



# 7210 Service Access System

Release 26.9.R1

## 7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide

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# 1 Getting started

This chapter provides an overview of the document organization and content, and describes the terminology used in this guide.

## 1.1 About this guide



**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.

This guide describes system concepts and provides configuration examples to provision cards, MDAs, and ports for 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:

- 7210 SAS-Mxp
- 7210 SAS-R6
- 7210 SAS-R12
- 7210 SAS-Sx/S 1/10GE
- 7210 SAS-Sx 10/100GE
- 7210 SAS-T

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 as 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:

- **network mode of operation**

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, and 7210 SAS-T

- **standalone mode of operation**

7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE

- **standalone-VC mode of operation**

7210 SAS-Sx/S 1/10GE

If the topic and CLI commands are supported on the 7210 SAS-T operating in the access-uplink mode, it is explicitly indicated, where applicable.

### 1.1.1 Document structure and content

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



**Note:**

This guide generically covers Release 26.x.Rx content and may include some content that will be released in later maintenance loads. See the *7210 SAS Software Release Notes 26.x.Rx*, part number 3HE 27852 000x TQZZA, for information about features supported in each load of the Release 26.x.Rx 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 26.x.Rx*, part number 3HE 27852 000x TQZZA, and to 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 <sup>1</sup>   | Port Mode Configuration <sup>2</sup>       | Port Mode Configuration <sup>2</sup> | Implicit                   |                            |                            |
| 7210 SAS-K 3SFP+ 8C <sup>1</sup> | Port Mode Configuration <sup>2</sup>       | Port Mode Configuration <sup>2</sup> | Implicit                   |                            |                            |
| 7210 SAS-Mxp                     | Implicit <sup>3</sup>                      |                                      | Explicit BOF Configuration |                            | Explicit BOF Configuration |
| 7210 SAS-R6 <sup>4</sup>         | Implicit                                   |                                      | Implicit                   |                            |                            |
| 7210 SAS-R12 <sup>4</sup>        | Implicit                                   |                                      | Implicit                   |                            |                            |
| 7210 SAS-Sx/S 1/10GE             | Implicit <sup>3</sup>                      |                                      | Explicit BOF Configuration | Explicit BOF Configuration | Explicit BOF Configuration |
| 7210 SAS-Sx 10/100GE             | Implicit <sup>3</sup>                      |                                      | 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**

- <sup>1</sup> 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.
- <sup>2</sup> See section [7210 SAS port modes](#) for information about port mode configuration
- <sup>3</sup> Implicitly operates in [network](#) mode when [standalone](#) mode of operation is configured
- <sup>4</sup> 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 <sup>5</sup> |                     |         |        |               |
| 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.

<sup>5</sup> Port modes are configured on the 7750 SR 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 <sup>6</sup> | Yes <sup>7</sup> | Yes <sup>8</sup> |

## 1.4 7210 SAS router configuration process

The following table lists the tasks necessary to provision cards, Media Dependent Adapters (MDAs), and ports.

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

<sup>6</sup> Network ports are supported only if the node is operating in network mode.

<sup>7</sup> Hybrid ports are supported only if the node is operating in network mode.

<sup>8</sup> 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                             | <a href="#">Chassis slots and cards</a>        |
|              | MDAs                                                | <a href="#">MDAs</a>                           |
|              | Ports                                               | <a href="#">Ports</a>                          |
| Reference    | List of IEEE, IETF, and other proprietary entities. | <a href="#">Standards and protocol support</a> |

## 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 guide uses the term "preprovisioning" in the context of preparing or preconfiguring entities such as chassis slots, line cards (for example, Switch Fabric and Control Plane Module (SF/CPM) and Integrated Media Modules (IMMs)), and 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-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE and its variants, are platforms with a fixed port configuration, and no expansion slots. 7210 SAS software inherits the concept of CPM, IOM, and MDA from the SR OS to represent the hardware logically. These logical cards are fixed and are not removable. The software creates two (2) logical cards to represent the CPM and IOM; the cards are preprovisioned on bootup. The IOM card is modeled with a single MDA that is a logical entity and represents the fixed ports on the system. The MDA is auto-provisioned on bootup and does not need to be provisioned. Ports and interfaces can also be preprovisioned.

The 7210 SAS-R6 is a chassis-based platforms that has 6 IMM slots that can accept media cards used for service delivery and 2 CPM slots that provide control-plane redundancy. The chassis slots must be provisioned to accept a specific line card and set the relevant configurations before the equipment is actually installed. The preprovisioning ability allows you to plan your configurations as well as monitor and manage your router hardware inventory. Ports and interfaces can also be preprovisioned. When the functionality is needed, the cards can be inserted into the appropriate chassis slots when required.

The 7210 SAS-R12 is a chassis-based platforms that have 12 IMM slots that can accept media cards used for service delivery and 2 CPM slots that provide control-plane redundancy. The chassis slots must be provisioned to accept a specific line card and set the relevant configurations before the equipment is actually installed. The preprovisioning ability allows you to plan your configurations as well as monitor and manage your router hardware inventory. Ports and interfaces can also be preprovisioned. When the functionality is needed, the cards can be inserted into the appropriate chassis slots when required.

#### 2.1.1 Chassis slots and cards

The 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE are platforms which have a set of fixed ports. Software preprovisions the cards on bootup. No expansion slots are supported on these platforms.

The **show card** command lists the cards auto-provisioned on 7210 SAS-T, 7210 SAS-Mxp, and 7210 SAS-Sx/S 1/10GE chassis.

## Example

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

```
A:7210SAST>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:7210SAST>show#
```

## Example

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

```
*A:sim_dutc>show# card state

=====
Card State
=====
Slot/  Provisioned Type           Admin Operational  Num   Num Comments
Id     Equipped Type (if different) State State      Ports MDA
-----
1      iom-sas                    up    up           2
1/1    m22-sfp+2-tx+4-sfpp        up    up          24
A      sfm-sas                    up    up           Active
=====
*A:sim_dutc>show#
```

## Example

The following **show card** sample output lists the cards auto-provisioned on 7210 SAS-Sx/S 1/10GE 48-port 1GE variant chassis.

```
*A:7210SAS>show# card state

=====
Card State
=====
Slot/  Provisioned Type           Admin Operational  Num   Num Comments
Id     Equipped Type (if different) State State      Ports MDA
-----
1      iom-sas                    up    up           2
1/1    s48-t4-sfpp                up    up          52
A      sfm-sas                    up    up           Active
=====
*A:7210SAS>show#
```

```
*A:VoyagerDCpemV2# show card state

=====
Card State
=====
Slot/  Provisioned Type           Admin Operational  Num   Num Comments
Id     Equipped Type (if different) State State      Ports MDA
```

|     |                |    |    |        |
|-----|----------------|----|----|--------|
| 1   | iom-sas        | up | up | 1      |
| 1/1 | s64-sfpp+4-cfp | up | up | 68     |
| A   | sfm-sas        | up | up | Active |

\*A: VoyagerDCpemV2#

The 7210 SAS-R6 is a chassis based platform with 6 IMM slots and 2 CPM slots. On a chassis based platform the slots must be provisioned. To preprovision a chassis slot, the line card type must be specified. System administrators or network operators can enter card type information for each slot, allowing a range of card types in particular slots. From the range of card types, a card and accompanying MDAs (if any) are specified. When a card is installed in a slot and enabled, the system verifies that the installed card type matches the allowed card type. If the parameters do not match, the card remains offline. A preprovisioned slot can remain empty without conflicting with populated slots. 7210 SAS-R6 supports only CPM and IMM slots. It does not support any physical removable MDAs. Software uses logical MDAs internally to represent the ports on the IMM slots and the MDA type is auto-provisioned by software when the IMM slots are provisioned. Check the latest release notes for a list of supported card types (that is, CPM and IMM slots). See the *7210 SAS-R6 Chassis Installation Guide* for more information about installation of cards.

The 7210 SAS-R12 is a chassis based platform with 12 IMM slots and 2 CPM slots. On a chassis based platform the slots must be provisioned. To preprovision a chassis slot, the line card type must be specified. System administrators or network operators can enter card type information for each slot, allowing a range of card types in particular slots. From the range of card types, a card and accompanying MDAs (if any) are specified. When a card is installed in a slot and enabled, the system verifies that the installed card type matches the allowed card type. If the parameters do not match, the card remains offline. A preprovisioned slot can remain empty without conflicting with populated slots. 7210 SAS-R12 supports only CPM and IMM slots. It does not support any physical removable MDAs. Software uses logical MDAs internally to represent the ports on the IMM slots and the MDA type is auto-provisioned by software when the IMM slots are provisioned. Please check the latest release notes for a list of supported card types (that is, CPM and IMM slots). See *7210 SAS-R12 Chassis Installation Guide* for more information about installation of cards.



**Note:**

On the 7210 SAS-R6 and 7210 SAS-R12, the user must preconfigure the type of IMM slots that will be populated so that appropriate resources can be allocated on system bootup. See the **config>system>chassis>allow-imm-family** command in the 7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide for more information.

Example

The following **show** sample output lists the cards provisioned and equipped in the 7210 SAS-R6 and 7210 SAS-R12 chassis.

\*A:sasr\_dutb>show# card

| Card Summary |                                                  |             |                   |          |
|--------------|--------------------------------------------------|-------------|-------------------|----------|
| Slot         | Provisioned Type<br>Equipped Type (if different) | Admin State | Operational State | Comments |
| 1            | imm-sas-10sfp+1xfp                               | up          | up                |          |
| 2            | imm-sas-10sfp+1xfp<br>(not equipped)             | up          | provisioned       |          |
| 3            | imm-sas-10sfp                                    | up          | up                |          |
| 4            | (not provisioned)<br>imm-sas-2xfp                | up          | unprovisioned     |          |
| 5            | imm-sas-2xfp                                     | up          | up                |          |

```
6      imm-sas-2xfp      up      up
A      cpm-sf-sas-R6      up      up/active
B      cpm-sf-sas-R6      up      up/standby
=====
*A:sasr_dutb>show#

A:A6144909484>show# card

=====
Card Summary
=====
Slot   Provisioned Type      Admin Operational   Comments
      Equipped Type (if different)  State      State
-----
8      (not provisioned)      up      unprovisioned
      imm-sas-b-4sfp+
A      cpm-sf-sas-R12      up      up/active
B      cpm-sf-sas-R12      up      up/standby
```

2.2 MDAs

The 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE platforms, as described in the previous section, do not support any physical removable MDAs. Software uses the concept of MDA internally (as a logical entity) to represent the ports and the MDA type is either auto-provisioned on bootup or auto-provisioned automatically based on the configured IMM type.

2.3 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 desired levels.

The following are potential uses of the DDM data:

- **optics degradation monitoring**

With the information returned by the DDM-capable optics module, degradation in optical performance can be monitored and trigger events based on custom or the factory-programmed warning and alarm thresholds.

- **link/router fault isolation**

With the information returned by the DDM-capable optics module, any optical problem affecting a port can be quickly identified or eliminated as the potential problem source.

The following table describes supported real-time DDM features.

*Table 5: Real-time DDM information*

| Parameter                              | User units                                     | SFP/XFP units | SFP           | XFP       |
|----------------------------------------|------------------------------------------------|---------------|---------------|-----------|
| Temperature                            | Celsius                                        | C             | Supported     | Supported |
| Supply Voltage                         | Volts                                          | $\mu$ V       | Supported     | Supported |
| TX Bias Current                        | mA                                             | $\mu$ A       | Supported     | Supported |
| TX Output Power                        | dBm (converted from mW)                        | mW            | Supported     | Supported |
| RX Received Optical Power <sup>4</sup> | dBm (converted from dBm) (Avg Rx Power or OMA) | mW            | Supported     | Supported |
| AUX1                                   | parameter dependent (embedded in transceiver)  | -             | Not supported | Supported |
| AUX2                                   | parameter dependent (embedded in transceiver)  | -             | Not supported | Supported |

The following table describes supported factory-programmed DDM alarms and warnings.



Table 6: DDM alarms and warnings

| Parameter                                                                          | SFP/XFP units                                          | SFP | XFP | Required? |
|------------------------------------------------------------------------------------|--------------------------------------------------------|-----|-----|-----------|
| Temperature<br>- High Alarm<br>- Low Alarm<br>- High Warning<br>- Low Warning      | C                                                      | Yes | Yes | Yes       |
| Supply Voltage<br>- High Alarm<br>- Low Alarm<br>- High Warning<br>- Low Warning   | $\mu$ V                                                | Yes | Yes | Yes       |
| TX Bias Current<br>- High Alarm<br>- Low Alarm<br>- High Warning<br>- Low Warning  | $\mu$ A                                                | Yes | Yes | Yes       |
| TX Output Power<br>- High Alarm<br>- Low Alarm<br>- High Warning<br>- Low Warning  | mW                                                     | Yes | Yes | Yes       |
| RX Optical Power<br>- High Alarm<br>- Low Alarm<br>- High Warning<br>- Low Warning | mW                                                     | Yes | Yes | Yes       |
| AUX1<br>- High Alarm<br>- Low Alarm<br>- High Warning<br>- Low Warning             | parameter<br>dependent<br>(embedded in<br>transceiver) | No  | Yes | Yes       |
| AUX2                                                                               | parameter<br>dependent                                 | No  | Yes | Yes       |

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

### 2.3.1 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.

### 2.3.2 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.

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

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

```
A:Dut-A# show port 2/1/6 detail
```

```
.....
```

```
=====
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
=====
```

|                            | Value  | High Alarm | High Warn | Low Warn | Low Alarm |
|----------------------------|--------|------------|-----------|----------|-----------|
| Temperature (C)            | +39.3  | +96.0      | +94.0     | -7.0     | -8.0      |
| Supply Voltage (V)         | 3.27   | 3.51       | 3.49      | 3.12     | 3.10      |
| Tx Bias Current (mA)       | 18.8   | 77.0       | 70.0      | 5.5      | 4.5       |
| Tx Output Power (dBm)      | 1.33   | 5.50       | 5.00      | 0.00     | -0.50     |
| Rx Optical Power (avg dBm) | -40.00 | -8.50      | -9.00     | -33.98!  | -35.23!   |

```
=====
```

## 2.4 Ports

This section describes 7210 SAS ports.

### 2.4.1 Port types

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

Table 7: Supported Ethernet ports

| 7210 SAS platform    | Fixed copper ports (10/100/1000 Base-T) | Ethernet SFP ports | 10 Gigabit XFP/SFP+ ports | 100 Gigabit QSFP28 ports |
|----------------------|-----------------------------------------|--------------------|---------------------------|--------------------------|
| 7210 SAS-T           | ✓                                       | ✓                  | ✓ <sup>9</sup>            |                          |
| 7210 SAS-R6          | ✓ <sup>10</sup>                         | ✓                  | ✓ <sup>11</sup>           | ✓                        |
| 7210 SAS-R12         | ✓ <sup>10</sup>                         | ✓                  | ✓ <sup>11</sup>           | ✓                        |
| 7210 SAS-Mxp         | ✓                                       | ✓                  | ✓ <sup>12</sup>           |                          |
| 7210 SAS-Sx/S 1/10GE | ✓                                       | ✓                  | ✓ <sup>12</sup>           |                          |
| 7210 SAS-Sx 10/100GE | ✓ <sup>12</sup>                         | ✓ <sup>12</sup>    | ✓ <sup>12</sup>           | ✓                        |

The following support guidelines apply to the supported Ethernet port types described in the preceding table:

- 10/100/1000 Base-T copper SFPs can be used in any of the SFP ports.
- Copper SFPs with speeds of 10 Mb/s and full-duplex are supported on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-T. Copper SFPs with speeds of 10 Mb/s and half-duplex mode are supported only on the 7210 SAS-T.
- Fixed copper ports on the 7210 SAS-Sx/S 1/10GE 24-port and 48-port copper variants, including PoE variants, support speeds of 10 Mb/s and 100 Mb/s with full-duplex mode. They do not support half-duplex mode.
- Combination ports on the 7210 SAS-Mxp and 7210 SAS-Sx 1/10GE support speeds of 10 Mb/s with full-duplex mode when the copper port is used.

<sup>9</sup> XFP

<sup>10</sup> IMMv2 with copper ports

<sup>11</sup> IMMv2 (SFP+)

<sup>12</sup> SFP+

- Fixed copper ports on the 16 x 10/100/1000 Base-T (RJ.5) IMMv2 card on the 7210 SAS-R6 and 7210 SAS-R12 support speeds of 10 Mb/s with full-duplex mode. They do not support speeds of 10 Mb/s with half-duplex mode.
- Fixed copper ports on the 7210 SAS-T support speeds of 10 Mb/s with full-duplex and half duplex modes.
- On the 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE, the user can select the fiber interface slot or the copper interfaces slot of the combination port using the following command.

```
configure port ethernet connection-type
```

By default, the combination port **connection-type** is set to **auto**. The **auto** option allows the software to automatically detect the connection type based on the link availability of the media inserted into the port and set the operational value to either "copper" or "fiber".

- The 7210 SAS-Sx 1/10GE (48-port fiber) supports the use of copper SFP in the SFP slot for combo ports.



**Note:** Nokia recommends that the user should not plug in the connector for the copper connection while using the SFP port (the opposite also applies). That is, at any point in time, only a single connector must be used.

- The SFP+ ports on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE allow the use of 1 GE fiber-optic SFPs or copper SFPs in SFP+ interface slots. Before using the 1 GE SFP, you must configure a speed of 1000 Mb/s on the SFP+ ports using the following command.

```
configure port ethernet speed
```

Only a speed of 1 Gb/s is supported for copper SFPs; that is, speeds of 10 Mb/s and 100 Mb/s are not supported.

