enabled       Off                PoE+          None          N/A
1/1/2       Disabled      None               None          None          N/A
1/1/3       Disabled      None               None          None          N/A
1/1/4       Disabled      None               None          None          N/A
1/1/5       Disabled      None               None          None          N/A
1/1/6       Disabled      None               None          None          N/A
1/1/7       Disabled      None               None          None          N/A
1/1/8       Disabled      None               None          None          N/A
……
-------------------------------------------------------------------------------
```

Table 47: Output fields: PoE

Label	Description
PoE Information	
PSE Maximum Power Budget	Displays the maximum power budget available for the system
PSE Power Provisioned	Displays the power provisioned
PSE Power Committed	Displays the sum of power supplied to all ports as determined by PoE type and class
PSE Power Available	Displays the power available from the maximum power budget
PoE provisioned	
PSE Power Provisioned H-PoE	Displays the power provisioned for HPoE devices
PSE Power Provisioned PoE++	Displays the power provisioned for PoE++ devices
PSE Power Provisioned PoE+	Displays the power provisioned for PoE+ devices
PSE Power Provisioned PoE	Displays the power provisioned for PoE devices
PoE committed	
PSE Power Committed H-PoE	Displays the power supplied to HPoE devices
PSE Power Committed PoE++	Displays the power supplied to PoE++ devices
PSE Power Committed PoE+	Displays the power supplied to PoE+ devices
PSE Power Committed PoE	Displays the power supplied to PoE devices
PoE Port Information	
Port-Id	Displays the port ID
PoE Admin State	Displays the PoE administrative state Enabled — Specifies that the PoE device is administratively enabled

Label	Description
	Disabled — Specifies that the PoE device is administratively disabled
PoE Type Provisioned	Displays the PoE type provisioned to the port
PoE Class Detected	Displays the PoE class, if available
PoE Power Committed	Displays the power committed to the PoE device

2.20.2.2.3 LAG commands

lag

Syntax

lag [*lag-id*] [**detail**] [**statistics**]

lag *lag-id* **associations**

lag [*lag-id*] **description**

lag [*lag-id*] **port**

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

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 about the specified LAG ID.

Default Display information for all LAG IDs.

Values 1 to 3 (7210 SAS-K 2F1C2T)
1 to 5 (7210 SAS-D)
1 to 6 (7210 SAS-Dxp, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C)

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

The following outputs are examples of LAG information, and the associated tables describe the output fields.

- Sample output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, Table 48: Output fields: LAG
- Sample output for LAG detail, Table 49: Output fields: LAG detail
- Sample output for LAG Statistics, Table 50: Output fields: LAG statistics
- Sample output for LAG Associations, Table 51: Output fields: LAG associations
- Sample output without MC-LAG, Table 52: Output fields: LAG (no MC-LAG)

Sample output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
*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#
```

Table 48: Output fields: LAG

Label	Description
LAG ID	The LAG ID that the port is assigned to.
Adm	Up The LAG is administratively up.
	Down The LAG is administratively down.
Opr	Up The LAG is operationally up.
	Down The LAG is operationally down.
Port-Threshold	The number of operational links for the LAG at or below which the configured action will be invoked.
Up-Link-Count	The number of ports that are physically present and have physical links present.
MC Act/Stdby	Member port is selected as active or standby link.

Sample output for LAG detail

```
*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#
```

Table 49: Output fields: LAG detail

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 Criteria	Configured subgroup selection criteria.
Number of subgroups	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.

Label	Description
Prtr System ID	System ID used by partner in LACP messages.
Prtr Oper Key	Key used by partner in LACP messages.
Prtr System Priority	System priority used by partner in LACP messages.
Mode	LAG in access or network mode.
Opr	Up The LAG is operationally up.
	Down The LAG is operationally down.
Port Threshold	Configured port threshold.
Thres. Exceeded Cnt	The number of times that the drop count was reached.
Threshold Action	Action to take when the number of available links is equal or below the port threshold.
Encap Type	The encapsulation method used to distinguish customer traffic on a LAG.
Lag-IFIndex	A box-wide unique number assigned to this interface.
Port ID	The specific slot/MDA/port ID.
(LACP) Mode	LACP active or passive mode.
LACP xmit standby	LACP transmits on standby links enabled or disabled.
Slave-to-partner	Configured enabled or 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 the member port is in the operational state.
Primary	Indicates that the member port is the primary port of the LAG.
Sub-group	Displays the member subgroup where the member port belongs to.
Priority	Displays the member port priority.

Sample output for LAG Statistics

```
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#
```

Table 50: Output fields: LAG statistics

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 for LAG Associations

```
A:ALA-1# show lag 5 associations
===============================================================================
Interface Table
===============================================================================
Router/ServiceId               Name                            Encap Val
-------------------------------------------------------------------------------
Router: Base                   LAG2West                        0
-------------------------------------------------------------------------------
Interfaces
===============================================================================
A:ALA-1#
```

Table 51: Output fields: LAG associations

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

Table 52: Output fields: LAG (no MC-LAG)

Label	Description
Lag-id	The LAG identifier
Mode	The mode of the LAG: access or network
Adm	Up: the LAG is administratively up
	Down: the LAG is administratively down
Opr	Up: the LAG is operationally up
	Down: the LAG is operationally down
Thres. Exceeded Cnt	The number of times that the drop count was reached
Port Threshold	The number of operational links at or below which the LAG is regarded as operationally down.
Thres. Last Cleared	The last time that keepalive statistics were cleared.
Threshold Action	Action to take when the number of operational links is equal to or below the port threshold.
Dynamic Cost	n/a
Encap Type	The encapsulation method used to distinguish customer traffic on a LAG.
Configured Address	The base chassis Ethernet MAC address.
Lag-IfIndex	A unique number assigned to this interface.
Hardware Address	The hardware address.
Adapt Qos	The configured QoS mode.
Hold-time Down	The hold-time, in tenths of seconds, before a failure is reported to higher levels.
Port Type	Standard: standard Ethernet port types are supported.
LACP	Enabled LACP is enabled.
	Disabled LACP is disabled.
Mode	Active LACP operates in active mode.
	Passive

Label	Description
	LACP operates in passive mode.
Role	Actor Local device (7705 SAR) participating in LACP negotiation.
	Partner Remote device participating in LACP negotiation.
LACP Transmit Intvl	LACP timeout signaled to peer.
LACP xmit stdby	LACP transmit on standby links enabled or disabled.
Selection Criteria	Configured subgroup selection criteria.
Slave-to-partner	Slave-to-partner flag enabled or disabled.
Number of sub-groups	Total subgroups in LAG.
Forced	n/a
System Id	System ID used by actor in LACP messages.
System Priority	System priority used by actor in LACP messages.
Admin Key	Configured LAG key.
Oper Key	Key used by actor in LACP messages.
Prtr System Id	System ID used by partner in LACP messages.
Prtr System Priority	System priority used by partner in LACP messages.
Prtr Oper Key	The key used by partner in LACP messages.
Port-id	The member physical port ID expressed in *slot/mda/port* format.
Adm	Up The member port is administratively up.
	Down The member port is administratively down.
Act/Stdby	Active The member port is active.
	Standby The member port is on standby.
Opr	Up

Label	Description
	The member port is operationally up.
	Down The member port is operationally down.
Primary	Indicates whether the member port is the primary port.
Sub-group	The member port subgroup.
Prio	The member port priority.

redundancy

Syntax

redundancy

Context

show

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

Commands in this context display multi-chassis redundancy information.

multi-chassis

Syntax

all

mc-lag peer *ip-address* [**lag** *lag-id*]

mc-lag [**peer** *ip-address* [**lag** *lag-id*]] **statistics**

sync peer [*ip-address*]

sync peer [*ip-address*] **detail**

sync peer [*ip-address*] **statistics**

Context

show>redundancy

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command displays multi-chassis redundancy information.