- The SFP+ ports on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE allow the use of 1 GE fiber-optic SFPs or copper SFPs in SFP+ interface slots. Before using the 1 GE SFP, you must configure a speed of 1000 Mb/s on the SFP+ ports using the **config port ethernet speed** command. Only a speed of 1 Gb/s is supported for copper SFPs; that is, 10 Mb/s and 100 Mb/s speeds are not supported.
- The ports on the 7210 SAS-Sx 10/100GE 64SFP+ 4QSFP28 front panel are named 1/1/1 to 1/1/64 for the 64 SFP+ ports and 1/1/c1, 1/1/c2, 1/1/c3, and 1/1/c4 for the 100GE 4QSFP28 ports.

### 2.4.1.1 Port modes

In 7210 SAS devices, port must be configured as either access, access uplink or network. The following paragraphs describe 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. After a port has been configured for access mode, one or more services can be configured on the port depending on the encapsulation value. Access ports can be configured on all the 7210 SAS platforms.

- **access-uplink ports**

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

- **network ports**

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. This is default for nodes operating in network mode.

- **hybrid ports**

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

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

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

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

The following table describes the port modes that are supported on each 7210 SAS platform.

*Table 8: 7210 SAS platforms supporting port modes*

| Port mode platforms | Access | Network           | Hybrid            | Access-uplink     | Connector |
|---------------------|--------|-------------------|-------------------|-------------------|-----------|
| 7210 SAS-T          | Yes    | Yes <sup>13</sup> | Yes <sup>14</sup> | Yes <sup>15</sup> | No        |

<sup>13</sup> Network ports can be configured only if the BOF is configured to operate the node in network mode (also known as, MPLS mode).

<sup>14</sup> Hybrid ports are supported only when the node is operating in network mode.

| Port mode platforms                      | Access | Network | Hybrid | Access-uplink | Connector         |
|------------------------------------------|--------|---------|--------|---------------|-------------------|
| 7210 SAS-R6 IMM-b (IMMv2)                | Yes    | Yes     | Yes    | No            | No                |
| 7210 SAS-R6 IMM-c 100GE (IMM-c 1QSFP28)  | Yes    | Yes     | No     | No            | No                |
| 7210 SAS-R12 IMM-b                       | Yes    | Yes     | Yes    | No            | No                |
| 7210 SAS-R12 IMM-c 100GE (IMM-c 1QSFP28) | Yes    | Yes     | No     | No            | No                |
| 7210 SAS-Mxp                             | Yes    | Yes     | Yes    | No            | No                |
| 7210 SAS-Sx/S 1/10GE                     | Yes    | Yes     | Yes    | No            | No                |
| 7210 SAS-Sx 10/100GE                     | Yes    | Yes     | Yes    | No            | Yes <sup>16</sup> |

- **connector**

This is a QSFP28 connector that can accept transceiver modules, including breakout connectors. The connectors themselves cannot be used as ports in other commands; however, breakout ports can be used as any Ethernet port.



**Note:** QSFP28 connectors are supported on the 7210 SAS-Sx 10/100GE. Only a single 100G breakout port can be configured on this platform.

### 2.4.1.2 Port dot1q VLAN Etype

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 pre-standard (other than 0x8100) dot1q VLAN etype.

### 2.4.1.3 Configuration guidelines for dot1q-etype

The following are the configuration guidelines for dot1q-etype configured for dot1q encap port:

- Dot1q-etype configuration is supported for all ports - Access, Hybrid and Network ports.
- Dot1q-preserve SAPs cannot be configured on dot1q encap ports configured to use ethertype other than 0x8100.

<sup>15</sup> Access-uplink ports can be configured only if the BOF is configured to operate the node in access-uplink mode (also known as, L2 mode).

<sup>16</sup> Connectors are only supported on the 7210 SAS-Sx 10/100GE QSFP28 variant.

- Priority tagged packet received with etype 0x8100 on a dot1q port configured with etype 0x9100 are classified as priority tagged packet and mapped to a dot1q :0 SAP (if configured) and the priority tag is removed.
- Priority tagged packets received with etype 0x6666 (any value other than 0x8100) on a dot1q port configured with etype 0x9100 is classified as null-tagged packet and mapped to a dot1q :0 SAP (if configured) and the priority tag is retained and forwarded.
- The dot1q-etype is modified only for the dot1q encap port (access/hybrid port). The dot1q-etype cannot be modified on Network ports.
- During the non-default dot1q-rvpls and qinq-rvpls, the extra tagged packets is dropped even for an 0x8100 packets on an RVPLS SAP, this is applicable only for network mode (and not access-uplink mode).

## 2.4.2 Support for Power over Ethernet



**Note:**

Power over Ethernet (PoE) is supported only on the 7210 SAS-Mxp ETR, 7210 SAS-Sx/S 1/10GE operating in standalone mode, and 7210 SAS-T ETR.

The 7210 SAS-Mxp ETR, 7210 SAS-Sx/S 1/10GE PoE variants, and 7210 SAS-T ETR support PoE in accordance with the 802.3af and 802.3at 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 7210 SAS-Sx 1/10GE supports two PoE variants:

- 24Tp 4SFP+ PoE
- 48Tp 4SFP+ PoE

In addition to the PoE variants, the following 7210 SAS-Sx 1/10GE fiber variants support two PoE/PoE+ ports:

- 22F 2C 4SFP+
- 46F 2C 4SFP+

The 7210 SAS-S 1/10GE supports two PoE variants:

- 24Tp 4SFP+ AC PoE
- 48Tp 4SFP+ AC PoE

The following PoE functionalities are available:

- The 7210 SAS supports both 802.3af (PoE) and 802.3at (PoE+) on all ports. The ports can be used to connect either PoE or PoE+ 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 supports classification of both Type 1 and Type 2 PoE devices (PDs) using the physical layer classification mechanism (using the 1-event physical layer classification mechanism for Type 1 PD and 2-event physical layer classification mechanism for Type 2 PD).
- The 7210 SAS supports the class-based power allocation method, which allocates power based on the identified class using a physical layer classification mechanism. The 802.3af and 802.3at standards define the power that can be allocated or requested by a particular class. The standards define four classes: Class 1, Class 2, Class 3, and Class 4. 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.

- 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 notify 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.

### 2.4.2.1 PoE configuration notes

The following configuration notes apply for PoE:

- On the 7210 SAS-T ETR, up to four fixed copper ports are available to connect PoE/PoE+ devices. The 7210 SAS-T ETR can supply a maximum of 60 W.
- On the 7210 SAS-Mxp ETR, up to 2 ports are available to connect PoE/PoE+ devices. The 7210 SAS-Mxp ETR can supply a maximum of 60 W.
- On the 7210 SAS-T ETR and 7210 SAS-Mxp ETR, the maximum available power must be shared among all PoE/PoE+ devices connected to the node. That is, the node can support a mix of PoE devices (using 15 W) and PoE+ devices (using 30 W) as long as the total power drawn is within the system limits.
- The 7210 SAS-Sx 1/10GE 24-port and 48-port fiber variants provide two PoE/PoE+ capable combo ports: 1/1/1 and 1/1/2. To use PoE/PoE+, these combo ports must be configured to use the copper interface and can draw maximum of 60 W. The ports can be used for either PoE or PoE+ devices, or a combination.
- On the 7210 SAS-Sx 1/10GE and 7210 SAS-S 1/10GE, the 24-port and 48-port copper PoE variants support PoE/PoE+ on all fixed copper ports. On both variants, the PoE ports can draw maximum of 720 W. On the 24-port PoE variant, each port can draw up to 15 W for PoE or up to 25 W for PoE+. On the 48-port PoE variant, each port can draw up to 15 W for PoE or up to 25 W for PoE+, or a combination of



PoE and PoE+ devices can be connected to the ports, as long as the total power drawn across all ports does not exceed 720 W.

## 2.5 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.

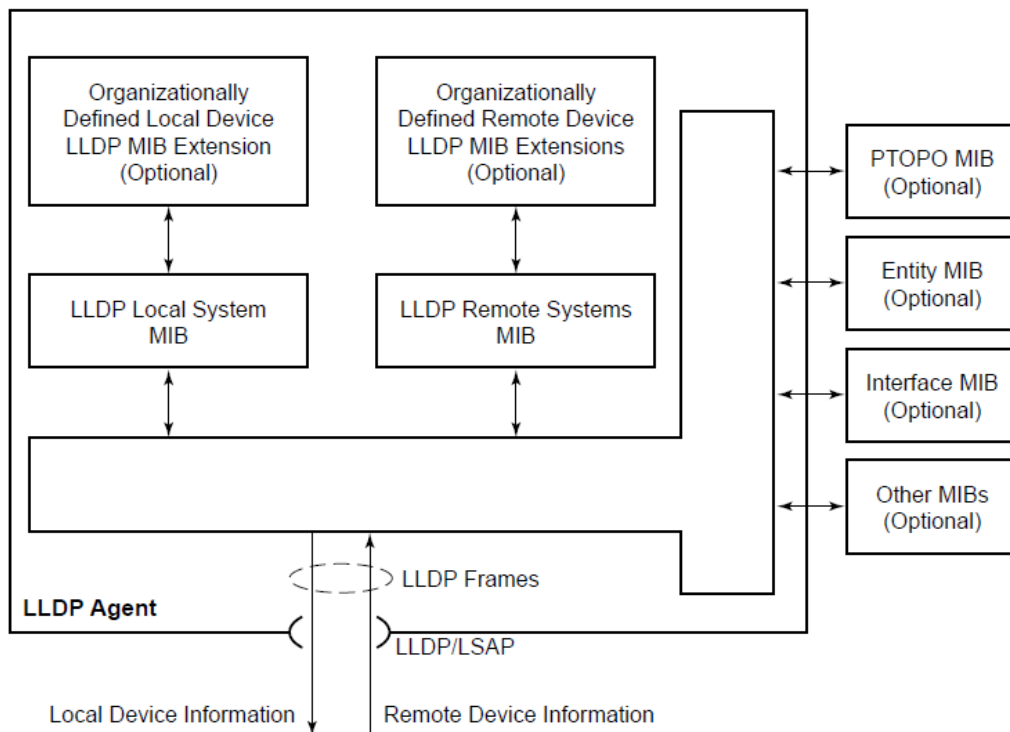
The LLDP helps the network operators to discover topology information. This information is used to detect and resolve network problems and inconsistencies in the configuration.

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 suitable for storing connection information about adjacent stations is established.
- Provides compatibility with a number of MIBs.

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

Figure 1: LLDP internal architecture for a network node



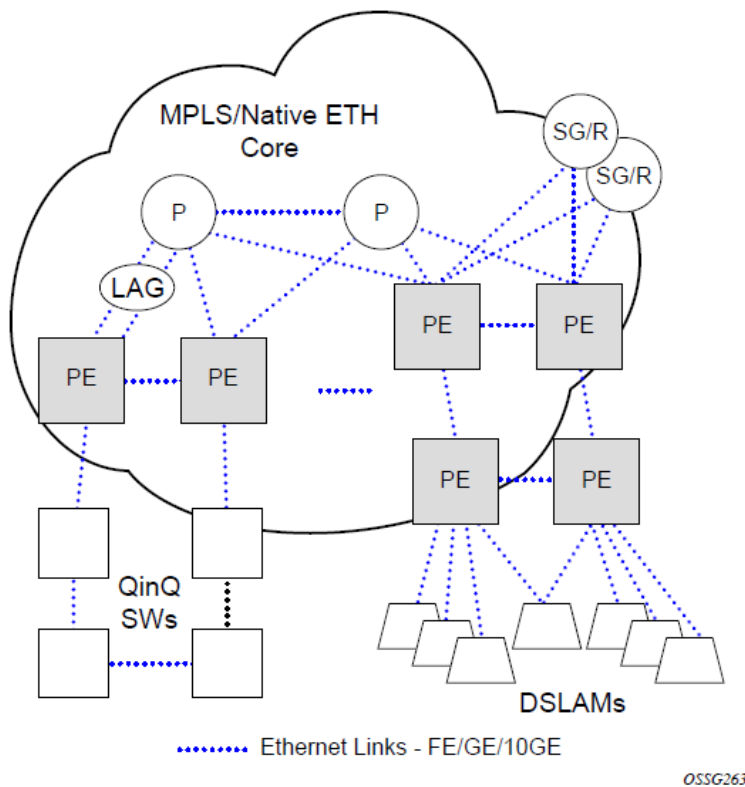
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To detect and address network problems and inconsistencies in the configuration, the network operators can discover the topology information using LLDP. The Standard-based tools address the complex network scenarios where multiple devices from different 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 2: Generic customer use case for LLDP



## 2.5.1 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.

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

The implementation defaults to setting the port-id field in the LLDP OAMPDU to tx-local. This encodes the port-id field as ifIndex (sub-type 7) of the associated port. This is required to support some releases of SAM. SAM may use the ifIndex value to correctly 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 sub-type using the port-id-sub-type option. Three options are supported for the port-id-sub-type:

- **tx-if-alias**

Transmit the ifAlias String (sub-type 1) that describes the port as stored in the IFMIB, either user configured description or the default entry (ie 10/100/Gig Ethernet SFP)

- **tx-if-name**

Transmits the ifName string (sub-type 5) that describes the port as stored in the IFMIB, ifName info

- **tx-local**

The interface ifIndex value (sub-type 7)

IPv6 (address sub-type 2) and IPv4 (address sub-type 1) LLDP System Management addresses are supported.

## 2.5.2 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 SAS devices support tunneling of LLDP frames that use the nearest bridge destination MAC address.

If enabled using the command **tunnel-nearest-bridge-dest-mac**, all frames received with the matching LLDP destination MAC address are forwarded transparently to the remote end of the Epipe service. To forward these frames transparently, the port on which tunneling is enabled must be configured with NULL

SAP and the NULL SAP must be configured in an Epipe service. Tunneling is not supported for any other port encapsulation or other services.

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

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

Table 9: Behavior for LLDP with different values

| Nearest-bridge-mac admin status | Tunneling enabled | Tunneling disabled |
|---------------------------------|-------------------|--------------------|
| Rx                              | Process/Peer      | Process/Peer       |
| Tx                              | Tunnel            | Drop               |
| Rx-Tx                           | Process/Peer      | Process/Peer       |
| Disabled                        | Process/Peer      | 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. Nokia recommends 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.

### 2.5.3 LLDP media endpoint discovery



**Note:**

This feature is only supported on the 7210 SAS-Sx/S 1/10GE operating in the standalone or standalone-VC mode.

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 attached to an Ethernet LAN/WAN to advertise functionalities provided by that node 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

### 2.5.3.1 LLDP-MED reference model

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

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

Endpoint devices are composed of three sub-types, 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).

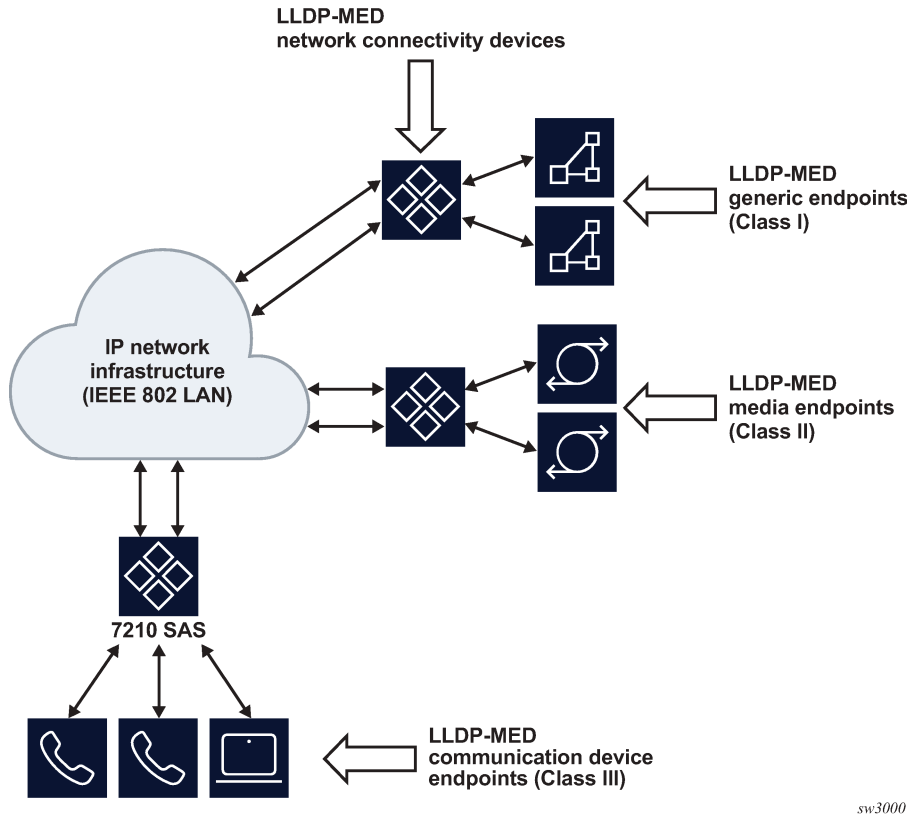
The following figure shows the LLDP-MED reference model.



**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 3: LLDP-MED reference model



### 2.5.3.2 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-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information about configuring network policy parameters using commands in the **config>system>lldp>lldp-med** context.

### 2.5.3.3 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, the 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.

### 2.5.3.4 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.

## 2.6 Port loopback for Ethernet ports

7210 SAS devices support 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.

### 2.6.1 Port loopback without 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 processes the packets as per the service configuration for the SAP.

This is recommended for use with only VLL 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.

### 2.6.2 Port loopback with MAC swap



**Note:**

Port loopback with MAC swap is not supported on 100GE IMM-c cards for the 7210 SAS-R6 and 7210 SAS-R12.



The 7210 SAS provides port loop back 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 VLL 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.

## 2.7 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 when 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 network and access ports.



**Note:**

For details on LAG scale per platform, contact your Nokia technical support representative.

### 2.7.1 LAG features

This section describes hardware and software LAG capabilities.

#### 2.7.1.1 Hardware capabilities

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

#### 2.7.1.2 Software capabilities

The Nokia solution conforms to the IEEE LAG implementation, including dynamic costing and LAG port threshold features. The dynamic cost and LAG port threshold features can be enabled even if the second node is not a Nokia router.

##### 2.7.1.2.1 Dynamic cost

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

If dynamic cost is enabled and the number of active links is greater than the port threshold value (0-7 or 0-15), depending on chassis-mode and IOM type), then the path cost is dynamically calculated whenever there is a change in the number of active links regardless of the specified port threshold action. If the port-threshold is met and the action is set to dynamic cost, then the path cost is dynamically recalculated regardless of the global dynamic cost configuration.

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

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

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

### 2.7.1.2.2 LAG port threshold

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

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

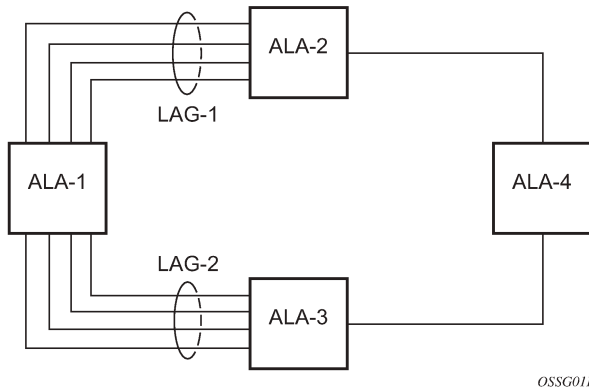
## 2.7.2 Configuring LAGs

The following are guidelines for configuring LAGs:

- Ports can be added or removed from the LAG while the LAG and its ports (other than the port being removed) remain operational. When ports to or from the LAG are added or removed, the hashing algorithm is adjusted for the new port count.
- The **show** commands display physical port statistics on a port-by-port basis or the entire LAG can be displayed.
- LAG is supported on Ethernet ports.
- Ports of a particular LAG can be of different types but they must be the same speed and duplex. To guarantee the same port speed is used for all ports in a LAG, auto-negotiation must be disabled or in 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 4: LAG configuration



### 2.7.3 LAG on access

Link Aggregation Groups (LAG) is supported on access ports and access-uplink ports. This is treated the same as LAG on network ports which provides a standard method to aggregate Ethernet links. The difference lies in how QoS is handled.

### 2.7.4 LAG and QoS policies on 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE

In the 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE 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 100 Mbps, 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 100 Mbps.

In the 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE 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 100 Mbps, 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 200 Mbps 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.

### 2.7.5 LAG and QoS policies on 7210 SAS-Mxp

In 7210 SAS-Mxp, a SAP ingress QoS policy or network port ingress QoS policy or network IP interface ingress QoS policy is applied to the aggregate traffic that enters the traffic through all the ports of the system. For example, if an ingress policy is configured with a policer of PIR 100 Mbps, for a SAP configured on a LAG with two ports, then the policer limits the traffic entering the system through the two ports to a maximum of 100 Mbps.

In 7210 SAS-Mxp, SAP egress QoS policy shaper parameters are applied to all the ports that are members of the LAG (all ports get the full SLA). For example, if an SAP egress policy is configured with a shaper of PIR 100 Mbps, each port would get a PIR of 100 Mbps. 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.

In 7210 SAS-Mxp, network port egress QoS policy shaper parameters are applied to all the ports that are members of the LAG (all ports get the full SLA). For example, if an network port egress policy is configured with a shaper of PIR 100 Mbps, each port would get a PIR of 100 Mbps. 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.

In 7210 SAS-Mxp, when operating in port-based queuing mode, the access egress QoS policy is applied to access ports and the policy parameters are applied to all the ports that are members of the LAG (all access ports get the full SLA). For example, if an access egress policy is configured with a shaper of PIR 100 Mbps, each port gets a PIR of 100 Mbps. 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. Access egress policy override parameters configured for the primary port of the LAG are applied to all the member ports of the LAG.

## 2.7.6 LAG and QoS policies on 7210 SAS-R6 and 7210 SAS-R12

In 7210 SAS-R6 and 7210 SAS-R12, a SAP ingress QoS policy or network port ingress QoS policy or network IP interface ingress QoS policy is applied to the aggregate traffic that enters through all the ports on a IMM. If the LAG has member ports on different IMM, then the policy is created for each IMM and is applied to the aggregate traffic that enters through all the ports on a specific IMM. For example, if an ingress policy is configured with a policer of PIR 100 Mbps, for a SAP configured on a LAG with two ports, then the policer limits the traffic entering through the two ports of the IMM to a maximum of 100 Mbps. If the LAG has two ports on 2 different IMM, then policy is applied each IMM individually, and the policer on each IMM allows a maximum of 100 Mbps for a total of 200 Mbps.

In 7210 SAS-R6 and 7210 SAS-R12, SAP egress QoS policy shaper parameters are applied to all the ports that are members of the LAG (all ports get the full SLA), irrespective of whether they are located on a single IMM or two different IMM. For example, if an SAP egress policy is configured with a shaper of PIR 100 Mbps, each port would get a PIR of 100 Mbps. 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.

In 7210 SAS-R6 and 7210 SAS-R12, network port egress QoS policy shaper parameters are applied to all the ports that are members of the LAG (all ports get the full SLA), irrespective of whether they are located on a single IMM or two different IMM. For example, if an network port egress policy is configured with a shaper of PIR 100 Mbps, each port would get a PIR of 100 Mbps. 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.

In 7210 SAS-R6 and 7210 SAS-R12, when operating in port-based queuing mode, the access egress QoS policy is applied to access ports and the policy parameters are applied to all the ports that are members of the LAG (all access ports get the full SLA). For example, if an access egress policy is configured with a shaper of PIR 100 Mbps, each port gets a PIR of 100 Mbps. 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. Access egress policy override parameters configured for the primary port of the LAG are applied to all the member ports of the LAG.

## 2.7.7 Port link damping

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

The 7210 SAS OS port link damping feature guards against excessive port transitions. Any initial port transition is immediately advertised to upper layer protocols, but any subsequent port transitions are not advertised to upper layer protocols until a configured timer has expired.

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

## 2.7.8 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.

Under normal operation, all non-failing links in a specific LAG will become active and traffic is load balanced across all active links. In some circumstances, however, this is not wanted. Instead, it may be wanted that only some of the links are active and the other links be kept in stand-by condition.

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

### 2.7.8.1 Active/standby LAG operation without LACP

Active/standby LAG is used to provide redundancy while keeping consistency of QOS enforcement. Some devices do not support LACP and therefore an alternative solution is required.

The active/standby decision for LAG member links is local decision driven by preconfigured selection-criteria. This decision was communicated to remote system using LACP signaling.

As an alternative, the operator can disable the signal transmitted by using the **power-off** option for **standby-signaling** in the CLI command at the LAG level at the port member level. The transmit laser is switched off for all LAG members in standby mode. On switch over (active-links failed), the laser is switched on and all LAG members become active.



**Note:**

This mode of operation cannot detect physical failures on the standby link, which means that the network operator cannot be certain that the standby links are capable to take over in case of active-links failure. This is an inherent limitation of this operational mode.

When LACP goes down on a standby link, a warning message announcing that LACP has expired on the corresponding member port is printed in log 99 at the other end.

The operation where standby ports are powered down is mutually exclusive with LACP and, therefore, is modeled as a separate mode of LACP operation of **power-off**. For this mode, the **best-port** selection criteria can be used. This criteria ensures that a subgroup with the **best-port** (the highest priority port) is always chosen to be used as the active subgroup.

It is not possible to have an active LACP in the **power-off** mode before the correct selection criteria is selected.

### 2.7.8.2 LAG subgroups

LACP is used to make a selection of active links predictable and compatible with any vendor equipment. See *IEEE STD 802.3-2002, Section 3, Clause 43.6.1*, which describes how LACP allows standby and active signaling.

The 7210 SAS-T, 7210 SAS-R6, 7210 SAS-R6, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE (operating in standalone and standalone-VC mode), and 7210 SAS-Sx 10/100GE (operating in standalone mode) implementation of LACP supports the following:

- A specific LAG member can be assigned to subgroups. The selection algorithm then assures that only members of a single subgroup are selected as active links.
- The selection algorithm is effective only if LACP is enabled on a specific LAG. At the same time, it is assumed that the connected system also has LACP enabled (active or passive mode).
- The algorithm selects active links based on following criteria:
  - Depending on the selection-criteria settings either the subgroup with the highest number of eligible links or the subgroup with the highest aggregate weight of all eligible members is selected first.
  - If multiple groups satisfy the selection criteria, the currently active subgroup remains active. Initially, the subgroup containing the highest priority eligible link is selected.
  - Only links pertaining to a single subgroup are active at any time.
  - An eligible member refers to a LAG member link that can potentially become active; that is, it is operationally up. If the slave-to-partner flag is set, the remote system does not disable its use (by signaling the "Standby" bit using LACP).
- The selection algorithm works in a reverting mode. Each time the configuration or status of any link in a LAG changes, the selection algorithm is rerun. In case of a tie between two groups (one of them being currently active), the active group remains active (no reverting).

### 2.7.9 LAG and ECMP hashing



**Note:**

See the *7210 SAS-Mxp, R6, R12, S, Sx, T 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 methods is applied; equal cost multi-path (ECMP) or LAG. A 7210 SAS can deploy both at the same time, meaning, using ECMP of two or more LAGs 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.

An option is provided per LAG to select the hashing function to be used for load-balancing flows on the member ports of the LAG. Users can use one of the available options based on the flows they have in their network and select an option that helps improve the load-balancing of flows in their network. The packets fields selected by the hashing function is different for some flows with the two hashing functions and is provided in the following tables.

### 2.7.9.1 LAG hashing for the 7210 SAS-T (network mode)

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-T in network mode.



**Note:**

The following notes apply to [Table 10: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-T configured in the network operating mode](#).

- In the case of LSR, incoming labels are used for hashing.
- The term "learned" corresponds to destination MAC.
- The term "source and destination MAC" refers to customer source and destination MACs unless otherwise specified.

*Table 10: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-T configured in the network operating mode*

| Traffic type            | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |      |
|-------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|------|
|                         | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          | VLAN |
|                         |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |      |
| VPLS service            |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| SAP to SAP              |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IP traffic (learned)    | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |      |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| IP traffic (unlearned)  | ✓               |        |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| PBB traffic (learned)   | ✓               |        | ✓                  | ✓   |     |     |           |                 |      |                  |                        |    |          | ✓    |
|                         |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |      |
| PBB traffic (unlearned) | ✓               |        | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |      |
|                         |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |      |

| Traffic type               | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |
|----------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|
|                            | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          |
|                            |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |
| MPLS traffic (learned)     | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>17</sup>        |    | ✓        |
|                            |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
| MPLS traffic (unlearned)   | ✓               |        |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
|                            |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
| Non-IP traffic (learned)   | ✓               |        |                    |     |     |     | ✓         |                 |      |                  | ✓                      |    | ✓        |
|                            |                 | ✓      |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
| Non-IP traffic (unlearned) | ✓               |        |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
|                            |                 | ✓      |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
| <b>VPLS service</b>        |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| <b>SAP to SDP</b>          |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| IP traffic (learned)       | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |
|                            |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |
| IP traffic (unlearned)     | ✓               |        |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |
|                            |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |
| PBB traffic (learned)      | ✓               |        | ✓                  | ✓   |     |     |           |                 |      |                  |                        |    | ✓        |
|                            |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |
| PBB traffic (unlearned)    | ✓               |        | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |
|                            |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |

<sup>17</sup> The outer MAC of the Ethernet packet that encapsulates an MPLS packet

<sup>18</sup> Two MPLS labels deep



| Traffic type               | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |
|----------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|
|                            | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          |
|                            |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |
| MPLS traffic (learned)     | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓                      |    | ✓        |
|                            |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
| MPLS traffic (unlearned)   | ✓               |        |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
|                            |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
| Non-IP traffic (learned)   | ✓               |        |                    |     |     |     | ✓         |                 |      |                  | ✓                      |    | ✓        |
|                            |                 | ✓      |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
| Non-IP traffic (unlearned) | ✓               |        |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
|                            |                 | ✓      |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
| <b>VPLS service</b>        |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| <b>SDP to SAP</b>          |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| IP traffic (learned)       | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>19</sup>        |    | ✓        |
|                            |                 | —      |                    |     |     |     |           |                 |      |                  |                        |    |          |
| PBB traffic (learned)      | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>19</sup>        |    |          |
|                            |                 | —      |                    |     |     |     |           |                 |      |                  |                        |    |          |
| Non-IP traffic (learned)   | ✓               |        |                    |     |     |     | ✓         |                 |      |                  | ✓ <sup>19</sup>        |    |          |
|                            |                 | —      |                    |     |     |     |           |                 |      |                  |                        |    |          |
| All traffic (learned)      | —               |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
|                            |                 | ✓      |                    |     |     |     | ✓         |                 |      |                  | ✓ <sup>19</sup>        |    |          |

<sup>19</sup> Outer MACs inside the payload just after the MPLS header

| Traffic type            | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |
|-------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|
|                         | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          |
|                         |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |
| All traffic (unlearned) | ✓               |        |                    |     |     |     |           | ✓               |      |                  | ✓ <sup>19</sup>        |    |          |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      |                  | ✓ <sup>19</sup>        |    |          |
| <b>VPLS service</b>     |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| <b>SDP to SDP</b>       |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| All traffic (learned)   | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>19</sup>        |    |          |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      |                  | ✓ <sup>19</sup>        |    |          |
| All traffic (unlearned) | ✓               |        |                    |     |     |     |           | ✓               |      |                  | ✓ <sup>19</sup>        |    |          |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      |                  | ✓ <sup>19</sup>        |    |          |
| <b>Epipe service</b>    |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| <b>SAP to SAP</b>       |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| IP traffic              | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |
| PBB traffic             | ✓               |        | ✓                  | ✓   |     |     |           |                 |      |                  |                        |    | ✓        |
|                         |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |
| MPLS traffic            | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>17</sup>        |    | ✓        |
|                         |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |
| Non-IP traffic          | ✓               |        |                    |     |     |     | ✓         |                 |      |                  | ✓                      |    | ✓        |
|                         |                 | ✓      |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    | ✓        |
| <b>Epipe service</b>    |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| <b>SAP to SDP</b>       |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |
| IP traffic              | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |

| Traffic type   | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |      |   |
|----------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|------|---|
|                | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          | VLAN |   |
|                |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |      |   |
|                |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        |    | ✓        | ✓    |   |
| PBB traffic    | ✓               |        | ✓                  | ✓   |     |     |           |                 |      |                  |                        |    |          |      | ✓ |
|                |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |    |          |      |   |
| MPLS traffic   | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓                      |    |          |      | ✓ |
|                |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓  |          |      |   |
| Non-IP traffic | ✓               |        |                    |     |     |     | ✓         |                 |      |                  | ✓                      |    |          |      | ✓ |
|                |                 | ✓      |                    |     |     |     | ✓         | ✓               |      |                  | ✓                      |    |          |      | ✓ |
| Epipe service  |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
| SDP to SAP     |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
| IP traffic     | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>19</sup>        |    | ✓        | ✓    |   |
|                |                 | —      |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
| PBB traffic    | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>19</sup>        |    |          |      |   |
|                |                 | —      |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
| Non-IP traffic | ✓               |        |                    |     |     |     | ✓         |                 |      |                  | ✓ <sup>19</sup>        |    |          |      |   |
|                |                 | —      |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
| All traffic    | —               |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
|                |                 | ✓      |                    |     |     |     |           | ✓               |      |                  | ✓ <sup>19</sup>        |    |          |      |   |
| MPLS – LSR     |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |   |
| All traffic    | ✓               |        |                    |     |     |     |           |                 |      |                  | ✓ <sup>17</sup>        |    |          |      |   |

| Traffic type                                        | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |                 |          |
|-----------------------------------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|-----------------|----------|
|                                                     | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |                 |          |
|                                                     |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP              | L4 ports |
|                                                     |                 | ✓      |                    |     |     |     |           | ✓               |      | ✓ <sup>18</sup>  |                        | ✓ <sup>20</sup> |          |
| <b>PBB VPLS service</b>                             |                 |        |                    |     |     |     |           |                 |      |                  |                        |                 |          |
| <b>B-SAP to B-SAP (PBB BCB traffic)</b>             |                 |        |                    |     |     |     |           |                 |      |                  |                        |                 |          |
| IP traffic (learned)                                | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓               | ✓        |
|                                                     |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓               | ✓        |
| IP traffic (unlearned)                              | ✓               |        |                    |     |     |     |           | ✓               |      |                  |                        | ✓               | ✓        |
|                                                     |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓               | ✓        |
| L2 and non-IP traffic (learned)                     | ✓               |        | ✓                  | ✓   |     |     |           |                 |      |                  |                        |                 |          |
|                                                     |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |                 |          |
| L2 and non-IP traffic (unlearned)                   | ✓               |        | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |                 |          |
|                                                     |                 | ✓      | ✓                  | ✓   |     |     |           | ✓               | ✓    |                  |                        |                 |          |
| <b>PBB VPLS service</b>                             |                 |        |                    |     |     |     |           |                 |      |                  |                        |                 |          |
| <b>I-SAP to B-SAP (originating PBB BEB traffic)</b> |                 |        |                    |     |     |     |           |                 |      |                  |                        |                 |          |
| IP traffic (learned)                                | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓               | ✓        |
|                                                     |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓               | ✓        |
| IP traffic (unlearned)                              | ✓               |        |                    |     |     |     |           | ✓               |      |                  |                        | ✓               | ✓        |
|                                                     |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓               | ✓        |
| L2 and non-IP                                       | ✓               |        |                    |     | ✓   | ✓   | ✓         |                 |      |                  |                        |                 | ✓        |
|                                                     |                 | ✓      |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |                 | ✓        |