Parameters

all

Displays all multi-chassis information.

mc-lag

Displays multi-chassis LAG information.

peer *ip-address*

Displays the address of the multi-chassis peer.

lag lag-id

Displays the specified LAG ID on this system that forms an multi-chassis LAG configuration with the indicated peer.

statistics

Displays statistics for the multi-chassis peer.

sync

Displays synchronization information.

detail

Displays more information.

Output

The following output is an example of multi-chassis redundancy information, and Table 53: Output fields: show multi-chassis describes the output fields.

Sample output

```
*A:SAS# show redundancy multi-chassis mc-lag peer 3.3.3.3

===============================================================================
Multi-Chassis MC-Lag Peer 3.3.3.3
===============================================================================
Last State chg  : 08/31/2014 07:07:48
Admin State     : Up                  Oper State           : Up
KeepAlive       : 10 deci-seconds     Hold On Ngbr Failure : 3
-------------------------------------------------------------------------------
Lag Id Lacp   Remote System Id          Sys   Last State Changed
       Key    Lag Id                    Prio
-------------------------------------------------------------------------------
25     0      1                         0     08/31/2014 07:20:10
-------------------------------------------------------------------------------
Number of LAGs : 1

*A:SAS# show redundancy multi-chassis all

===============================================================================
Multi-Chassis Peers
===============================================================================
Peer IP          Peer Admin      Client    Admin        Oper         State
Src IP           Auth
-------------------------------------------------------------------------------
3.3.3.3          Enabled         MC-Sync:  --           --           --
```

```
2.2.2.2          hash2          MC-Ring:  --           --           --
                                 MC-Endpt: --           --           --
                                 MC-Lag:   Enabled      Enabled      --


*A:SAS# show redundancy multi-chassis sync peer 10.3.3.3

===============================================================================
Multi-chassis Peer Table
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 10.3.3.3
Description             : (Not Specified)
Authentication          : Enabled
Source IP Address       : 10.2.2.2
Admin State             : Enabled
-------------------------------------------------------------------------------
Sync: Not-configured
-------------------------------------------------------------------------------
===============================================================================
*A:SAS# show redundancy multi-chassis sync peer 3.3.3.3 detail

===============================================================================
Multi-chassis Peer Table
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 10.3.3.3
Description             : (Not Specified)
Authentication          : Enabled
Source IP Address       : 10.2.2.2
Admin State             : Enabled
-------------------------------------------------------------------------------
Sync: Not-configured
-------------------------------------------------------------------------------

===============================================================================
Ports synced on peer 10.3.3.3
===============================================================================
Port/Encap                    Tag
-------------------------------------------------------------------------------
===============================================================================

===============================================================================
DHCP Server instances synced on peer 10.3.3.3
===============================================================================
Router-Name                      Server-Name
  Tag
-------------------------------------------------------------------------------
No instances found
===============================================================================
```

Table 53: Output fields: show multi-chassis

Label	Description
Peer IP	Displays the multi-chassis redundancy peer IP address
Src IP	Displays the source IP address used to communicate with the multi-chassis peer

Label	Description
Auth	If configured, displays the authentication key used between this node and the multi-chassis peer

mc-lag

Syntax

mac-lag peer *ip-address* [**lag** *lag-id*]

mac-lag [**peer** *ip-address* [**lag** *lag-id*]] **statistics**

Context

show>redundancy>multi-chassis

Platforms

7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Description

This command displays multi-chassis LAG information.

Parameters

peer *ip-address*

Specifies the peer IP address for which to display multi-chassis LAG information.

lag *lag-id*

Displays information about the specified LAG ID

statistics

Displays LAG statistics information.

Output

The following output is an example of multi-chassis LAG information, and Table 54: Output fields: MC-LAG describes the output fields.

Sample output

```
*7210-SAS>show>redundancy>multi-chassis# mc-lag peer 1.1.1.1

===============================================================================
Multi-Chassis MC-Lag Peer 1.1.1.1
===============================================================================
Last State chg  : 08/13/2011 09:02:31
Admin State     : Down                Oper State           : Down
KeepAlive       : 10 deci-seconds     Hold On Ngbr Failure : 3
-------------------------------------------------------------------------------
Lag Id Lacp   Remote System Id          Sys   Last State Changed
       Key    Lag Id                    Prio
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
```

```
No LAGs found
===============================================================================
*7210-SAS>show>redundancy>multi-chassis# ^C
*A:SAS# show redundancy multi-chassis mc-lag peer 3.3.3.3 statistics

===============================================================================
Multi-Chassis Statistics, Peer 3.3.3.3
===============================================================================
Packets Rx                        : 8333
Packets Rx Keepalive              : 8321
Packets Rx Config                 : 1
Packets Rx Peer Config            : 2
Packets Rx State                  : 9
Packets Dropped State Disabled    : 0
Packets Dropped Packets Too Short : 0
Packets Dropped Tlv Invalid Size  : 0
Packets Dropped Tlv Invalid LagId : 0
Packets Dropped Out of Seq        : 0
Packets Dropped Unknown Tlv       : 0
Packets Dropped MD5               : 0
Packets Tx                        : 9229
Packets Tx Keepalive              : 8705
Packets Tx Peer Config            : 509
Packets Tx Failed                 : 1
===============================================================================
```

Table 54: Output fields: MC-LAG

Label	Description
Last State chg	Displays date and time of the last state change for the MC-LAG peer
Admin State	Displays the administrative state of the MC-LAG peer
KeepAlive	Displays the time interval between keepalive messages exchanged between peers
Oper State	Displays the operational state of the MC-LAG peer
Hold On Ngbr Failure	Displays how many keep alive intervals the standby will wait for packets from the active node before assuming a redundant neighbor node failure
Lag Id	Displays the LAG identifier, expressed as a decimal integer
Lacp Key	Displays the 16-bit Lacp key
Remote system Id	Displays the LAG identifier of the remote system, expressed as a decimal integer
Multi-Chassis Statistics	
Packets Rx	Displays the number of MC-LAG packets received from the peer
Packets Rx Keepalive	Displays the number of MC-LAG keepalive packets received from the peer