<sup>20</sup> Applies only when the IP header immediately follows the MPLS header without having a source and destination MAC in between in side the MPLS encapsulation

| Traffic type                                           | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |      |
|--------------------------------------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|------|
|                                                        | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          | VLAN |
|                                                        |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |      |
| traffic (learned)                                      |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| L2 and non-IP traffic (unlearned)                      | ✓               |        |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          | ✓    |
|                                                        |                 | ✓      |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          | ✓    |
| PBB VPLS service                                       |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| B-SAP to I-SAP (terminating PBB BEB traffic)           |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IP traffic (learned)                                   | ✓               |        |                    |     | ✓   | ✓   |           |                 |      |                  |                        |    |          |      |
|                                                        |                 | ✓      |                    |     | ✓   | ✓   |           | ✓               |      |                  |                        |    |          |      |
| IP traffic (unlearned)                                 | ✓               |        |                    |     | ✓   | ✓   |           | ✓               |      |                  |                        |    |          |      |
|                                                        |                 | ✓      |                    |     | ✓   | ✓   |           | ✓               |      |                  |                        |    |          |      |
| L2 and non-IP traffic (learned)                        | ✓               |        |                    |     | ✓   | ✓   | ✓         |                 |      |                  |                        |    |          |      |
|                                                        |                 | ✓      |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          |      |
| L2 and non-IP traffic (unlearned)                      | ✓               |        |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          |      |
|                                                        |                 | ✓      |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          |      |
| PBB Epipe service                                      |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| PBB Epipe I-SAP to B-SAP (originating PBB BEB traffic) |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IP traffic                                             | ✓               |        |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
|                                                        |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| L2 and non-IP traffic                                  | ✓               |        |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          | ✓    |
|                                                        |                 | ✓      |                    |     | ✓   | ✓   | ✓         | ✓               |      |                  |                        |    |          | ✓    |
| PBB Epipe service                                      |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |

| Traffic type                                         | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |    |          |      |
|------------------------------------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|----|----------|------|
|                                                      | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |    |          | VLAN |
|                                                      |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP | L4 ports |      |
| PBB Epipe SAP to B-SAP (terminating PBB BEB traffic) |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IP traffic                                           | ✓               |        |                    |     | ✓   | ✓   |           |                 |      |                  |                        |    |          |      |
|                                                      |                 | ✓      |                    |     | ✓   | ✓   |           |                 |      |                  |                        |    |          |      |
| L2 and non-IP traffic                                | ✓               |        |                    |     | ✓   | ✓   | ✓         |                 |      |                  |                        |    |          |      |
|                                                      |                 | ✓      |                    |     | ✓   | ✓   | ✓         |                 |      |                  |                        |    |          |      |
| VPRN service                                         |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| SAP to SAP                                           |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| SAP to SDP                                           |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| SDP to SAP                                           |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| —                                                    | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |      |
|                                                      |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| IES service (IPv4)                                   |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IES SAP to IES SAP                                   |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| —                                                    | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |      |
|                                                      |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| IES service (IPv4)                                   |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IES SAP to IPv4 network port interface               |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| —                                                    | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |      |
|                                                      |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| Network port IPv4 interface                          |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| IPv4 network interface to IPv4 network interface     |                 |        |                    |     |     |     |           |                 |      |                  |                        |    |          |      |
| —                                                    | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓  | ✓        |      |
|                                                      |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |

| Traffic type                                     | Hashing options |        | Packet fields used |     |     |     |           |                 |      |                  |                        |                 |          |      |
|--------------------------------------------------|-----------------|--------|--------------------|-----|-----|-----|-----------|-----------------|------|------------------|------------------------|-----------------|----------|------|
|                                                  | Hash-1          | Hash-2 | BDA                | BSA | CDA | CSA | EtherType | Ingress Port-ID | ISID | MPLS label stack | Source and destination |                 |          | VLAN |
|                                                  |                 |        |                    |     |     |     |           |                 |      |                  | MAC                    | IP              | L4 ports |      |
| Network port IPv6 interface                      |                 |        |                    |     |     |     |           |                 |      |                  |                        |                 |          |      |
| IPv6 network interface to IPv6 network interface |                 |        |                    |     |     |     |           |                 |      |                  |                        |                 |          |      |
| —                                                | ✓               |        |                    |     |     |     |           |                 |      |                  |                        | ✓ <sup>21</sup> | ✓        |      |
|                                                  |                 | ✓      |                    |     |     |     |           | ✓               |      |                  |                        | ✓ <sup>21</sup> | ✓        |      |

### 2.7.9.2 LAG hashing for the 7210 SAS-T (access-uplink mode)

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-T in access-uplink mode.



**Note:**

The following notes apply to [Table 11: LAG hashing algorithm for services configured on the 7210 SAS-T in the access-uplink operating mode](#):

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

<sup>21</sup> Source and destination IPv6 address

Table 11: LAG hashing algorithm for services configured on the 7210 SAS-T in the access-uplink operating mode

| Traffic type                | Packet fields used |     |           |                 |      |                  |                        |    |          |      |
|-----------------------------|--------------------|-----|-----------|-----------------|------|------------------|------------------------|----|----------|------|
|                             | BDA                | BSA | EtherType | Ingress Port-ID | ISID | MPLS Label Stack | Source and destination |    |          | VLAN |
|                             |                    |     |           |                 |      |                  | MAC                    | IP | L4 Ports |      |
| VPLS service                |                    |     |           |                 |      |                  |                        |    |          |      |
| SAP to SAP                  |                    |     |           |                 |      |                  |                        |    |          |      |
| IP traffic (learned)        |                    |     |           |                 |      |                  |                        | ✓  | ✓        |      |
| IP traffic (unlearned)      |                    |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |
| PBB traffic (learned)       | ✓                  | ✓   |           |                 |      |                  |                        |    |          |      |
| PBB traffic (unlearned)     | ✓                  | ✓   |           | ✓               | ✓    |                  |                        |    |          |      |
| MPLS traffic (learned)      |                    |     |           |                 |      |                  | ✓ <sup>22</sup>        |    |          |      |
| IP MPLS traffic (unlearned) |                    |     |           | ✓               |      | ✓ <sup>23</sup>  |                        | ✓  |          |      |
| L2 MPLS traffic (unlearned) |                    |     |           | ✓               |      | ✓ <sup>23</sup>  |                        |    |          |      |
| Non-IP traffic (learned)    |                    |     | ✓         |                 |      |                  | ✓                      |    |          | ✓    |
| Non-IP traffic (unlearned)  |                    |     | ✓         | ✓               |      |                  | ✓                      |    |          | ✓    |
| Epipe service               |                    |     |           |                 |      |                  |                        |    |          |      |
| SAP to SAP                  |                    |     |           |                 |      |                  |                        |    |          |      |
| IP traffic                  |                    |     |           | ✓               |      |                  |                        | ✓  | ✓        |      |

<sup>22</sup> The outer MAC of the Ethernet packet that encapsulates an MPLS packet

<sup>23</sup> Two MPLS labels deep



| Traffic type              | Packet fields used |     |           |                 |      |                  |                        |    |          |      |
|---------------------------|--------------------|-----|-----------|-----------------|------|------------------|------------------------|----|----------|------|
|                           | BDA                | BSA | EtherType | Ingress Port-ID | ISID | MPLS Label Stack | Source and destination |    |          | VLAN |
|                           |                    |     |           |                 |      |                  | MAC                    | IP | L4 Ports |      |
| PBB traffic               | ✓                  | ✓   |           | ✓               | ✓    |                  |                        |    |          |      |
| IP MPLS traffic           |                    |     |           | ✓               |      | ✓ <sup>23</sup>  |                        | ✓  |          |      |
| L2 MPLS traffic           |                    |     |           | ✓               |      | ✓ <sup>23</sup>  |                        |    |          |      |
| Non-IP traffic            |                    |     | ✓         | ✓               |      |                  | ✓                      |    |          | ✓    |
| <b>IES service (IPv4)</b> |                    |     |           |                 |      |                  |                        |    |          |      |
| <b>IES SAP to IES SAP</b> |                    |     |           |                 |      |                  |                        |    |          |      |
| IPv4 unicast traffic      |                    |     |           |                 |      |                  |                        | ✓  | ✓        |      |

### 2.7.9.3 LAG hashing for the 7210 SAS-R6 and 7210 SAS-R12

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-R6 and 7210 SAS-R12.



**Note:**

The following notes apply to [Table 12: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-R6 and 7210 SAS-R12](#):

- The term "service\_id" refers to the service ID of the egressing VPLS, Epipe, IES, or VPRN service.
- The term "lag\_index" refers to the Lag-IfIndex of the egressing lag.
- the terms "encap\_value" and "service\_vlan" are based on the inner and outer VLAN values of the egressing LAG SAP.
- The term "sap\_index" is a value assigned uniquely for each SAP internally.
- Parameters used for LAG hashing are the same in both SAP egress queue mode (SAP-based egress scheduling) or port egress queue mode (port-based egress scheduling), unless otherwise specified.
- The term "learned" corresponds to the destination MAC.
- The term "source and destination MAC" refers to customer source and destination MACs, unless otherwise specified.
- In the case of a LAG with two ports at egress, different ingress port IDs may result in the same hash index, which causes traffic to always get hashed to only one of the ports. Load balancing is expected to occur when there are more than 2 ports in the lag.
- The term "mgid" is the multicast group ID and is a software-allocated number. A unique number is allocated for each Layer-2 multicast MAC address.
- The 7210 SAS supports Layer-2 multicast in a VPLS service. A group of 32 multicast IP addresses map to a single Layer-2 multicast MAC address. The "mgid" parameter remains the same for all IP multicast addresses that map to the same Layer-2 multicast MAC address.

*Table 12: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-R6 and 7210 SAS-R12*

| Traffic type            | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |  |
|-------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|--|
|                         | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |  |
|                         |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |  |
| VPLS service            |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |  |
| SAP to SAP              |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |  |
| IP traffic<br>(learned) | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |  |
|                         |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |  |
|                         |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |  |

| Traffic type                | Hashing options        |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|-----------------------------|------------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                             | Hash-1<br>Version 1    | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                             |                        |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| PBB traffic<br>(learned)    | ✓                      |                     |        | ✓                  | ✓   |           |                     |      |                     |                           |    |          | ✓    |
|                             |                        | ✓                   |        | ✓                  | ✓   |           |                     |      |                     |                           |    |          | ✓    |
|                             |                        |                     | ✓      | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |    |          |      |
| MPLS traffic<br>(learned)   | ✓                      |                     |        |                    |     |           |                     |      |                     | ✓ <sup>24</sup>           |    |          | ✓    |
|                             |                        | ✓                   |        |                    |     |           |                     |      |                     | ✓ <sup>24</sup>           |    |          | ✓    |
|                             |                        |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           |    |          |      |
| Non-IP traffic<br>(learned) | ✓                      |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                             |                        | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                             |                        |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
| All traffic<br>(unlearned)  | See note <sup>26</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                             |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                             |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| VPLS service                |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SDP                  |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic<br>(learned)     | ✓                      |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                             |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                             |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| IP traffic<br>(unlearned)   | ✓                      |                     |        |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |

<sup>24</sup> The outer MAC of the Ethernet packet that encapsulates an MPLS packet

<sup>25</sup> Two MPLS labels deep

<sup>26</sup> Based on LAG SAP parameters: service-id, lage\_index, encap\_value, service\_vlan, sap\_index, and number of active ports in the LAG. The hash function is implemented in the software and does not use hash-1 and hash-2 functions.

| Traffic type                  | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|-------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                               | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                               |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
|                               |                     | ✓                   |        |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| PBB traffic<br>(learned)      | ✓                   |                     |        | ✓                  | ✓   |           |                     |      |                     |                           |                 |          | ✓    |
|                               |                     | ✓                   |        | ✓                  | ✓   |           |                     |      |                     |                           |                 |          | ✓    |
|                               |                     |                     | ✓      | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |                 |          |      |
| PBB traffic<br>(unlearned)    | ✓                   |                     |        | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |                 |          |      |
|                               |                     | ✓                   |        | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |                 |          |      |
|                               |                     |                     | ✓      | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |                 |          |      |
| MPLS traffic<br>(learned)     | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           | ✓ <sup>27</sup> |          |      |
| MPLS traffic<br>(unlearned)   | ✓                   |                     |        |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           | ✓ <sup>27</sup> |          |      |
|                               |                     | ✓                   |        |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           | ✓ <sup>27</sup> |          |      |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           | ✓ <sup>27</sup> |          |      |
| Non-IP traffic<br>(learned)   | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| Non-IP traffic<br>(unlearned) | ✓                   |                     |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | —                   |        |                    |     |           |                     |      |                     |                           |                 |          |      |
|                               |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| VPLS service                  |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |

<sup>27</sup> Used when the IP header follows the MPLS header

| Traffic type                                         | Hashing options        |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|------------------------------------------------------|------------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                      | Hash-1<br>Version 1    | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                      |                        |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| SDP to SAP                                           |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic<br>(learned)                              | ✓                      |                     |        |                    |     |           |                     |      | ✓ <sup>25</sup>     | ✓                         |    | ✓        | ✓    |
|                                                      |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                      |                        |                     | —      |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic,<br>excluding<br>IP traffic<br>(learned) | ✓                      |                     |        |                    |     | ✓         |                     |      |                     | ✓ <sup>28</sup>           |    |          |      |
|                                                      |                        | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓ <sup>28</sup>           |    |          |      |
|                                                      |                        |                     | —      |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic<br>(learned)                             | —                      |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                      |                        | —                   |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                      |                        |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>28</sup>           |    |          |      |
| All traffic<br>(unlearned)                           | See note <sup>26</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                      |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| VPLS service                                         |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SDP to SDP                                           |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic<br>(learned)                             | ✓                      |                     |        |                    |     |           |                     |      |                     | ✓ <sup>28</sup>           |    |          |      |
|                                                      |                        | ✓                   |        |                    |     |           |                     |      |                     | ✓ <sup>28</sup>           |    |          |      |
|                                                      |                        |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>28</sup>           |    |          |      |
| All traffic<br>(unlearned)                           | ✓                      |                     |        |                    |     |           | ✓                   |      |                     | ✓ <sup>28</sup>           |    |          |      |
|                                                      |                        | ✓                   |        |                    |     |           | ✓                   |      |                     | ✓ <sup>28</sup>           |    |          |      |
|                                                      |                        |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>28</sup>           |    |          |      |

<sup>28</sup> Outer MACs inside the payload just after the MPLS header

| Traffic type   | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|----------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| Epipe service  |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SAP     |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic     | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| PBB traffic    | ✓                   |                     |        | ✓                  | ✓   |           |                     |      |                     |                           |    |          | ✓    |
|                |                     | ✓                   |        | ✓                  | ✓   |           |                     |      |                     |                           |    |          | ✓    |
|                |                     |                     | ✓      | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |    |          |      |
| MPLS traffic   | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓ <sup>24</sup>           |    |          | ✓    |
|                |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓ <sup>24</sup>           |    |          | ✓    |
|                |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           |    |          |      |
| Non-IP traffic | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
| Epipe service  |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SDP     |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic     | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| PBB traffic    | ✓                   |                     |        | ✓                  | ✓   |           |                     |      |                     |                           |    |          | ✓    |
|                |                     | ✓                   |        | ✓                  | ✓   |           |                     |      |                     |                           |    |          | ✓    |
|                |                     |                     | ✓      | ✓                  | ✓   |           | ✓                   | ✓    |                     |                           |    |          |      |

| Traffic type         | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|----------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                      | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                      |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
| MPLS traffic         | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                      |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                      |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>25</sup>     |                           | ✓ <sup>27</sup> |          |      |
| Non-IP traffic       | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                      |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                      |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| <b>Epipe service</b> |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| <b>SDP to SAP</b>    |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IP traffic           | ✓                   |                     |        |                    |     |           |                     |      | ✓ <sup>25</sup>     | ✓                         |                 | ✓        | ✓    |
|                      |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                      |                     |                     | —      |                    |     |           |                     |      |                     |                           |                 |          |      |
| All other traffic    | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓ <sup>28</sup>           |                 |          |      |
|                      |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓ <sup>28</sup>           |                 |          |      |
|                      |                     |                     | —      |                    |     |           |                     |      |                     |                           |                 |          |      |
| All traffic          | —                   |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
|                      |                     | —                   |        |                    |     |           |                     |      |                     |                           |                 |          |      |
|                      |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>28</sup>           |                 |          |      |
| <b>MPLS – LSR</b>    |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| All traffic          | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓ <sup>24</sup>           |                 |          |      |
|                      |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓ <sup>24</sup>           |                 |          |      |

| Traffic type                                        | Hashing options        |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|-----------------------------------------------------|------------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                                                     | Hash-1<br>Version 1    | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                                                     |                        |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
|                                                     |                        |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>29</sup>     |                           | ✓ <sup>30</sup> |          |      |
| VPLS (Multicast traffic with IGMP snooping enabled) |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SAP to SAP                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SDP to SAP                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                   | See note <sup>31</sup> |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
|                                                     |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
|                                                     |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| VPRN service                                        |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SAP to SAP                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SAP to SDP                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SDP to SAP                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                   | ✓                      |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                     |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                     |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| IES service (IPv4)                                  |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IES SAP to IES SAP                                  |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                   | ✓                      |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                     |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                     |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| IES service (IPv4)                                  |                        |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |

<sup>29</sup> Three MPLS labels deep

<sup>30</sup> Only applies if there are 3 or fewer MPLS labels when an IP header follows the MPLS header

<sup>31</sup> Based on LAG SAP parameters: service-id, lage\_index, encap\_value, service\_vlan, mgid, sap\_index, and number of active ports in the LAG. The hash function is implemented in the software and does not use hash-1 and hash-2 functions.



| Traffic type                                     | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|--------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                                                  | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                                                  |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
| IES SAP to IPv4 network port interface           |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                  |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                  |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| Network port IPv4 interface                      |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IPv4 network interface to IPv4 network interface |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                  |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                  |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| Network port IPv6 interface                      |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IPv6 network interface to IPv6 network interface |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓ <sup>32</sup> | ✓        |      |
|                                                  |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓ <sup>32</sup> | ✓        |      |
|                                                  |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓ <sup>32</sup> | ✓        |      |

#### 2.7.9.4 LAG hashing for the 7210 SAS-Mxp

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

<sup>32</sup> Source and destination IPv6 addresses



**Note:**

The following notes apply to [Table 13: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-Mxp](#) :

- In the case of LSR, incoming labels are used for hashing.
- 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 term "service\_id" refers to the service ID of the egressing VPLS, Epipe, IES, or VPRN service.
- The term "lag\_index" refers to the Lag-IfIndex of the egressing lag.
- The terms "encap\_value" and "service\_vlan" are based on the inner/outer VLAN values of the egressing LAG SAP.
- The term "sap\_index" is a value assigned uniquely for each SAP internally.
- Parameters used for LAG hashing are the same in both SAP egress queue mode (SAP-based egress scheduling) or port egress queue mode (port-based egress scheduling mode), unless otherwise specified previously.
- The term "mgid" is the multicast group ID and is a software-allocated number. A unique number is allocated for each Layer-2 multicast MAC address.
- The 7210 SAS supports Layer-2 multicast in a VPLS service. A group of 32 multicast IP addresses map to a single Layer-2 multicast MAC address. The "mgid" parameter remains the same for all IP multicast addresses that map to the same Layer-2 multicast MAC address.

Table 13: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-Mxp

| Traffic type                                                                      | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |  |
|-----------------------------------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|--|
|                                                                                   | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |  |
|                                                                                   |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |  |
| VPLS and Epipe services                                                           |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |  |
| SAP to SAP                                                                        |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |  |
| IP traffic<br>(VPLS<br>learned and<br>Epipe; port-<br>based egress<br>scheduling) | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |  |
|                                                                                   |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |  |
|                                                                                   |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |  |
| MPLS traffic<br>(VPLS)                                                            | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          |      |  |

| Traffic type                                                                          | Hashing options        |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|---------------------------------------------------------------------------------------|------------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                                                       | Hash-1<br>Version 1    | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                                                       |                        |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| learned and<br>Epipe; port-<br>based egress<br>scheduling)                            |                        | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          |      |
|                                                                                       |                        |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>33</sup>     |                           |    |          |      |
| Non-IP<br>traffic (VPLS<br>learned and<br>Epipe; port-<br>based egress<br>scheduling) | ✓                      |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                        | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                        |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
| All traffic<br>(learned and<br>unlearned;<br>SAP-based<br>egress<br>scheduling)       | See note <sup>34</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                       |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                       |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic<br>(VPLS<br>unlearned;<br>port-based<br>egress<br>scheduling)             | See note <sup>34</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                       |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                       |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| VPLS service                                                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SDP                                                                            |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic<br>(learned;<br>SAP-based<br>and port-<br>based egress<br>sheduling)       | ✓                      |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                       |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                       |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |

<sup>33</sup> Two MPLS labels deep

<sup>34</sup> Based on LAG SAP parameters: service-id, lag\_index, encap\_value, service\_vlan, sap\_index, and number of active ports in the LAG. The hash function is implemented in the software and does not use hash-1 and hash-2 functions.

| Traffic type                                                                          | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|---------------------------------------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                                                       | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                                                       |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| IP traffic<br>(unlearned;<br>SAP-based<br>and port-<br>based egress<br>sheduling)     | ✓                   |                     |        |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
|                                                                                       |                     | ✓                   |        |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
|                                                                                       |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| MPLS traffic<br>(learned;<br>SAP-based<br>and port-<br>based egress<br>sheduling)     | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>33</sup>     |                           |    |          |      |
| MPLS traffic<br>(unlearned;<br>SAP-based<br>and port-<br>based egress<br>sheduling)   | ✓                   |                     |        |                    |     |           | ✓                   |      | ✓ <sup>33</sup>     |                           |    |          |      |
|                                                                                       |                     | ✓                   |        |                    |     |           | ✓                   |      | ✓ <sup>33</sup>     |                           |    |          |      |
|                                                                                       |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>33</sup>     |                           |    |          |      |
| Non-IP traffic<br>(learned;<br>SAP-based<br>and port-<br>based egress<br>sheduling)   | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
| Non-IP traffic<br>(unlearned;<br>SAP-based<br>and port-<br>based egress<br>sheduling) | ✓                   |                     |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                     | ✓                   |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
|                                                                                       |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
| <b>Epipe service</b>                                                                  |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| <b>SAP to SDP</b>                                                                     |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic<br>(SAP-based<br>and port-                                                 | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                       |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |

| Traffic type                                                                                        | Hashing options        |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|-----------------------------------------------------------------------------------------------------|------------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                                                                     | Hash-1<br>Version 1    | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                                                                     |                        |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| based egress<br>sheduling)                                                                          |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| MPLS traffic<br>(SAP-based<br>and port-<br>based egress<br>sheduling)                               | ✓                      |                     |        |                    |     |           |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                                     |                        | ✓                   |        |                    |     |           |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                                     |                        |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>33</sup>     |                           |    |          |      |
| Non-IP traffic<br>(SAP-based<br>and port-<br>based egress<br>sheduling)                             | ✓                      |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                                     |                        | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
|                                                                                                     |                        |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |    |          | ✓    |
| <b>VPLS and Epipe services</b>                                                                      |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| <b>SDP to SAP</b>                                                                                   |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic<br>(including<br>VPLS<br>learned and<br>unlearned;<br>SAP-based<br>egress<br>sheduling) | See note <sup>34</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                                     |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                                     |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic<br>(VPLS<br>unlearned;<br>port-based<br>egress<br>sheduling)                            | See note <sup>34</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                                     |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                                                                     |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All other<br>traffic (VPLS<br>learned and<br>Epipe; port-                                           | ✓                      |                     |        |                    |     |           |                     |      |                     | ✓ <sup>35</sup>           |    |          |      |
|                                                                                                     |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |

<sup>35</sup> Outer MACs inside the payload just after the MPLS header

| Traffic type                                                        | Hashing options     |                     |        | Packet fields used |     |           |                 |      |                  |                        |                 |          |      |
|---------------------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|-----------------|------|------------------|------------------------|-----------------|----------|------|
|                                                                     | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-ID | ISID | MPLS Label Stack | Source and destination |                 |          | VLAN |
|                                                                     |                     |                     |        |                    |     |           |                 |      |                  | MAC                    | IP              | L4 Ports |      |
| based egress scheduling)                                            |                     |                     | ✓      |                    |     |           | ✓               |      |                  | ✓ <sup>35</sup>        |                 |          |      |
| <b>VPLS service</b>                                                 |                     |                     |        |                    |     |           |                 |      |                  |                        |                 |          |      |
| <b>SDP to SDP</b>                                                   |                     |                     |        |                    |     |           |                 |      |                  |                        |                 |          |      |
| All traffic (learned; SAP-based and port-based egress scheduling)   | ✓                   |                     |        |                    |     |           |                 |      |                  | ✓ <sup>35</sup>        |                 |          |      |
|                                                                     |                     | ✓                   |        |                    |     |           |                 |      |                  | ✓ <sup>35</sup>        |                 |          |      |
|                                                                     |                     |                     | ✓      |                    |     |           | ✓               |      |                  | ✓ <sup>35</sup>        |                 |          |      |
| All traffic (unlearned; SAP-based and port-based egress scheduling) | ✓                   |                     |        |                    |     |           | ✓               |      |                  | ✓ <sup>35</sup>        |                 |          |      |
|                                                                     |                     | ✓                   |        |                    |     |           | ✓               |      |                  | ✓ <sup>35</sup>        |                 |          |      |
|                                                                     |                     |                     | ✓      |                    |     |           | ✓               |      |                  | ✓ <sup>35</sup>        |                 |          |      |
| <b>MPLS – LSR</b>                                                   |                     |                     |        |                    |     |           |                 |      |                  |                        |                 |          |      |
| All traffic (SAP-based and port-based egress scheduling)            | ✓                   |                     |        |                    |     |           |                 |      |                  | ✓ <sup>35</sup>        |                 |          |      |
|                                                                     |                     | ✓                   |        |                    |     |           |                 |      |                  | ✓ <sup>35</sup>        |                 |          |      |
|                                                                     |                     |                     | ✓      |                    |     |           | ✓               |      | ✓ <sup>36</sup>  |                        | ✓ <sup>37</sup> |          |      |
| <b>VPLS (Multicast traffic with IGMP snooping enabled)</b>          |                     |                     |        |                    |     |           |                 |      |                  |                        |                 |          |      |
| <b>SAP to SAP</b>                                                   |                     |                     |        |                    |     |           |                 |      |                  |                        |                 |          |      |
| <b>SDP to SAP</b>                                                   |                     |                     |        |                    |     |           |                 |      |                  |                        |                 |          |      |

<sup>36</sup> Three MPLS labels deep

<sup>37</sup> Only applies if there are 3 or fewer MPLS labels when an IP header follows the MPLS header

| Traffic type                                             | Hashing options        |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|----------------------------------------------------------|------------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                          | Hash-1<br>Version 1    | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                          |                        |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| — (SAP-based and port-based egress scheduling)           | See note <sup>38</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| VPRN service                                             |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SAP                                               |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SDP to SAP                                               |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic (SAP-based egress scheduling)                | See note <sup>34</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                                                          |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic (Port-based egress scheduling)               | ✓                      |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                          |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                          |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| VPRN service                                             |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SDP                                               |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic (SAP-based and port-based egress scheduling) | ✓                      |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                          |                        | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                          |                        |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| IES service (IPv4)                                       |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IES SAP to IES SAP                                       |                        |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic                                              | See note <sup>34</sup> |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |

<sup>38</sup> Based on LAG SAP parameters: service-id, lag\_index, encap\_value, service\_vlan, mgid, sap\_index, and number of active ports in the LAG. The hash function is implemented in the software and does not use hash-1 and hash-2 functions.

| Traffic type                                            | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|---------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                         | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                         |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| (SAP-based egress scheduling)                           |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic (Port-based egress scheduling)              | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| <b>IES service (IPv4)</b>                               |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| <b>IES SAP to IPv4 network port interface</b>           |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| — (SAP-based and port-based egress scheduling)          | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| <b>Network port IPv4 interface</b>                      |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| <b>IPv4 network interface to IPv4 network interface</b> |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| — (SAP-based and port-based egress scheduling)          | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| <b>Network port IPv6 interface</b>                      |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| <b>IPv6 network interface to IPv6 network interface</b> |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| — (SAP-based and port-based egress scheduling)          | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                         |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |



### 2.7.9.5 LAG hashing algorithm for the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE in standalone and standalone-VC mode

The following table describes the packet fields used for hashing for services configured on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE operating in the standalone and standalone-VC modes.



**Note:**

The following terms are use in [Table 14: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE in standalone and standalone-VC Mode](#):

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

*Table 14: LAG hashing algorithm for services and traffic flows configured on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE in standalone and standalone-VC Mode*

| Traffic type               | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|----------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                            | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                            |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
| VPLS service               |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| SAP to SAP                 |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic<br>(learned)    | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                            |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| IP traffic<br>(unlearned)  | ✓                   |                     |        |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
|                            |                     | ✓                   |        |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| PBB traffic<br>(learned)   | ✓                   |                     |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |    |          | ✓    |
|                            |                     | ✓                   |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |    |          | ✓    |
|                            |                     |                     | ✓      | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |    |          |      |
| PBB traffic<br>(unlearned) | ✓                   |                     |        | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |    |          |      |

| Traffic type                  | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|-------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                               | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                               |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
|                               |                     | ✓                   |        | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
|                               |                     |                     | ✓      | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
| MPLS traffic<br>(learned)     | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓ <sup>39</sup>           |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓ <sup>39</sup>           |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
| MPLS traffic<br>(unlearned)   | ✓                   |                     |        |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
|                               |                     | ✓                   |        |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
| Non-IP traffic<br>(learned)   | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| Non-IP traffic<br>(unlearned) | ✓                   |                     |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| <b>Epipe service</b>          |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| <b>SAP to SAP</b>             |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IP traffic                    | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                               |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |

<sup>39</sup> The outer MAC of the Ethernet packet that encapsulates an MPLS packet

<sup>40</sup> Three MPLS labels deep

<sup>41</sup> Only applies if there are 3 or fewer MPLS labels when an IP header follows the MPLS header

| Traffic type               | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|----------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                            | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                            |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
| PBB traffic                | ✓                   |                     |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          | ✓    |
|                            |                     | ✓                   |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          | ✓    |
|                            |                     |                     | ✓      | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
| MPLS traffic               | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓ <sup>39</sup>           |                 |          | ✓    |
|                            |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓ <sup>39</sup>           |                 |          | ✓    |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
| Non-IP traffic             | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                            |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                            |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| <b>VPLS service</b>        |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| <b>SAP to SDP</b>          |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IP traffic<br>(learned)    | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                            |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| IP traffic<br>(unlearned)  | ✓                   |                     |        |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
|                            |                     | ✓                   |        |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| PBB traffic<br>(learned)   | ✓                   |                     |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          |      |
|                            |                     | ✓                   |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          |      |
|                            |                     |                     | ✓      | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
| PBB traffic<br>(unlearned) | ✓                   |                     |        | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
|                            |                     | ✓                   |        | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |

| Traffic type                  | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|-------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                               | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                               |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
|                               |                     |                     | ✓      | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
| MPLS traffic<br>(learned)     | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
| MPLS traffic<br>(unlearned)   | ✓                   |                     |        |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
|                               |                     | ✓                   |        |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
| Non-IP traffic<br>(learned)   | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| Non-IP traffic<br>(unlearned) | ✓                   |                     |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
|                               |                     | ✓                   |        |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
|                               |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| <b>Epipe service</b>          |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| <b>SAP to SDP</b>             |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IP traffic                    | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                               |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                               |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| PBB traffic                   | ✓                   |                     |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          |      |
|                               |                     | ✓                   |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          |      |
|                               |                     |                     | ✓      | ✓                  | ✓   | ✓         | ✓                   | ✓    |                     |                           |                 |          |      |
| MPLS traffic                  | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |

| Traffic type                | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|-----------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                             | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                             |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
|                             |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓                         |                 |          | ✓    |
|                             |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>41</sup> |          |      |
|                             |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| Non-IP traffic              | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                             |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                             |                     |                     | ✓      |                    |     | ✓         | ✓                   |      |                     | ✓                         |                 |          | ✓    |
| <b>VPLS service</b>         |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| <b>SDP to SAP</b>           |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IP traffic<br>(learned)     | ✓ <sup>42</sup>     |                     |        |                    |     |           |                     |      | ✓ <sup>43</sup>     | ✓                         |                 | ✓        | ✓    |
|                             |                     | ✓ <sup>42</sup>     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                             |                     |                     | —      |                    |     |           |                     |      |                     |                           |                 |          |      |
| PBB traffic<br>(learned)    | ✓                   |                     |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          |      |
|                             |                     | ✓                   |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |                 |          |      |
|                             |                     |                     | —      |                    |     |           |                     |      |                     |                           |                 |          |      |
| Non-IP traffic<br>(learned) | ✓ <sup>44</sup>     |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          |      |
|                             |                     | ✓ <sup>44</sup>     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          |      |
|                             |                     |                     | —      |                    |     |           |                     |      |                     |                           |                 |          |      |
| All traffic<br>(learned)    | —                   |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |

<sup>42</sup> In the standalone-VC mode, the IP traffic packet fields are used for null and dot1q tagged traffic; only source and destination MACs are used for qinq tagged traffic. In the standalone operating mode, source and destination MACs and MPLS label stacks (two labels deep) are used for qinq tagged traffic.