Label	Description
Packets Rx Config	Displays the number of MC-LAG configured packets received from the peer
Packets Rx Peer Config	Displays the number of MC-LAG packets configured by the peer
Packets Rx State	Displays the number of received MC-LAG "lag" state packets received from the peer
Packets Dropped State Disabled	Displays the number of packets that were dropped because the peer was administratively disabled
Packets Dropped Packets Too Short	Displays the number of packets that were dropped because the packet was too short
Packets Dropped Tlv Invalid Size	Displays the number of packets that were dropped because the packet size was invalid
Packets Dropped Tlv Invalid LagId	Displays the number of packets that were dropped because the packet referred to an invalid or non-multi-chassis LAG
Packets Dropped Out of Seq	Displays the number of packets that were dropped because the packet was out of sequence
Packets Dropped Unknown Tlv	Displays the number of packets that were dropped because the packet contained an unknown TLV
Packets Dropped MD5	Displays the number of packets that were dropped because the packet failed MD5 authentication
Packets Tx	Displays the number of packets transmitted from this system to the peer
Packets Tx Keepalive	Displays the number of keepalive packets transmitted from this system to the peer
Packets Tx Peer Config	Displays the number of configured packets transmitted from this system to the peer
Packets Tx Failed	Displays the number of packets that failed to be transmitted from this system to the peer

2.20.2.2.4 MACsec show commands

macsec

Syntax

macsec

Context

show

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

Commands in this context display MACsec information.

connectivity-association

Syntax

connectivity-association [*ca-name*] [**detail**]

Context

show>macsec

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command displays MACsec CA information.

Parameters

ca-name

Displays CA name information, up to 256 characters.

detail

Displays MACsec CA detailed information.

Output

The following outputs are examples of CA information, and the associated tables describe the output fields:

- Sample output: MACsec CA , Table 55: Output fields: MACsec connectivity association
- Sample output: MACsec CA with CA name, Table 56: Output fields: MACsec CA with CA name

Sample output: MACsec CA

```
A:Dut-C# show macsec connectivity-association
===============================================================================
ca-name            : dut_B_C_128_01
ca-name            : dut_B_C_256_01
ca-name            : to_Juniper_1_1_2__1
ca-name            : abcdefghijklmnoprstuvxyz@!
===============================================================================
```

Table 55: Output fields: MACsec connectivity association

Label	Description
ca-name	Specifies the CA name

Sample output: MACsec CA with CA name

```
A:Dut-C# show macsec connectivity-association "abcdefghijklmnoprstuvxyz@!"
===============================================================================
Connectivity Association "abcdefghijklmnoprstuvxyz@!"
===============================================================================
Admin State        : Up
Description        : alsfjalsfjafja;lsjflasjflasjfl
Replay Protection  : Disabled
Replay Window Size : 333
Macsec Encrypt     : Enabled
Clear Tag Mode     : dual-tag
Cipher Suite       : gcm-aes-256
Encryption Offset  : 30
Assigned ports     : 2/1/9 2/1/10
-------------------------------------------------------------------------------
Static Cak
-------------------------------------------------------------------------------
MKA Key Server Priority      : 16
Active Pre-Shared-Key Index  : 1
Active Pre-Shared-Key CKN    : aabbccddeeff00112233445566778899
===============================================================================
```

Table 56: Output fields: MACsec CA with CA name

Label	Description
Admin State	Up — The CA is administratively up
	Down — The CA is administratively down If **port <x/y/z> ethernet>macsec** is shutdown, the admin state is down. Otherwise, the admin state is up.
Description	Displays a user description for this CA
Replay Protection	Enabled — Replay Protection is enabled
	Disabled — Replay Protection is disabled If replay protection is enabled for this CA, the out of window packet is discarded.
Replay Window Size	Displays the size, in packets, of the replay window
Macsec Encrypt	Enabled MACsec is enabled
	Disabled

Label	Description
	MACsec is disabled
Clear Tag Mode	Displays the clear tag mode: single-tag, dual-tag
Cipher Suite	Displays the cipher suite used for encrypting the SAK: gcm-aes-128 or gcm-aes-256
Encryption Offset	Displays the encryption offset configured on this node: 0, 30, 50
Assigned ports	Displays all ports that contain this CA
MKA Key Server Priority	Displays the MKA key server priority: 0 to 255 (default 16)
Active Pre-Shared Key Index	Displays the active preshared key index: 1 to 2 (default 1)
Active Pre-Shared Key CKN	Displays the active PSK CAK name

mka-session

Syntax

mka-session [**port** *port-id*]

mka-session [**port** *port-id*] **detail**

mka-session [**port** *port-id*] **statistics**

Context

show>macsec

Platforms

7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, and 7210 SAS-Dxp 24p

Description

This command displays MACsec MKA session information.

Parameters

port-id

Specifies the port ID, up to 17 characters.

Note: See SA limits and network design for more information about security zones and ports where MACsec can be enabled.

detail

Displays MACsec MKA session detailed information.

statistics

Displays MACsec MKA session statistical information.

Output

The following outputs are examples of MACsec MKA session information, and the associated tables describe the output fields:

- Sample output: MACsec MKA-session port, Table 57: Output fields: MACsec MKA-session port
- Sample output: MACsec MKA-session port (detail), Table 58: Output fields: MACsec MKA-session port (detail and statistics)
- Sample output: MACsec MKA-session (statistics), Table 58: Output fields: MACsec MKA-session port (detail and statistics)

Sample output: MACsec MKA-session port

```
A:Dut-C# show macsec mka-session port 2/1/11
===============================================================================
MKA Session for port 2/1/11
===============================================================================
Port               : 2/1/11
Security Zone      : 3
===============================================================================
===============================================================================
Live Peer List
===============================================================================
Member Identifier             Mesg Num  Rx-SCI                      KS priority
-------------------------------------------------------------------------------
bf4102704294fa1057022bdf      28322     a47b2ce112ef0000            16
===============================================================================
===============================================================================
Potential Peer List
===============================================================================
Member Identifier             Mesg Num  Rx-SCI                      KS priority
-------------------------------------------------------------------------------
===============================================================================
```

Table 57: Output fields: MACsec MKA-session port

Label	Description
MKA Session for port	Displays the MKA session for the current port
Port	Displays the MKA session current port
Security Zone	Displays security zone this port belongs to
Live Peer List	Displays peers (participants) that have provided their MI and MN via KMA. The peer entry is in the Live Peer List.
Member Identifier	Displays the MI of the peer entry
Mesg Num	Displays the latest Member Number of the peer entry
Rx-SCI	Displays the Peer Rx-SCI
KS-priority	Displays the Peer Key server priority

Label	Description
Potential Peer List	Peers (participants) that have Potential Peers List includes all the other peers that have transmitted an MKPDU that has been directly received by the participant or that were included in the Live Peers List of a MKPDU transmitted by a peer that has proved liveness, an MKA PDU. The peer entry is in the Potential Peers List.