<sup>43</sup> Two MPLS labels deep

<sup>44</sup> In the standalone-VC operating mode, EtherType is used only for null and dot1q tagged traffic; it is not used for qinq tagged traffic.

| Traffic type               | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|----------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                            | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                            |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
|                            |                     | —                   |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |    |          |      |
| All traffic<br>(unlearned) | ✓                   |                     |        |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |    |          |      |
|                            |                     | ✓                   |        |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |    |          |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |    |          |      |
| <b>Epipe service</b>       |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| <b>SDP to SAP</b>          |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| IP traffic                 | ✓ <sup>42</sup>     |                     |        |                    |     |           |                     |      | ✓ <sup>43</sup>     | ✓                         |    | ✓        | ✓    |
|                            |                     | ✓ <sup>42</sup>     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                            |                     |                     | —      |                    |     |           |                     |      |                     |                           |    |          |      |
| PBB traffic                | ✓                   |                     |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |    |          |      |
|                            |                     | ✓                   |        | ✓                  | ✓   | ✓         |                     |      |                     |                           |    |          |      |
|                            |                     |                     | —      |                    |     |           |                     |      |                     |                           |    |          |      |
| Non-IP traffic             | ✓ <sup>44</sup>     |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          |      |
|                            |                     | ✓ <sup>44</sup>     |        |                    |     | ✓         |                     |      |                     | ✓                         |    |          |      |
|                            |                     |                     | —      |                    |     |           |                     |      |                     |                           |    |          |      |
| All traffic                | —                   |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                            |                     | —                   |        |                    |     |           |                     |      |                     |                           |    |          |      |
|                            |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |    |          |      |
| <b>VPLS service</b>        |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |

<sup>45</sup> Outer MACs inside the payload just after the MPLS header

| Traffic type                                         | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                                                      | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                                                      |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
| SDP to SDP                                           |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| All traffic<br>(learned)                             | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓ <sup>45</sup>           |                 |          |      |
|                                                      |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓ <sup>45</sup>           |                 |          |      |
|                                                      |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |                 |          |      |
| All traffic<br>(unlearned)                           | ✓                   |                     |        |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |                 |          |      |
|                                                      |                     | ✓                   |        |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |                 |          |      |
|                                                      |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓ <sup>45</sup>           |                 |          |      |
| MPLS – LSR                                           |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| All traffic                                          | ✓                   |                     |        |                    |     |           |                     |      |                     | ✓ <sup>39</sup>           |                 |          |      |
|                                                      |                     | ✓                   |        |                    |     |           |                     |      |                     | ✓ <sup>39</sup>           |                 |          |      |
|                                                      |                     |                     | ✓      |                    |     |           | ✓                   |      | ✓ <sup>40</sup>     |                           | ✓ <sup>46</sup> |          |      |
| VPLS IGMP snooping                                   |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| VPLS (Multicast traffic with IGMP snooping enabled): |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SAP to SAP                                           |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| SAP to SDP                                           |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| IP multicast<br>traffic                              | ✓                   |                     |        |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
|                                                      |                     | ✓                   |        |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
|                                                      |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| L2 multicast<br>traffic                              | ✓                   |                     |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |
|                                                      |                     | ✓                   |        |                    |     | ✓         |                     |      |                     | ✓                         |                 |          | ✓    |

<sup>46</sup> Used when the IP header follows the MPLS header

| Traffic type                                                                                                              | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |    |          |      |
|---------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|----|----------|------|
|                                                                                                                           | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |    |          | VLAN |
|                                                                                                                           |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP | L4 Ports |      |
|                                                                                                                           |                     |                     | ✓      |                    |     | ✓         |                     |      |                     | ✓                         |    |          | ✓    |
| <b>VPLS IGMP snooping</b><br><b>VPLS (Multicast traffic with IGMP snooping enabled):</b><br><b>SDP to SAP, SDP to SDP</b> |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| —                                                                                                                         | ✓                   |                     |        |                    |     |           | ✓                   |      |                     | ✓                         |    |          |      |
|                                                                                                                           |                     | ✓                   |        |                    |     |           | ✓                   |      |                     | ✓                         |    |          |      |
|                                                                                                                           |                     |                     | ✓      |                    |     |           | ✓                   |      |                     | ✓                         |    |          |      |
| <b>VPRN service</b><br><b>SAP to SAP</b><br><b>SAP to SDP</b><br><b>SDP to SAP</b>                                        |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| —                                                                                                                         | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                                                           |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                                                           |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| <b>IES service (IPv4):</b><br><b>IES SAP to IES SAP</b>                                                                   |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| —                                                                                                                         | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                                                           |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                                                           |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |
| <b>IES service (IPv4):</b><br><b>IES SAP to IPv4 network port interface</b>                                               |                     |                     |        |                    |     |           |                     |      |                     |                           |    |          |      |
| —                                                                                                                         | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                                                           |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓  | ✓        |      |
|                                                                                                                           |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓  | ✓        |      |



| Traffic type                                                                     | Hashing options     |                     |        | Packet fields used |     |           |                     |      |                     |                           |                 |          |      |
|----------------------------------------------------------------------------------|---------------------|---------------------|--------|--------------------|-----|-----------|---------------------|------|---------------------|---------------------------|-----------------|----------|------|
|                                                                                  | Hash-1<br>Version 1 | Hash-1<br>Version 2 | Hash-2 | BDA                | BSA | EtherType | Ingress Port-<br>ID | ISID | MPLS Label<br>Stack | Source and<br>destination |                 |          | VLAN |
|                                                                                  |                     |                     |        |                    |     |           |                     |      |                     | MAC                       | IP              | L4 Ports |      |
| Network port IPv4 interface:<br>IPv4 network interface to IPv4 network interface |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                                                | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                                                  |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓               | ✓        |      |
|                                                                                  |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓               | ✓        |      |
| Network port IPv6 interface:<br>IPv6 network interface to IPv6 network interface |                     |                     |        |                    |     |           |                     |      |                     |                           |                 |          |      |
| —                                                                                | ✓                   |                     |        |                    |     |           |                     |      |                     |                           | ✓ <sup>47</sup> | ✓        |      |
|                                                                                  |                     | ✓                   |        |                    |     |           |                     |      |                     |                           | ✓ <sup>47</sup> | ✓        |      |
|                                                                                  |                     |                     | ✓      |                    |     |           | ✓                   |      |                     |                           | ✓ <sup>47</sup> | ✓        |      |

### 2.7.9.6 PW hash-label generation for 7210 SAS-R6 and 7210 SAS-R12

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

<sup>47</sup> Source and destination IPv6 address



**Note:**

The following notes apply to [Table 15: Packet fields used for PW hash-label generation on the 7210 SAS-R6 and 7210 SAS-R12](#):

- Source and destination MAC addresses are from the outermost Ethernet header.
- MPLS and PBB traffic always use a fixed hash value. MPLS and PBB traffic encapsulation is identified by the system, only if the outermost Ethernet has two or fewer VLAN tags. If there are more VLAN tags, the system identifies the traffic as "Any other traffic".
- For IP traffic with two or more VLAN tags, source and destination MAC and VLAN are used to generate the hash label.
- Any other traffic with three or more VLAN tags uses source and destination MAC and VLAN to generate the hash label.
- The value of a hash label generated for the packet is the same and is not influenced by the configuration of the load-balancing algorithm using the command **configure>lag>load-balancing**.
- Traffic identified as "All Other Traffic" have Ethertype or may not have Ethertype (for example, xSTP traffic does not have Ethertype). Ethertype is used only if available in the outermost Ethernet header for packets with two or fewer VLAN tags.

Table 15: Packet fields used for PW hash-label generation on the 7210 SAS-R6 and 7210 SAS-R12

| Traffic type            | Packet fields used |                   |                        |    |          |      |
|-------------------------|--------------------|-------------------|------------------------|----|----------|------|
|                         | EtherType          | Fixed Label Value | Source and destination |    |          | VLAN |
|                         |                    |                   | MAC                    | IP | L4 Ports |      |
| VPLS and Epipe services |                    |                   |                        |    |          |      |
| SAP to SDP              |                    |                   |                        |    |          |      |
| IP traffic              |                    |                   |                        | ✓  | ✓        |      |
| PBB traffic             |                    | ✓                 |                        |    |          |      |
| MPLS traffic            |                    | ✓                 |                        |    |          |      |
| Any other traffic       | ✓                  |                   | ✓                      |    |          | ✓    |
| VPLS service            |                    |                   |                        |    |          |      |
| SDP to SDP              |                    |                   |                        |    |          |      |
| IP traffic              |                    |                   |                        | ✓  | ✓        |      |
| PBB traffic             |                    | ✓                 |                        |    |          |      |
| MPLS traffic            |                    | ✓                 |                        |    |          |      |

| Traffic type      | Packet fields used |                   |                        |    |          |      |
|-------------------|--------------------|-------------------|------------------------|----|----------|------|
|                   | EtherType          | Fixed Label Value | Source and destination |    |          | VLAN |
|                   |                    |                   | MAC                    | IP | L4 Ports |      |
| Any other traffic | ✓                  |                   | ✓ <sup>48</sup>        |    |          | ✓    |

### 2.7.9.7 PW hash-label – packet fields used for PW Hash-label generation for 7210 SAS-Mxp

The following table describes the packet fields used for different services and different traffic types, to generate the hash-label.



**Note:**

The following notes apply to [Table 16: Packet fields used for PW hash-label generation on the 7210 SAS-Mxp](#) :

- Source and destination MAC addresses are from the outermost Ethernet header.
- MPLS and PBB traffic encapsulation is identified by the system only if the outermost Ethernet header has two or fewer VLAN tags.
- Any traffic with three or more VLAN tags uses source and destination MAC and VLAN to generate the hash label.
- The value of the hash label generated for the packet is the same and is not influenced by the configuration of the load-balancing algorithm using the command **configure>lag>load-balancing**.
- Traffic identified as "All other traffic" may or may not have the Ethertype packet field (for example: xSTP traffic does not have Ethertype). Ethertype is used only if available in the outermost Ethernet header for packets with two or fewer VLAN tags.

<sup>48</sup> Outer MACs

Table 16: Packet fields used for PW hash-label generation on the 7210 SAS-Mxp

| Traffic type            | Packet fields used |     |           |                 |      |                  |                        |                 |          |      |
|-------------------------|--------------------|-----|-----------|-----------------|------|------------------|------------------------|-----------------|----------|------|
|                         | BDA                | BSA | EtherType | Ingress Port-ID | ISID | MPLS Label Stack | Source and destination |                 |          | VLAN |
|                         |                    |     |           |                 |      |                  | MAC                    | IP              | L4 Ports |      |
| VPLS and Epipe services |                    |     |           |                 |      |                  |                        |                 |          |      |
| SAP to SDP              |                    |     |           |                 |      |                  |                        |                 |          |      |
| IP traffic              |                    |     |           | ✓               |      |                  |                        | ✓               | ✓        |      |
| PBB traffic             | ✓                  | ✓   |           | ✓               | ✓    |                  |                        |                 |          |      |
| MPLS traffic            |                    |     |           | ✓               |      | ✓ <sup>49</sup>  |                        | ✓ <sup>50</sup> |          |      |
| All other traffic       |                    |     | ✓         | ✓               |      |                  | ✓                      |                 |          | ✓    |
| VPLS service            |                    |     |           |                 |      |                  |                        |                 |          |      |
| SDP to SDP              |                    |     |           |                 |      |                  |                        |                 |          |      |
| All traffic             |                    |     |           | ✓               |      |                  | ✓ <sup>51</sup>        |                 |          |      |

### 2.7.9.8 PW hash-label – packet fields used for PW hash-label generation for 7210 SAS-Sx/S 1/10GE

The following table describes the packet fields used for different services and different traffic types, to generate the hash-label.

<sup>49</sup> Three MPLS labels deep

<sup>50</sup> Only applies if there are 3 or fewer MPLS labels when an IP header follows the MPLS header

<sup>51</sup> Outer MACs



**Note:**

The following notes apply to table [Table 17: Packet fields used for PW hash-label generation on the 7210 SAS-Sx/S 1/10GE](#) :

- Source and destination MAC addresses are from the outermost Ethernet header.
- MPLS and PBB traffic encapsulation is identified by the system only if the outermost Ethernet has two or fewer VLAN tags.
- Any traffic with three or more VLAN tags uses source and destination MAC and VLAN to generate the hash label.
- The value of the hash label generated for the packet is the same and is not influenced by the configuration of the load-balancing algorithm using the command **configure>lag>load-balancing**.
- Traffic identified as "All other traffic" may or may not have the Ethertype packet field (for example: xSTP traffic does not have Ethertype). Ethertype is used only if available in the outermost Ethernet header for packets with two or fewer VLAN tags.

Table 17: Packet fields used for PW hash-label generation on the 7210 SAS-Sx/S 1/10GE

| Traffic type            | Packet fields used |                 |                  |                        |                 |          |      |
|-------------------------|--------------------|-----------------|------------------|------------------------|-----------------|----------|------|
|                         | EtherType          | Ingress Port-ID | MPLS Label Stack | Source and destination |                 |          | VLAN |
|                         |                    |                 |                  | MAC                    | IP              | L4 Ports |      |
| VPLS and Epipe services |                    |                 |                  |                        |                 |          |      |
| SAP to SDP              |                    |                 |                  |                        |                 |          |      |
| IP traffic              |                    | ✓               |                  |                        | ✓               | ✓        |      |
| PBB traffic             |                    | ✓               |                  |                        |                 |          |      |
| MPLS traffic            |                    | ✓               | ✓ <sup>52</sup>  |                        | ✓ <sup>53</sup> |          |      |
| All other traffic       | ✓                  | ✓               |                  | ✓                      |                 |          | ✓    |
| VPLS service            |                    |                 |                  |                        |                 |          |      |
| SDP to SDP              |                    |                 |                  |                        |                 |          |      |
| All traffic             |                    | ✓               |                  | ✓ <sup>54</sup>        |                 |          |      |

<sup>52</sup> Three MPLS labels deep

<sup>53</sup> Only applies if there are 3 or fewer MPLS labels when an IP header follows the MPLS header

<sup>54</sup> Outer MACs

### 2.7.9.9 ECMP hashing for 7210 SAS devices in network mode

The following table describes the packet fields used for different services and different traffic types, to generate the hash-label.

Table 18: ECMP hashing algorithm for services configured on 7210 SAS devices in network mode

| Traffic type                | Packet fields used |                 |                  |                        |    |          |      |
|-----------------------------|--------------------|-----------------|------------------|------------------------|----|----------|------|
|                             | EtherType          | Ingress Port-ID | MPLS Label Stack | Source and destination |    |          | VLAN |
|                             |                    |                 |                  | MAC                    | IP | L4 Ports |      |
| Network port IPv4 interface |                    |                 |                  |                        |    |          |      |
| IPv4 traffic                |                    | ✓               |                  |                        | ✓  | ✓        |      |
| IES service                 |                    |                 |                  |                        |    |          |      |
| SAP to SAP                  |                    |                 |                  |                        |    |          |      |
| IPv4 traffic                |                    | ✓               |                  |                        | ✓  | ✓        |      |

### 2.7.10 Bidirectional Forwarding Detection over LAG links

The 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-T, and 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE operating in standalone mode support bidirectional forwarding detection (BFD) to monitor individual LAG link members, which speeds up the detection of link failures. When BFD is associated with an Ethernet LAG, BFD sessions are established over each link member; sessions are called micro-BFD (uBFD) sessions. A link is not operational in the associated LAG until the associated micro-BFD session is fully established. The link member is also removed from the operational state in the LAG if the BFD session fails.

If BFD over LAG links is configured before the LAG is active, a link will not become operational in the associated LAG until the associated BFD session is fully established. If a LAG link is already in a forwarding state when BFD over LAG links is enabled, the forwarding state of the LAG link is not influenced until the uBFD session is fully established. A setup timer is started to remove the link from the LAG in the case where the uBFD session is not set up in time. By default, the setup timer value is set to never expire.

When configuring the local and remote IP addresses for BFD over LAG link sessions, the *local-ip* parameter must match an IP address associated with the IP interface to which this LAG is bound. In addition, the *remote-ip* parameter must match an IP address on the remote system, and should also be in the same subnet as the local IP address. If the LAG bundle is reassociated with a different IP interface, the *local-ip* and *remote-ip* parameters should be modified to match the new IP subnet.

### 2.7.10.1 Configuration guidelines and restrictions for BFD over LAG links

The following guidelines apply for BFD over LAG links:

- The local address used for BFD sessions over LAG links cannot be an IP interface address that is associated with R-VPLS services.
- When a micro-BFD session is established, resources are allocated per member port of the LAG. These resources are taken from the pool that is used to map packets to SAPs. Therefore, adding ports to the LAG on which the micro-BFD session is configured reduces the number of SAPs.
- When configuring a micro-BFD session with dot1q encapsulation, an IP interface with dot1q explicit null SAP (:0 SAP) must be configured on the port for the BFD session to be operational. The local IP address of the BFD session can inherit the IP address of the IP interface that is configured with dot1q explicit null SAP or any other IP interface with the LAG.
- The local IP interface address used for micro-BFD sessions must match the address of an IP interface configured on the LAG. If an IP interface is configured with an encapsulation of dot1q explicit null SAP configured on the LAG (lag:0), the uBFD session is not established unless one of the following occurs:
  - The interface using lag:0 also has the same source IP address as the uBFD configuration.
  - There is an operationally up interface with the same source IP address in the same routing instance.
- Micro-BFD sessions share the resources from the pool used to identify MAC addresses belonging to the node, and the sessions must be processed by the applications on the node. Establishing a micro-BFD session results in one less resource available for other applications that use the pool, such as an IP interface, which is explicitly configured with a MAC address. On the 7210 SAS-R6 and 7210 SAS-R12, the MAC address resource is allocated per card, and is only allocated on cards with a LAG member port configured.
- A remote IP address configured for a micro-BFD session must be the same IP address used to configure the micro-BFD session in the peer node.
- The local IP address configured for micro-BFD should belong to the same routing instance as the IP interface configured for :0 LAG.