Sample output: MACsec MKA-session port (detail)

```
A:Dut-C# show macsec mka-session port 2/1/11 detail
===============================================================================
MKA Session for port 2/1/11
===============================================================================
Port               : 2/1/11
Security Zone      : 3
MKA Oper State     : unknown value
Oper Cipher Suite  : unknown value
Oper Encrypt Offset: 0
CAK Name           : 11223344556677889900aabbccddeeff11223344556677889900aabbc*
MKA Member ID      : f134218784b114eb61dbe834
Transmit Interval  : 2000
Outbound SCI       : a4:7b:2c:e1:12:8f
Message Number     : 28298
Key Number         : 878
Key Server         : yes
Key Server Priority: 16
Latest SAK AN      : 3
Latest SAK KI      : f134218784b114eb61dbe8340000036d
Previous SAK AN    : 2
Previous SAK KI    : f134218784b114eb61dbe83400000000
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Live Peer List
===============================================================================
Member Identifier             Mesg Num  Rx-SCI                     KS priority
-------------------------------------------------------------------------------
bf4102704294fa1057022bdf      28323     a47b2ce112ef0000           16
===============================================================================
===============================================================================
Potential Peer List
===============================================================================
Member Identifier             Mesg Num  Rx-SCI                     KS priority
-------------------------------------------------------------------------------
===============================================================================
===============================================================================
MKA Session Statistics for port 2/1/11
===============================================================================
Peer Removed Due to Timeout  : 0
CKN Not Found                : 0
New Live peer                : 0
SAK Generated by Server      : 0
SAK Installed for TX         : 0
SAK Installed for RX         : 0
PDU Too Small                : 0
PDU Too Big                  : 0
PDU Not Quad Size            : 0
PDU Message Number Invalid   : 0
PDU Param Set Size Invalid   : 0
```

```
PDU Liveness Check Fail      : 0
Param Set Not Quad Size      : 0
Unsupported Agility          : 0
Invalid CAK Name Length      : 0
ICV Check Failed             : 0
Peer Using Same MID          : 0
SAK From Non-Live Peer       : 0
SAK From Non-Key Server      : 0
SAK Decrypt Fail             : 0
SAK Encrypt Fail             : 0
Key Number Invalid           : 0
SAK Installation Failed      : 0
CAK Info Missing             : 0
Max Peers Set as Zero        : 0
===============================================================================
```

Sample output: MACsec MKA-session (statistics)

```
A:Dut-C# show macsec mka-session statistics
===============================================================================
MKA Session Statistics for port 2/1/11
===============================================================================
Peer Removed Due to Timeout  : 0
CKN Not Found                : 0
New Live peer                : 0
SAK Generated by Server      : 0
SAK Installed for TX         : 0
SAK Installed for RX         : 0
PDU Too Small                : 0
PDU Too Big                  : 0
PDU Not Quad Size            : 0
PDU Message Number Invalid   : 0
PDU Param Set Size Invalid   : 0
PDU Liveness Check Fail      : 0
Param Set Not Quad Size      : 0
Unsupported Agility          : 0
Invalid CAK Name Length      : 0
ICV Check Failed             : 0
Peer Using Same MID          : 0
SAK From Non-Live Peer       : 0
SAK From Non-Key Server      : 0
SAK Decrypt Fail             : 0
SAK Encrypt Fail             : 0
Key Number Invalid           : 0
SAK Installation Failed      : 0
CAK Info Missing             : 0
Max Peers Set as Zero        : 0
===============================================================================
```

Table 58: Output fields: MACsec MKA-session port (detail and statistics)

Label	Description
MKA Oper State	Displays the operational state of the MKA participant on this port. The operational MKA state will be up if MKA hellos are received on this port and have a valid session.
Oper Cipher Suite	Displays the operational encryption algorithm used for datapath PDUs when all parties in the CA have the (SAK). This value is specified by the key server: gcm-aes-128 or gcm-aes-256

Label	Description
Oper Encrypt Offset	Displays the operational encryption offset used for the datapath PDUs when all parties in the CA have the SAK. This value is specified by the key server: 0, 30, 50.
CAK Name	Displays the name of the CAK in use by this MKA which is used to find the correct CAK
MKA Member ID	Displays the Member Identifier (MI) for the MKA instance
Transmit Interval	Displays the time interval (in ms) at which the MKA broadcasts its liveliness to its peers and is non-configurable
Outbound SCI	Displays the Secure Channel Identifier (SCI) information for transmitting MACsec frames and consists of the outgoing port MAC Address and a port identifier
Message Number	Displays the current count of MKA messages that is attached to MKA PDUs
Key Number	Displays the number of the currently assigned CAK. When a new CAK is generated, this number is incremented. A SAK is identified by 128-bit Key Identifier (KI) and 32-bit Key-Number (KN).
Key Server	Displays whether this server is the highest priority server in the peer group: no, yes
Key Server Priority	Displays the priority of the active key server: 0-255 (default 16)
Latest SAK AN	Displays the Association Number (AN) of the latest SAK. This number is concatenated with an SCI to identify a Secure Association (SA). In SR OS, only two SAKs are supported.
Latest SAK KI	Displays the Key Identifier (KI) of the latest SAK. This number is derived from the MI of the key server and the key number.
Previous SAK AN	Displays the AN of the previous SAK. This number is concatenated with an SCI to identify an SA.
Previous SAK KI	Displays the KI of the previous SAK. This number is derived from the MI of the key server and the key number.
Peer Removed Due to Timeout	Displays the number of peers removed from the live/potential peer list caused by not receiving an MKPDU within the MKA Live Time (6.0 seconds) and is not configurable
CKN Not Found	Displays the number of MKPDUs received with a CKN that does not match the CA configured for the port
New Live Peer	Displays the number of validated peers that have been added to the live peer list

Label	Description
SAK Generated by Server	Displays the number of SAKs generated by this MKA instance
SAK Installed for TX	Displays the number of SAKs installed for transmitting
SAK Installed for RX	Displays the number of SAKs installed for receiving
PDU Too small	Indicates that the number of MKPDUs received that are less than 32 octets
PDU Too big	Indicates the number of MKPDUs received where the EAPOL header indicates a size larger than the received packet.
PDU Not Quad Size	Indicates the number of MKPDUs received with a size that is not a multiple of 4 octets long
PDU Message Number Invalid	Indicates the number of MKPDUs received out of order as indicated by the Message Number
PDU Param Set Size Invalid	Indicates the number of MKPDUs received which contain a parameter set body length that exceeds the remaining length of the MKPDU
PDU Liveness Check Fail	Indicates the number of MKPDUs received which contain an MN that is not acceptably recent
Param Set Not Quad Size	Indicates the number of MKPDUs received which contain a parameter set that is not a multiple of 4 octets long
Unsupported Agility	Indicates the number of MKPDUs received which contain an unsupported Algorithm Agility value
Invalid CAK Name Length	Indicates the number of MKPDUs received which contain a CAK name that exceeds the maximum CAK name length
ICV Check Failed	Indicates the number of MKPDUs received which contain an ICV value that does not authenticate
Peer Using Same MID	Indicates the number of MKPDUs received which contain a peer list with an MI entry which conflicts with the local MI
SAK From Non-Live Peer	Indicates the number of SAKs received from peer that is not a member of the Live Peers List
SAK From Non-Key Server	Indicates the number of SAKs received from an MKA participant that has not been designated as the Key Server. Only the key server should distribute SAK.
SAK Decrypt Fail	Indicates the number of AES Key Wrap SAK decryption failures that have occurred