### 2.7.11 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 all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

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).



**Note:**

The 7210 SAS platforms configured in access-uplink mode cannot peer with an MC-LAG-enabled node because it does not implement MC-LAG protocol; a 7210 SAS-T in access-uplink mode

cannot provide MC-LAG server functionality. Instead they can be used as MC-LAG clients, with the platforms connected to a head-end node that support MC-LAG server functionality. These platforms connect to the head-end node using LAG.

### 2.7.11.1 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.

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.



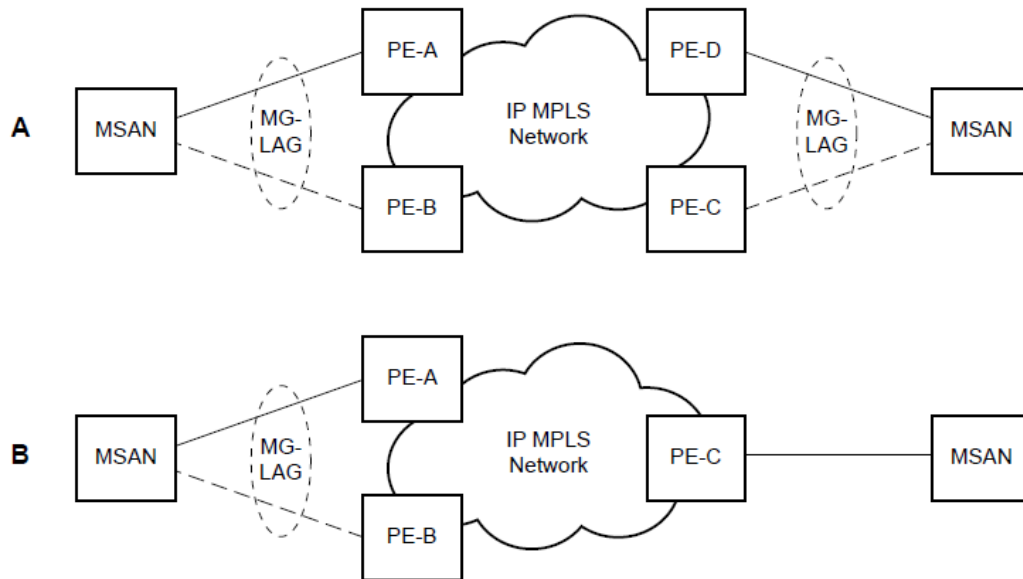
- Traffic over the signaling link is encrypted using a user-configurable message digest key.
- The MC-LAG function provides active/standby status to other software applications to build reliable solutions.

Figure 5: MC-LAG L2 dual homing to remote PE pairs and Figure 6: 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.

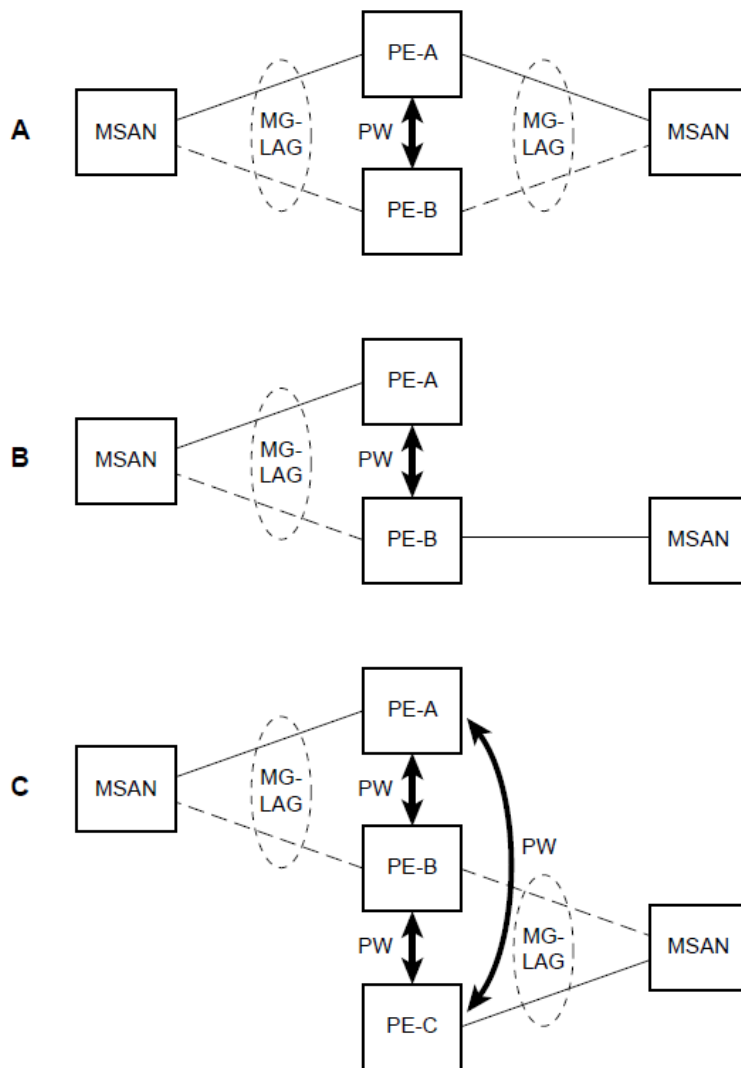
Figure 5: MC-LAG L2 dual homing to remote PE pairs



Fig\_6

The following figure shows dual homing to local PE pairs.

Figure 6: MC-LAG L2 dual homing to local PE pairs



Fig\_7

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.

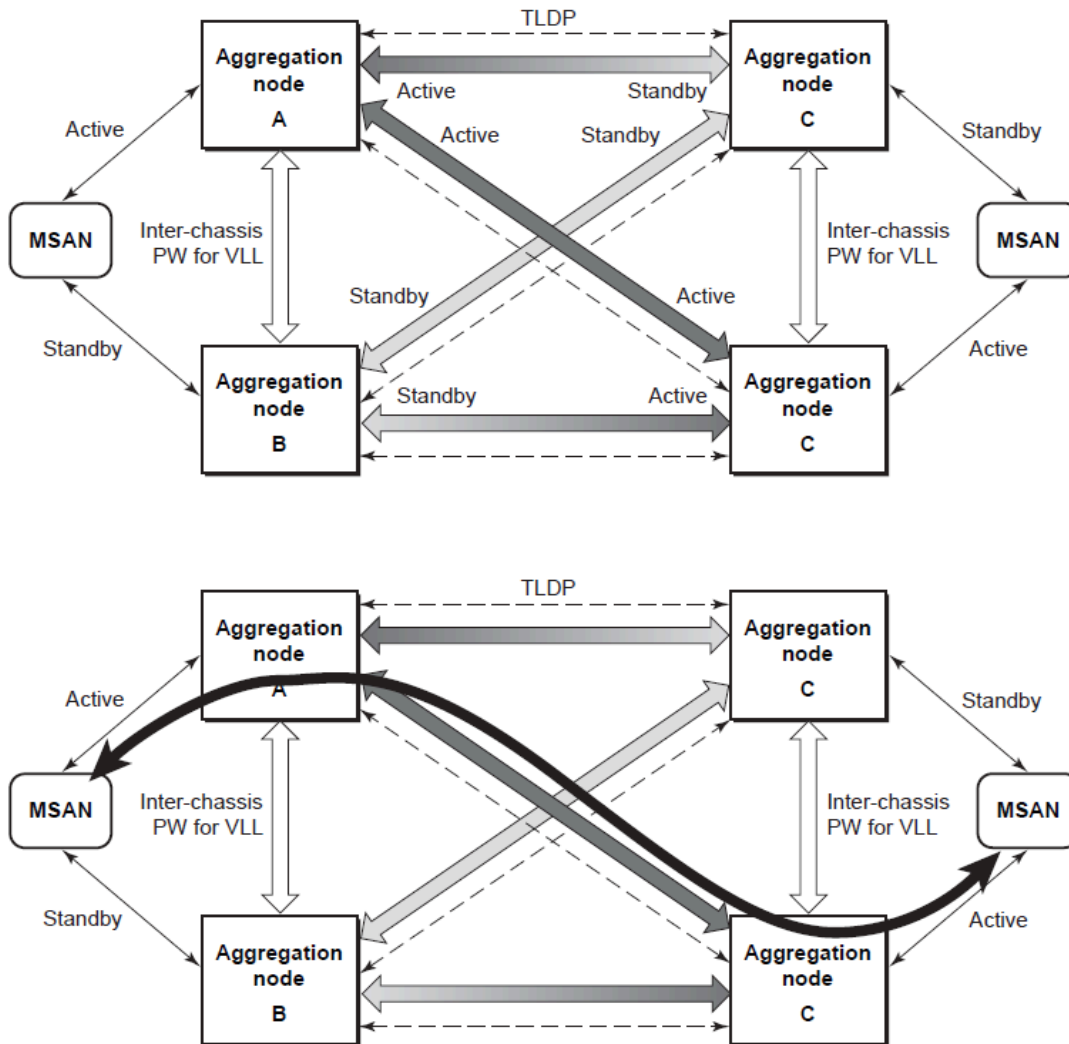
### 2.7.11.2 Point-to-point redundant connection across Layer 2/3 VPN network

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 7: P2P redundant connection through a Layer 2 VPN network



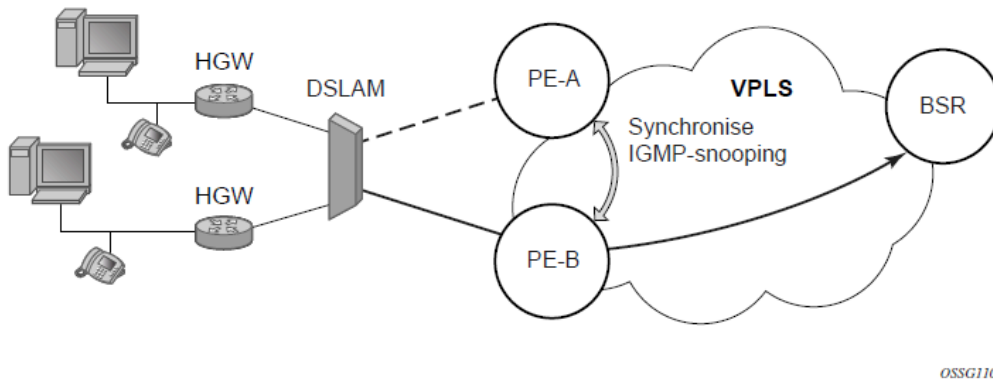
OSSG116

### 2.7.11.3 DSLAM dual homing in Layer 2 network

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

PE-A and PE-B implement MC-LAG toward access. The active node synchronizes the IGMP snooping state with the standby node, allowing the standby node to forward multicast streams to receivers on the access side, if the active node fails.

Figure 8: DSLAM dual-homing using MC-LAG



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#### 2.7.11.4 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-Sx/S 1/10GE can only peer with another 7210 SAS-Sx/S 1/10GE. 7210 SAS-Sx/S 1/10GE cannot be configured with 7210 SAS-Sx 10/100GE.
- MC-LAG is only supported in network mode on 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE. For example, if two MC-LAG peers are set up using 7210 SAS-T, both need to be configured in network mode. It is not possible to have a node operating in network mode to be an MC-LAG peer with a node operating in access-uplink mode. This is true of standalone and standalone-VC modes, as well.
- 7210 SAS-T access-uplink mode supports active/standby LAG, which allows it to be used as client in an MC-LAG solution.