Label	Description
SAK Encrypt Fail	Indicates the number of AES Key Wrap SAK encryption failures that have occurred
Key Number Invalid	Indicates the number of SAKs received with an invalid Key Number
SAK Installation Failed	Indicates the number of Secy SAK installation failures that have occurred
CAK Info Missing	Indicates the number of times internal CAK data is not available for the generation of the SAK
Max Peers Set as Zero	Indicates the number of Secy SAK installations that have failed because the max peer entry being set to 0

2.20.2.3 Port monitor commands

port

Syntax

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

port all-ethernet-rates [**interval** *seconds*] [**repeat** *repeat*]

Context

monitor

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables port traffic monitoring. The specified port statistical information displays at the configured interval until the configured count is reached.

The first screen displays the current statistics related to the specified ports. The subsequent statistical information listed for each interval is displayed as a delta to the previous 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-id

Specifies up to five port IDs in the form *slot/mda/port*.

interval

Specifies the interval for each display, in seconds.

Default 10

Values 3 to 60

repeat *repeat*

Specifies how many times the command is repeated.

Default 10

Values 1 to 999

absolute

Displays raw statistics. No calculations are performed on the delta or rate statistics.

rate

Displays the rate-per-second for each statistic instead of the delta.

all-ethernet-rates

Displays all statistics and rates for Ethernet ports.

Output

Sample output

```
A:ALA-12>monitor# port 1/1/3 interval 3 repeat 3 rate
===============================================================================
Monitor statistics for Port 1/1/3
===============================================================================
                                                    Input                 Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                           1472000               1120000
Packets                                             1472                  1120
Errors                                                 0                     0

-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                            405333                394667
Packets                                              405                   395
Errors                                                 0                     0
Bits                                             3242664               3157336
Utilization (% of port capacity)                    0.33                  0.32

A:ALA-12>monitor#

A:Dut-A# monitor port all-ethernet-rates
===============================================================================
Monitor statistics for all Ethernet Port Rates
```

```
===============================================================================
Port-Id          D                 Bits   Packets     Errors    Util
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
1/1/12           I                    0         0          0     N/A
                 O                    0         0          0     N/A

1/1/20           I                    0         0          0     N/A
                 O                    0         0          0     N/A

3/1/12           I                    0         0          0     N/A
                 O                 3696         6          0     N/A

3/1/13           I                    0         0          0     N/A
                 O                    0         0          0     N/A

4/1/11           I                    0         0          0     N/A
                 O                    0         0          0     N/A

-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Rate)
-------------------------------------------------------------------------------
1/1/12           I                    0         0          0    0.00
                 O                    0         0          0    0.00

1/1/20           I                    0         0          0    0.00
                 O                    0         0          0    0.00

3/1/12           I                    0         0          0    0.00
                 O                    0         0          0    0.00

3/1/13           I                    0         0          0    0.00
                 O                    0         0          0    0.00

4/1/11           I                    0         0          0    0.00
                 O                    0         0          0    0.00
```

2.20.2.4 Clear commands

lag

Syntax

lag *lag-id* **statistics**

Context

clear

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command clears statistics for the specified LAG ID.

Parameters

lag-id

Specifies the LAG ID for which to clear statistics.

Values 1 to 3 (7210 SAS-K 2F1C2T)
1 to 5 (7210 SAS-D)
1 to 6 (7210 SAS-Dxp, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C)

statistics

Specifies to clear statistics for the specified LAG ID.

port

Syntax

port *port-id* **statistics**

Context

clear

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command clears port statistics for the specified ports.

Parameters

port-id

Specifies the port identifier.

statistics

Specifies that port statistics will be cleared.

2.20.2.5 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

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

3 Standards and protocol support

Note:
The information provided in this chapter is subject to change without notice and may not apply to all platforms.

Nokia assumes no responsibility for inaccuracies.

The following conventions are used in this section:

- T(A,N) indicates 7210 SAS-T in both Access-uplink mode and Network mode. Similarly, T(N) indicates 7210 SAS-T in network mode only.
- K5 indicates 7210 SAS-K 2F2T1C.
- K12 indicates 7210 SAS-K 2F4T6C.
- K30 indicates 7210 SAS-K 3SFP+ 8C.
- Sx/S-1/10GE indicates all variants of 7210 SAS-Sx 1/10GE and 7210 SAS-S 1/10GE platforms.
- Sx-10/100GE indicates only the variants of 7210 SAS-Sx 10/100GE. Sx-10/100GE QSFP28 indicates the 7210 SAS-Sx 10/100GE 64 SFP+ 4QSFP28 variant.
- Sx/S-1/10GE-VC indicates 7210 SAS-Sx 1/10GE and 7210 SAS-S 1/10GE platforms in standalone VC mode.
- R6 indicates 7210 SAS-R6.
- R12 indicates 7210 SAS-R12.
- D indicates 7210 SAS-D and 7210 SAS-D ETR. If a line item applies only to 7210 SAS-D ETR, then it is indicated as D-ETR.
- Dxp indicates 7210 SAS-Dxp-12p (2SFP+ 4F6T) 7210 SAS-Dxp-12p ETR (2SFP+ 4F6T), 7210 SAS-Dxp 16p (2SFP+ 4F10T), and 7210 SAS-Dxp-24p (2SFP+ 6F16T). If a line item applies only to a particular variant, the variant name will be called out explicitly against that item.
- This standards list is not applicable to platforms in the satellite mode of operation, as most of the features are supported on 7x50 SR platforms. For this reason, the host platforms standards compliance must be consulted for the satellite mode of operation.

3.1 BGP

draft-ietf-idr-add-paths-04, Advertisement of Multiple Paths in BGP is supported on T(N), 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1772, Application of the Border Gateway Protocol in the Internet is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1997, BGP Communities Attribute is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2385, Protection of BGP Sessions via the TCP MD5 Signature Option is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2439, BGP Route Flap Damping is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2545, Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2858, Multiprotocol Extensions for BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2918, Route Refresh Capability for BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3107, Carrying Label Information in BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3392, Capabilities Advertisement with BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4271, A Border Gateway Protocol 4 (BGP-4) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4360, BGP Extended Communities Attribute is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4364, BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, K30, T(N), 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only R6 and R12 supports RR server functionality. Rest of the platforms support only client function.

RFC 4659, BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4684, Constrained Route Distribution for Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4724, Graceful Restart Mechanism for BGP (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4760, Multiprotocol Extensions for BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4798, Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE) is supported on K12, K30, T(N), 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5004, Avoid BGP Best Path Transitions from One External to Another is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5291, Outbound Route Filtering Capability for BGP-4 is supported on K12, K30, T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5668, 4-Octet AS Specific BGP Extended Community is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6811, Prefix Origin Validation is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.2 Ethernet

IEEE 802.1AB, Station and Media Access Control Connectivity Discovery is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

TIA-1057, LLDP for Media endpoint devices is supported on Dxp, Sx/S-1/10GE, and Sx/S-1/10GE-VC

IEEE 802.1ad, Provider Bridges is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1ag, Connectivity Fault Management is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1ah, Provider Backbone Bridges is supported on T(N)

IEEE 802.1ax, Link Aggregation is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1D, MAC Bridges is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1p, Traffic Class Expediting is supported on D, E, Dxp, K5, K12, K30, T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1Q, Virtual LANs is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1s, Multiple Spanning Trees is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1w, Rapid Reconfiguration of Spanning Tree is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1X, Port Based Network Access Control is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ab, 1000BASE-T is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ac, VLAN Tag is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ad, Link Aggregation is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ae, 10 Gb/s Ethernet is supported on Dxp, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ah, Ethernet in the First Mile is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ba, 40 Gb/s and 100 Gb/s Ethernet is supported on R6, R12, and Sx-10/100GE

IEEE 802.3i, Ethernet is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3u, Fast Ethernet is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3z, Gigabit Ethernet is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3af, Power Over Ethernet (PoE) is supported on Dxp, T-ETR, Mxp-ETR, and Sx/S-1/10GE

Note:
Sx/S-1/10GE only on PoE variant and Sx-1/10GE fiber variant with two fixed copper ports. Only on Dxp-16p and Dxp-24p.

IEEE 802.3at, Power Over Ethernet (PoE+) is supported on Dxp, T-ETR, Mxp-ETR, and Sx/S-1/10GE

Note:
Sx/S-1/10GE only on PoE variant and Sx-1/10GE fiber variant with two fixed copper ports. Only on Dxp-16p and Dxp-24p.

IEEE 802.3bt, Power Over Ethernet (PoE++/HPoE) is supported on Dxp

Note:
Only on Dxp-16p and Dxp-24p.

ITU-T G.8032, Ethernet Ring Protection Switching is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ITU-T Y.1731, OAM functions and mechanisms for Ethernet based networks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.3 EVPN

draft-snr-bess-evpn-proxy-arp-nd-00, Proxy-ARP/ND function in EVPN networks is supported on K12, K30, Mxp, Sx/S-1/10GE, R6, and R12

Note:
Sx/S-/10GE standalone mode only.

RFC 7432, BGP MPLS-Based Ethernet VPN is supported on K12, K30, Mxp, Sx/S-1/10GE, R6, and R12

Note:
Sx/S-/10GE standalone mode only.

draft-ietf-bess-evpn-vpws-14, Virtual Private Wire Service support in Ethernet VPN is supported on Mxp

3.4 Fast Reroute

draft-ietf-rtgwg-lfa-manageability-08, Operational management of Loop Free Alternates is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
With Segment Routing.

RFC 5286, Basic Specification for IP Fast Reroute: Loop-Free Alternates is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
With Segment Routing.

RFC 7490, Remote Loop-Free Alternate (LFA) Fast Reroute (FRR) is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
With Segment Routing.

3.5 Internet Protocol (IP) — General

draft-grant-tacacs-02, The TACACS+ Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-vrrp-unified-spec-02, Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6 is supported on Mxp

RFC 768, User Datagram Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 793, Transmission Control Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 854, TELNET Protocol Specifications is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 951, Bootstrap Protocol (BOOTP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1034, Domain Names - Concepts and Facilities is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1035, Domain Names - Implementation and Specification is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1350, The TFTP Protocol (revision 2) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1534, Interoperation between DHCP and BOOTP is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1542, Clarifications and Extensions for the Bootstrap Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2131, Dynamic Host Configuration Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2347, TFTP Option Extension is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2348, TFTP Blocksize Option is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2349, TFTP Timeout Interval and Transfer Size Options is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2428, FTP Extensions for IPv6 and NATs is supported on D, Dxp, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2865, Remote Authentication Dial In User Service (RADIUS) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2866, RADIUS Accounting is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3046, DHCP Relay Agent Information Option (Option 82) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3596, DNS Extensions to Support IP version 6 is supported on D, Dxp, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3768, Virtual Router Redundancy Protocol (VRRP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4250, The Secure Shell (SSH) Protocol Assigned Numbers is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4251, The Secure Shell (SSH) Protocol Architecture is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4252, The Secure Shell (SSH) Authentication Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
All 7210 platforms support password and publickey based user authentication. 7210 SAS-D supports only password based authentication.

RFC 4253, The Secure Shell (SSH) Transport Layer Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4254, The Secure Shell (SSH) Connection Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4632, Classless Inter-domain Routing (CIDR): The Internet Address Assignment and Aggregation Plan is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5880, Bidirectional Forwarding Detection (BFD) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IPv4 only on all platforms listed. IPv4 and IPv6 only on Mxp.

RFC 5881, Bidirectional Forwarding Detection (BFD) IPv4 and IPv6 (Single Hop) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IPv4 only on all platforms listed. IPv4 and IPv6 only on Mxp.

RFC 5883, Bidirectional Forwarding Detection (BFD) for Multihop Paths is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IPv4 only on all platforms listed. IPv4 and IPv6 only on Mxp.

RFC 6528, Defending against Sequence Number Attacks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7130, Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces is supported on T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

3.6 IP — Multicast

RFC 1112, Host Extensions for IP Multicasting is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IGMP v1, v2, v3 is supported.

RFC 2236, Internet Group Management Protocol, Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3306, Unicast-Prefix-based IPv6 Multicast Addresses is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3376, Internet Group Management Protocol, Version 3 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3446, Anycast Rendevous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
MSDP supported only on Sx/S-1/10GE standalone.

RFC 3618, Multicast Source Discovery Protocol (MSDP) is supported on Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 4601, Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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 K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
MLD not supported.

RFC 4607, Source-Specific Multicast for IP is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4608, Source-Specific Protocol Independent Multicast in 232/8 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4610, Anycast-RP Using Protocol Independent Multicast (PIM) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5059, Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5384, The Protocol Independent Multicast (PIM) Join Attribute Format is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6513, Multicast in MPLS/BGP IP VPNs is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6514, BGP Encodings and Procedures for Multicast in MPLS/IP VPNs is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6515, IPv4 and IPv6 Infrastructure Addresses in BGP Updates for Multicast VPNs is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6625, Wildcards in Multicast VPN Auto-Discover Routes is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6826, Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Path is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 7246, Multipoint Label Distribution Protocol In-Band Signaling in a Virtual Routing and Forwarding (VRF) Table Context is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 7385, IANA Registry for P-Multicast Service Interface (PMSI) Tunnel Type Code Points is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

3.7 IP — Version 4

RFC 791, Internet Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 792, Internet Control Message Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 826, An Ethernet Address Resolution Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1519, Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1812, Requirements for IPv4 Routers is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1981, Path MTU Discovery for IP version 6 is supported on K12, K30, T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2401, Security Architecture for Internet Protocol is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Supported only for OSPFv3 authentication. Not supported for services.

RFC 2460, Internet Protocol, Version 6 (IPv6) Specification is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

3.8 IP — Version 6

RFC 2464, Transmission of IPv6 Packets over Ethernet Networks is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 3021, Using 31-Bit Prefixes on IPv4 Point-to-Point Links is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3122, Extensions to IPv6 Neighbor Discovery for Inverse Discovery Specification is supported on K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3587, IPv6 Global Unicast Address Format is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 4007, IPv6 Scoped Address Architecture is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 4193, Unique Local IPv6 Unicast Addresses is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 4291, Internet Protocol Version 6 (IPv6) Addressing Architecture is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 4443, Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 4861, Neighbor Discovery for IP version 6 (IPv6) is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 4862, IPv6 Stateless Address Autoconfiguration (Router Only) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5095, Deprecation of Type 0 Routing Headers in IPv6 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5952, A Recommendation for IPv6 Address Text Representation is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

RFC 6106, IPv6 Router Advertisement Options for DNS Configuration is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6164, Using 127-Bit IPv6 Prefixes on Inter-Router Links is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.9 IPsec

RFC 2401, Security Architecture for the Internet Protocol is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only for use with OSPFv3 authentication. Not supported for services.

RFC 2406, IP Encapsulating Security Payload (ESP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only for use with OSPFv3 authentication. Not supported for services.

3.10 IS-IS

draft-ietf-isis-mi-02, IS-IS Multi-Instance is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-isis-segment-routing-extensions-04, IS-IS Extensions for Segment Routing is supported on K12, K30, 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1195, Use of OSI IS-IS for Routing in TCP/IP and Dual Environments is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3359, Reserved Type, Length and Value (TLV) Codepoints in Intermediate System to Intermediate System is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3719, Recommendations for Interoperable Networks using Intermediate System to Intermediate System (IS-IS) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3787, Recommendations for Interoperable IP Networks using Intermediate System to Intermediate System (IS-IS) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4971, Intermediate System to Intermediate System (IS-IS) Extensions for Advertising Router Information is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5120, M-ISIS: Multi Topology (MT) Routing in IS-IS is supported on K12, 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5301, Dynamic Hostname Exchange Mechanism for IS-IS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5302, Domain-wide Prefix Distribution with Two-Level IS-IS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5303, Three-Way Handshake for IS-IS Point-to-Point Adjacencies is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5304, IS-IS Cryptographic Authentication is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5305, IS-IS Extensions for Traffic Engineering TE is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5306, Restart Signaling for IS-IS (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5308, Routing IPv6 with IS-IS is supported on K12, T(N), 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5310, IS-IS Generic Cryptographic Authentication is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6232, Purge Originator Identification TLV for IS-IS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6233, IS-IS Registry Extension for Purges is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-isis-mi-02, IS-IS Multi-Instance is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
K12, K30 support only a single instance and can operate in multi-instance deployment as it supports the processing of TLVs for multi-instance support.

draft-ietf-isis-segment-routing-extensions-04, IS-IS Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

3.11 Management

draft-ieft-snmpv3-update-mib-05, Management Information Base (MIB) for the Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-isis-wg-mib-06, Management Information Base for Intermediate System to Intermediate System (IS-IS) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-mboned-msdp-mib-01, Multicast Source Discovery protocol MIB is supported on Sx/S-1/10GE

Note:
Only in standalone mode.

draft-ietf-mpls-ldp-mib-07, Definitions of Managed Objects for the Multiprotocol Label Switching, Label Distribution Protocol (LDP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-mpls-te-mib-04, Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-ospf-mib-update-08, OSPF Version 2 Management Information Base is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ianaaddressfamilynumbers-mib, IANA-ADDRESS-FAMILY-NUMBERS-MIB is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ianaiftype-mib, IANAifType-MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ianaiprouteprotocol-mib, IANA-RTPROTO-MIB is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE8021-CFM-MIB, IEEE P802.1ag(TM) CFM MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE8021-PAE-MIB, IEEE 802.1X MIB is supported on D, Dxp, K5, K12, K30, T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE8023-LAG-MIB, IEEE 802.3ad MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

LLDP-MIB, IEEE P802.1AB(TM) LLDP MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1157, A Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1215, A Convention for Defining Traps for use with the SNMP is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1724, RIP Version 2 MIB Extension is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 2021, Remote Network Monitoring Management Information Base Version 2 using SMIv2 is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2138, Remote Authentication Dial In User Service (RADIUS) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2206, RSVP Management Information Base using SMIv2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2213, Integrated Services Management Information Base using SMIv2 is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2571, An Architecture for Describing SNMP Management Frameworks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2572, Message Processing and Dispatching for the Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2573, SNMP Applications is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2575, View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP) is supported on D, E, Dxp, K5, K12, K30, T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2578, Structure of Management Information Version 2 (SMIv2) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2579, Textual Conventions for SMIv2 is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2787, Definitions of Managed Objects for the Virtual Router Redundancy Protocol is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2819, Remote Network Monitoring Management Information Base is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2856, Textual Conventions for Additional High Capacity Data Types is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2863, The Interfaces Group MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2864, The Inverted Stack Table Extension to the Interfaces Group MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2933, Internet Group Management Protocol MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3014, Notification Log MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3164, The BSD syslog Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3165, Definitions of Managed Objects for the Delegation of Management Scripts is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3231, Definitions of Managed Objects for Scheduling Management Operations is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3273, Remote Network Monitoring Management Information Base for High Capacity Networks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3414, User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3416. Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3417, Transport Mappings for the Simple Network Management Protocol (SNMP) (SNMP over UDP over IPv4) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3419, Textual Conventions for Transport Addresses is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3593, Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3635, Definitions of Managed Objects for the Ethernet-like Interface Types is supported on D, E, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3826, The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3877, Alarm Management Information Base (MIB) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4001, Textual Conventions for Internet Network Addresses is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4022, Management Information Base for the Transmission Control Protocol (TCP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4113, Management Information Base for the User Datagram Protocol (UDP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4220, Traffic Engineering Link Management Information Base is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4292, IP Forwarding Table MIB is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4293, Management Information Base for the Internet Protocol (IP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5101, Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information is supported on Mxp, Sx/S-1/10GE, and R6

RFC 6241, Network Configuration Protocol (NETCONF) is supported on K5, K12, T(N), Mxp, Sx/S-1/10GE, R6, and R12

RFC 6242, Using the NETCONF Protocol over Secure Shell (SSH) is supported on K5, K12, T(N), Mxp, Sx/S-1/10GE, R6, and R12

3.12 MPLS — General

RFC 3031, Multiprotocol Label Switching Architecture is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3032, MPLS Label Stack Encoding is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3443, Time To Live (TTL) Processing in Multi-Protocol Label Switching (MPLS) Networks is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4182, Removing a Restriction on the use of MPLS Explicit NULL is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5332, MPLS Multicast Encapsulations is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

3.13 MPLS — GMPLS

draft-ietf-ccamp-rsvp-te-srlg-collect-04, RSVP-TE Extensions for Collecting SRLG Information is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.14 MPLS — LDP

draft-ietf-mpls-ldp-ipv6-15, Updates to LDP for IPv6 is supported on Mxp

draft-pdutta-mpls-ldp-adj-capability-00, LDP Adjacency Capabilities is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-pdutta-mpls-ldp-v2-00, LDP Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-pdutta-mpls-tldp-hello-reduce-04, Targeted LDP Hello Reduction is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3037, LDP Applicability is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3478, Graceful Restart Mechanism for Label Distribution Protocol (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5036, LDP Specification is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5283, LDP Extension for Inter-Area Label Switched Paths (LSPs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5443, LDP IGP Synchronization is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5561, LDP Capabilities is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6388, Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
P2MP LSPs only.

3.15 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

3.16 MPLS — OAM

RFC 6424, Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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

3.17 MPLS — RSVP-TE

RFC 2702, Requirements for Traffic Engineering over MPLS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2747, RSVP Cryptographic Authentication is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2961, RSVP Refresh Overhead Reduction Extensions is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3097, RSVP Cryptographic Authentication -- Updated Message Type Value is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3209, RSVP-TE: Extensions to RSVP for LSP Tunnels is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3477, Signalling Unnumbered Links in Resource ReSerVation Protocol - Traffic Engineering (RSVP-TE) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4090, Fast Reroute Extensions to RSVP-TE for LSP Tunnels is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4561, Definition of a Record Route Object (RRO) Node-Id Sub-Object is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, 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, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4950, ICMP Extensions for Multiprotocol Label Switching is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5817, Graceful Shutdown in MPLS and Generalized MPLS Traffic Engineering Networks is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.18 OSPF

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-ospf-segment-routing-extensions-04, OSPF Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1765, OSPF Database Overflow is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2328, OSPF Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3101, The OSPF Not-So-Stubby Area (NSSA) Option is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3509, Alternative Implementations of OSPF Area Border Routers is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3623, Graceful OSPF Restart Graceful OSPF Restart (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3630, Traffic Engineering (TE) Extensions to OSPF Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4222, Prioritized Treatment of Specific OSPF Version 2 Packets and Congestion Avoidance is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4552, Authentication/Confidentiality for OSPFv3 is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, 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, K30, T(N), 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, K30, T(N), 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, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5185, OSPF Multi-Area Adjacency is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5187, OSPFv3 Graceful Restart (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5243, OSPF Database Exchange Summary List Optimization is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5250, The OSPF Opaque LSA Option is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5309, Point-to-Point Operation over LAN in Link State Routing Protocols is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5340, OSPF for IPv6 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5838, Support of Address Families in OSPFv3 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6987, OSPF Stub Router Advertisement is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, K30, Mxp, Sx/S-1/10GE, R6, and R12

draft-ietf-ospf-segment-routing-extensions-04, OSPF Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

3.19 Pseudowire

draft-ietf-l2vpn-vpws-iw-oam-04, OAM Procedures for VPWS Interworking is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3916, Requirements for Pseudo- Wire Emulation Edge-to-Edge (PWE3) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3985, Pseudo Wire Emulation Edge-to-Edge (PWE3) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4385, Pseudo Wire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4446, IANA Allocations for Pseudowire Edge to Edge Emulation (PWE3) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4447, Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4448, Encapsulation Methods for Transport of Ethernet over MPLS Networks is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5659, An Architecture for Multi-Segment Pseudowire Emulation Edge-to-Edge is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6073, Segmented Pseudowire is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6310, Pseudowire (PW) Operations, Administration, and Maintenance (OAM) Message Mapping is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6391, Flow-Aware Transport of Pseudowires over an MPLS Packet Switched Network is supported on K12, K30, Mxp, R6, and R12

RFC 6718, Pseudowire Redundancy is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6870, Pseudowire Preferential Forwarding Status bit is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7023, MPLS and Ethernet Operations, Administration, and Maintenance (OAM) Interworking is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7267, Dynamic Placement of Multi-Segment Pseudowires is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.20 Quality of Service

RFC 2430, A Provider Architecture for Differentiated Services and Traffic Engineering (PASTE) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2474, Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2598, An Expedited Forwarding PHB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3140, Per Hop Behavior Identification Codes is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3260, New Terminology and Clarifications for Diffserv is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.21 RIP

RFC 1058, Routing Information Protocol is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 2082, RIP-2 MD5 Authentication is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 2453, RIP Version 2 is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

3.22 Timing

GR-1244-CORE, Clocks for the Synchronized Network: Common Generic Criteria, Issue 3, May 2005 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

GR-253-CORE, SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

IEEE 1588-2008, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, IEEE default profile is supported only includes the Dxp-12p ETR, Dxp-16p, Dxp-24p. Sx-10/100GE does not support IEEE default profile.

ITU-T G.781, Synchronization layer functions, issued 09/2008 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.813, Timing characteristics of SDH equipment slave clocks (SEC), issued 03/2003 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8261, Timing and synchronization aspects in packet networks, issued 04/2008 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8262, Timing characteristics of synchronous Ethernet equipment slave clock (EEC), issued 08/2007 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8264, Distribution of timing information through packet networks, issued 10/2008 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8265.1, Precision time protocol telecom profile for frequency synchronization, issued 10/2010 is supported on D-ETR, K5, K12, K30, T(A,N), 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 Dxp, K12, K30, T(A,N), Mxp, Sx-1/10GE, Sx-10/100GE, R6, and R12

Note:
For 7210 SAS-Sx 10/100GE, the support only includes the Sx 10/100GE QSFP28 variant. For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

IEC/IEEE 61850-9-3-2016, Communication networks and systems for power utility automation - Part 9-3: Precision time protocol profile for power utility automation is supported on Dxp-16p and Dxp-24p

IEEE C37.238-2017 - IEEE Standard Profile for Use of IEEE 1588 Precision Time Protocol in Power System Applications is supported on Dxp-16p and Dxp-24p

RFC 5905, Network Time Protocol Version 4: Protocol and Algorithms Specification is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

3.23 VPLS

RFC 4761, Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

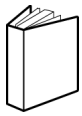
Note:
On 7210 platforms, only BGP-AD is suported with TLDP signalling for PW. No BGP signalling is supported for PW establishment.

RFC 4762, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5501, Requirements for Multicast Support in Virtual Private LAN Services is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6074, Provisioning, Auto-Discovery, and Signaling in Layer 2 Virtual Private Networks (L2VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Customer document and product support



Customer documentation

Customer documentation welcome page

Technical support

Product support portal

Documentation feedback

Customer documentation feedback