#### 2.7.11.5 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#
```

## 2.8 G.8032 protected Ethernet rings

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

See "G.8032 Ethernet Ring Protection Switching" in the 7210 SAS-Mxp, S, Sx, T Services Guide and the 7210 SAS-R6, R12 Services Guide.

## 2.9 802.1x network access control

The 7210 SAS supports network access control of client devices (PCs, STBs, and others) on an Ethernet network in accordance with the IEEE 802.1x standard (Extensible Authentication Protocol (EAP) over a LAN network or EAPOL).

Layer 2 control protocols affect 802.1x authentication behavior differently depending on the protocol in use; see [Layer 2 control protocol interaction with authentication methods](#) for more information.

### 2.9.1 802.1x 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, 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.

### 2.9.2 802.1x basics

The IEEE 802.1x standard defines three participants in an authentication conversation:

- **supplicant**

This is the end-user device that requests access to the network.

- **authenticator**

This participant controls access to the network. Both the supplicant and the authenticator are referred to as Port Authentication Entities (PAEs).

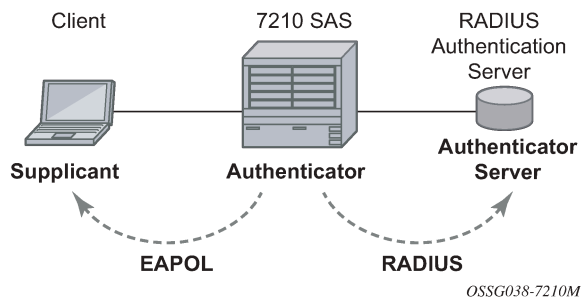
- **authentication server**

This participant 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.

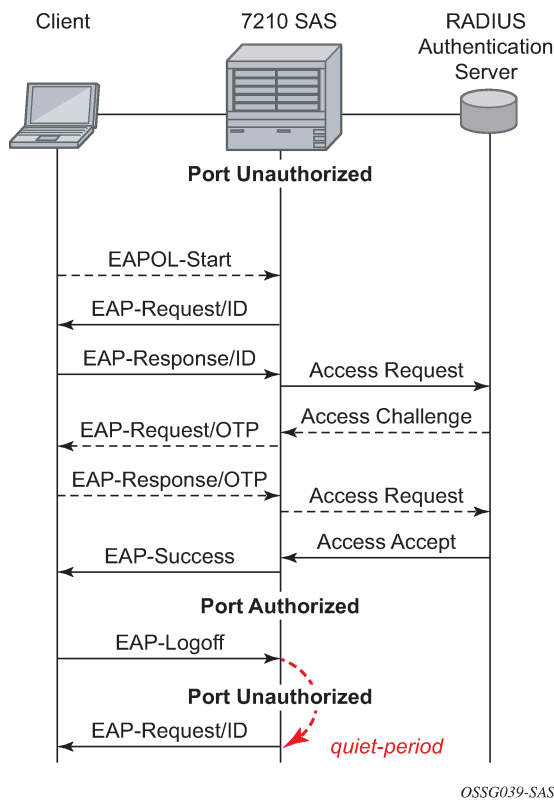
The following figure shows the 802.1x architecture.

*Figure 9: 802.1x architecture*



The following figure shows the messages involved in the authentication procedure.

*Figure 10: 802.1x authentication scenario*



The router will initiate the procedure when the Ethernet port becomes operationally up, by sending a special PDU called EAP-Request/ID to the client. The client can also initiate the exchange by sending an EAPOL-start PDU, if it 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.

### 2.9.3 802.1x 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 scalar:

- **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 following figure shows sample EAPOL and RADIUS timers on the 7210 SAS.

The diagram illustrates the timing of 802.1x EAPOL and RADIUS protocols across three components: Client, 7210 SAS, and RADIUS Authentication Server.

**802.1x EAPOL Timers:**

- transmit-period:** Indicated by a red dashed arrow between the first two EAP-Request/ID messages sent from the Client to the 7210 SAS.
- supplicant-timeout:** Indicated by a red dashed arrow between the third and fourth EAP-Request/ID messages sent from the Client to the 7210 SAS.
- quiet-period:** Indicated by a red dashed arrow between the fourth EAP-Request/ID message sent from the Client to the 7210 SAS and the RADIUS Authentication Server.

**802.1x RADIUS Timers:**

- server-timeout:** Indicated by a red dashed arrow between the first and second Access Request messages sent from the 7210 SAS to the RADIUS Authentication Server.
- max-auth-request:** Indicated by a red dashed arrow between the second and third Access Request messages sent from the 7210 SAS to the RADIUS Authentication Server.
- quiet-period:** Indicated by a red dashed arrow between the EAP-Failure message sent from the RADIUS Authentication Server to the 7210 SAS and the final EAP-Request/ID message sent from the Client to the 7210 SAS.

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.

- generic parameters, which are configured under **config>security>dot1x**
- port-specific parameters, which are configured under **config>port>ethernet>dot1x**

- 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.

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



**Note:**

This feature only applies to port-based Epipe SAPs because 802.1x runs at the port level and not at 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**).



**Note:**

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

2.10 802.3ah 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 mechanism to handle critical link events, including link fault and dying gasp
- dying gasp support; EFM OAM dying gasp messages and SNMP dying gasp messages are mutually exclusive and are generated on power failure. See the *7210 SAS-Mxp, R6, R12, S, Sx, T System Management Guide* for more information about support for SNMP dying gasp.

All 7210 SAS platforms process the EFM OAM dying gasp message received on a port enabled for EFM and generate an SNMP trap. Support for generation of dying gasp messages on 7210 SAS platforms is listed in the following table.

Table 19: Dying gasp message support on 7210 SAS platforms

| 7210 SAS platform | Dying gasp message support <sup>55</sup> |
|-------------------|------------------------------------------|
| 7210 SAS-Mxp      | ✓                                        |
| 7210 SAS-R6       |                                          |

<sup>55</sup> EFM OAM dying gasp messages are generated on either the network ports or access uplink ports based on the operating mode of the device. The messages are not generated on access ports.

| 7210 SAS platform    | Dying gasp message support <sup>55</sup> |
|----------------------|------------------------------------------|
| 7210 SAS-R12         |                                          |
| 7210 SAS-Sx/S 1/10GE | ✓                                        |
| 7210 SAS-Sx 10/100GE | ✓                                        |
| 7210 SAS-T           | ✓                                        |

- loopback, a mechanism provided to support a data link layer frame-level loopback mode. Both remote and local loopback modes are supported.
- EFM OAMPDU tunneling
- high resolution timer for EFM OAM in 500ms interval (minimum)

### 2.10.1 OAM events

EFM OAM defines a set of events that may impact link operation. The following critical link events (as 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.

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.

### 2.10.2 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

<sup>55</sup> EFM OAM dying gasp messages are generated on either the network ports or access uplink ports based on the operating mode of the device. The messages are not generated on access ports.

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.

### 2.10.3 802.3ah 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 the port level, not at the 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 by enabling 802.3ah for a specific port and enabling OAM PDU tunneling for the same port are mutually exclusive.

## 2.11 MAC authentication



**Note:**

MAC authentication is only supported on 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-T.

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.

### 2.11.1 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 step 3 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.

## 2.11.2 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.

## 2.12 VLAN authentication



**Note:**

VLAN authentication is only supported on 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-T.

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.

### 2.12.1 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 step 1.

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

## 2.12.2 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.

## 2.12.3 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-Sx/S 1/10GE (standalone).

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-Mxp, S, Sx, T Services Guide* and *7210 SAS-Mxp, R6, R12, S, Sx, T System Management Guide* for more information and configuration guidelines on dynamic VLAN assignment using dot1x RADIUS authentication with the event handling system (EHS).

## 2.13 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 20: 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<br>Allow if port is authenticated | Block if MAC is unauthenticated<br>Allow if MAC is authenticated | Allow                                                                                  | Allow                                                                      |
| LACP                     | Block if port is unauthenticated<br>Allow if port is authenticated | Block if MAC is unauthenticated<br>Allow if MAC is authenticated | LAG and LACP are not supported on ports with VLAN authentication enabled               | LAG and LACP are not supported on ports with VLAN authentication enabled   |
| CFM                      | Block if port is unauthenticated<br>Allow if port is authenticated | Block if MAC is unauthenticated<br>Allow if MAC is authenticated | Block if VLAN (SAP) is unauthenticated<br>Allow only if specific VLAN is authenticated | Block if null SAP is unauthenticated<br>Allow if null SAP is authenticated |
| xSTP (STP/RSTP/MSTP)     | Block if port is unauthenticated<br>Allow if port is authenticated | Block if MAC is unauthenticated<br>Allow if MAC is authenticated | Block if VLAN (SAP) is unauthenticated<br>Allow if VLAN (SAP) is authenticated         | Block if null SAP is unauthenticated<br>Allow if null SAP is authenticated |

## 2.14 MTU configuration guidelines

The 7210 SAS devices provide the option to configure MTU limitations at many service points. The physical (access and network) port, service, and SDP MTU values must be individually defined.

MTU values must conform to both of the following conditions:

- The service MTU must be less than or equal to the SDP path MTU.
- The service MTU must be less than or equal to the access port (SAP) MTU.

### 2.14.1 Default MTU values

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

Table 21: 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  | network | —          | 1514            |
| Other Ethernet | network | —          | 9212            |
| Ethernet       | hybrid  | —          | 9212            |

**Notes:**

1. The **no service-mtu-check** command disables service MTU check. Disabling the service MTU check allows packets to pass to the egress if the packet length is less than or equal to the MTU configured on the port. The length of the packet sent from a SAP is limited only by the access port MTU. In case of a pseudowire, the length of the packet is limited by the network port MTU (including the MPLS encapsulation).
2. In 7210 SAS, length of the SAP tag (or service-delimiting tag, for a packet received over a pseudowire) is included in the computation of the packet length before comparing it with the service-MTU configured for the service. Packet length= Length of IP packet + L2 header + length of SAP tag

For example, if the IP packet received over a dot1q SAP is 1500 and the service-MTU configured is 1514, the service MTU validation check fails as:

Packet length=1500 (Length of IP packet) +14 (L2 header) +4 (length of SAP tag) =1518. The packet is dropped as packet length is greater than the service MTU configured.



**Note:**

See the 7210 SAS release notes for other restrictions with regards to MTU checking and processing on each of the platforms.

## 2.15 Deploying preprovisioned components on 7210 SAS

This section describes the deployment of preprovisioned components on 7210 SAS platforms.

### 2.15.1 Deploying preprovisioned components for 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE.

Appropriate MDAs are auto-provisioned on the 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE. The user is not required to provision the slots or MDA on these platforms.

## 2.15.2 Deploying preprovisioned components for 7210 SAS-R6 and 7210 SAS-R12

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

When the correct preprovisioned cards are installed in the appropriate chassis slot, alarm, status, and performance details display.

The 7210 SAS-R6 has 6 IMM slots and 2 SF/CPM slots, which are not auto-provisioned and need to be provisioned by the user.

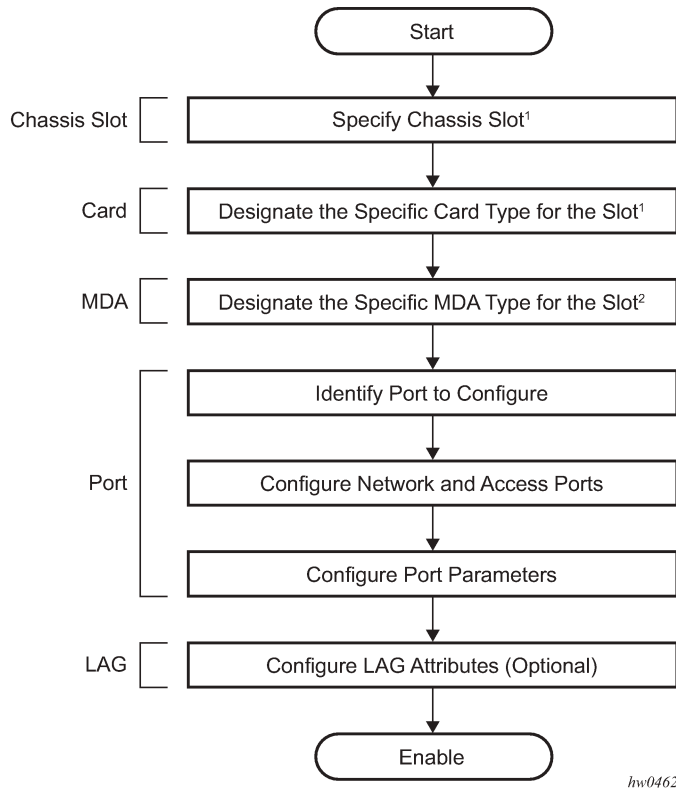
The 7210 SAS-R12 has 12 IMM slots and 2 SF/CPM slots, which are not auto-provisioned and need to be provisioned by the user.

The 7210 SAS-R6 and 7210 SAS-R12 allow the user to preprovision the chassis to accept either IMMv2 or IMM-c cards. By default, without any configuration, the chassis accepts IMMv2 cards. Use the **configure>system>allow-imm-family** command to configure the type of card the chassis can accept and reboot the device for the value to take effect. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information about this command.

## 2.16 Configuration process overview

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

Figure 12: Slot, card, MDA, and port configuration and implementation flow



**Note:**

- Specifying the chassis slot and card type is not needed for fixed platforms such as 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE; these platforms do not support removable cards. On fixed platforms, the card type is auto-provisioned. It is typically used only on chassis-based platforms that support slots for inserting cards, such as the 7210 SAS-R6 and 7210 SAS-R12.
- Specifying the MDA type is not required on platforms that do not support an MDA, such as 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-R6, and 7210 SAS-R12. 7210 SAS-Mxp does not have an expansion slot and therefore does not support MDAs.

## 2.17 Configuring physical ports with CLI

This section provides information to configure ports.

## 2.18 Preprovisioning guidelines

The 7210 SAS platforms have a console port to connect terminals to the device. The Ethernet management port is supported.

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

## 2.18.1 Predefining entities

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:

- provision the chassis to accept specific IMM cards on the 7210 SAS-R6 and 7210 SAS-R12
- 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 (7210 SAS-R6 and 7210 SAS-R12). On 7210 SAS platforms that do not support any removable cards or 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 (7210 SAS-R6 and 7210 SAS-R12). On 7210 SAS platforms that do not support any removable cards or MDAs, the MDAs are preprovisioned for all fixed ports.

## 2.18.2 Preprovisioning a port

On 7210 SAS chassis-based platforms (7210 SAS-R6 and 7210 SAS-R12), before a port can be configured, the slot must be preprovisioned with an allowed card type or the MDA must be preprovisioned with an allowed MDA type.

Some recommendations to configure a port include:

- Ethernet
  - Configure an access port for customer facing traffic on which services are configured.  
An encapsulation type may be specified to distinguish services on the port or channel. Encapsulation types are not required for network ports.  
To configure an Ethernet access port, see [Ethernet access port](#).
  - Configure a network port to participate in the service provider transport or infrastructure network.  
To configure an Ethernet network port, see [Ethernet network port](#).  
Accounting policies can only be associated with network ports and Service Access Points (SAPs). Accounting policies are configured in the **config>log>accounting-policy** context.

When ports are preprovisioned, Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two nodes. All physical links in a specific LAG combine to form one logical connection. A LAG also provides redundancy in case one or more links that participate in the LAG fail. For command syntax, see [Configuring LAG parameters](#).

## 2.19 Basic configuration

For 7210 SAS platforms that do not support any removable cards or MDAs (7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE), the card and MDA is auto-provisioned and operators can directly start with identifying and configuring the ports as follows.

On 7210 SAS chassis-based platforms, (7210 SAS-R6 and 7210 SAS-R12), the card type must be provisioned and operators need to start from identifying the chassis slot and configuration of the slot and card type, as shown below.

The most basic configuration must have the following:

- identify chassis slot (if applicable)
- specify line card type (must be an allowed card type).
- identify MDA slot (if applicable)
- specify MDA (must be an allowed MDA type) – if applicable
- identify specific port to configure

### 2.19.1 Configuring cards and MDAs

Card configurations include a chassis slot designation.

#### Example

The following is a sample of card configuration output for the 7210 SAS-R6.

```
A:SASR6>config>card# info
-----
card-type imm-sas-2xfp
mda 1
no shutdown
exit
no shutdown
-----
A:SASR6>config>card#
```

### 2.19.2 Configuration notes for provisioning of cards

The following provisioning guidelines and restrictions apply:

- On 7210 SAS systems that require provisioning of the card type (7210 SAS-R6 and 7210 SAS-R12), if a card type is installed in a slot provisioned for a different type, the card will not initialize.
- On 7210 SAS systems that require provisioning of a card (7210 SAS-R6 and 7210 SAS-R12), if the card is installed in an unprovisioned slot, it will remain administratively and operationally down until the card type is specified.
- Ports cannot be provisioned until the slot and card type are specified, on systems that require provisioning of the card. Ports can be provisioned on bootup on systems that auto-provision the cards (7210 SAS-T, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE).

### 2.19.2.1 Configuration notes for provisioning of 7210 SAS-R6 IMMv2 (IMM-b) cards

The 7210 SAS-R6 platform supports IMM version-2 cards (imm-sas-b variants). To use IMMv2 cards, you must provision the chassis using the **config>system>chassis>allow-imm-family** CLI command as shown below. This command allows the software know which version of cards will be used in the system and allows it to initialize the system appropriately with the correct set of parameters. A change to this value requires a reboot of the chassis.

```
config>system>chassis#
    allow-imm-family imm-family
```

where:

*imm-family* = imm-sas-r-b | imm-sas-r-c

- imm-sas-r-b: use for IMMv2
- imm-sas-r-c: use for IMM-c

For the list of IMM supported in a particular release, see the release notes.

The user can change the value of **allow-imm-family** at any time. It does not change the operational state of the chassis. For the value to take effect, the user must reboot. If the software detects a mismatch in the cards specified by **allow-imm-family** and the IMM cards provisioned/equipped in the chassis, it will generate an error as shown below.

```
*A:NS140500018# /configure system chassis allow-imm-family ?
- allow-imm-family <imm-family>
- no allow-imm-family

<imm-family>          : imm-sas-r-b|imm-sas-r-c
*A:NS140500018# /configure system chassis allow-imm-family imm-sas-r-b
INFO: CHMGR #4004 Configuration changes successful. Reboot the chassis for configura
tion to take effect.
```

Use the following command to display a list of supported cards per family.

```
*A:sasr_dutb>show>system# chassis imm-family all

=====
IMM FAMILY INFORMATION
=====
IMM-TYPE                IMM-FAMILY                SUPPORTED
-----
imm-sas-b-4sfp+         imm-sas-r-b              ---
imm-sas-b-2sfp+         imm-sas-r-b              ---
imm-sas-b-10sfp-1sfp+   imm-sas-r-b              ---
imm-sas-b-11csfp        imm-sas-r-b              ---
imm-sas-b-16tx          imm-sas-r-b              ---
=====
*A:sasr_dutb>show>system#
```

Use the following command to display the list of IMM cards allowed in the chassis based on the configured value of **allow-imm-family**.

```
*A:sasr_dutb>show>system# chassis imm-family configured

=====
```

#### IMM FAMILY INFORMATION

| IMM-TYPE              | IMM-FAMILY  | SUPPORTED |
|-----------------------|-------------|-----------|
| imm-sas-b-4sfp+       | imm-sas-r-b | ----      |
| imm-sas-b-2sfp+       | imm-sas-r-b | ----      |
| imm-sas-b-10sfp-1sfp+ | imm-sas-r-b | ----      |

\*A:sasr\_dutb>show>system#



#### Note:

For more information about upgrading the chassis to use IMMv2 cards, see the *7210 SAS-R6 Chassis Installation Guide*.

### 2.19.2.2 Configuration notes for provisioning of 7210 SAS-R6 IMM-c cards

The user has the option to aggregate 1G and 10G customer services to 100GE uplinks to meet the increasing bandwidth needs in access networks by provisioning 7210 SAS-R6 IMM-c cards. The QSFP28 (named imm-sas-c-1qsfp28) variant is supported, providing the flexibility of using optics based on needs.

Before using the card, the command **config>system>chassis>allow-imm-family imm-sas-r-c** must be used, followed by a reboot of the node to allow the system to initialize correctly when using the new card.

On both the 7210 SAS-R6 and 7210 SAS-R12, imm-b and imm-c can be used simultaneously (that is, some slots can be populated with imm-b and some slots can be populated with imm-c). To achieve that, configure both **imm-sas-r-b** and **imm-sas-r-c** using the CLI command **config>system>chassis>allow-imm-family**. The system scaling of the functions supported when a mix of IMM-b and IMM-c are in use in the chassis is the lower of the scaling supported by each of the cards. See the scaling guide or contact your Nokia representative for more information.

```
config>system>chassis#
    allow-imm-family imm-family
```

where:

*imm-family* = imm-sas-r-b | imm-sas-r-c

- imm-sas-r-b: use for IMMv2
- imm-sas-r-c: use for IMM-c

The following guidelines and restrictions apply:

- IMM-c supports hot-swapping (after one-time configuration of the node).
- On the 7210 SAS-R6, only two 100GE IMM-c cards in specified slots can be used. On the 7210 SAS-R12, all slots can be populated with 100GE IMM-c cards.
- SyncE (as a reference and for distribution of frequency) and PTP (IEEE default and G.8265.1 profile) are available for use with the 100GE port.
- Supports eight egress queues per network port for egress queuing and scheduling, along with MPLS EXP based marking, for prioritizing service traffic on network uplinks. Supports network port ingress classification with policing and network IP interface ingress classification with policing to differentiate and prioritize service traffic.
- 100GE QSFP28 IMM-c variant does not provide a breakout option.



## 2.20 Common configuration tasks

This section describes common configuration tasks.

### 2.20.1 Configuring ports

```
*A:7210SAS_duth>config>port# info detail
-----
description "10/100/Gig Ethernet TX"
access
  egress
    pool default
    resv-cbs default
    slope-policy "default"
  exit
exit
exit
network
  egress
    pool default
    no amber-alarm-threshold
    no red-alarm-threshold
    resv-cbs default
    slope-policy "default"
  exit
exit
exit
-----
*A:7210_SAS_duth>config>port#
```

#### 2.20.1.1 Configuring Ethernet port parameters

This section describes Ethernet port configuration.

##### 2.20.1.1.1 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
  mode network
exit
no shutdown
-----
A:ALA-B>config>port#
```

### 2.20.1.1.2 Ethernet access-uplink port

Access-uplink ports are network-facing and transport customer services. Only QinQ encapsulation can be used.

#### Example

The following is a sample access-uplink port configuration output.

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

### 2.20.1.1.3 Ethernet access port

Services are configured on access ports used for customer-facing traffic. If a SAP is to be configured on a port, it must be configured in access 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 output.

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

### 2.20.1.1.4 Configuring 802.1x authentication port parameters

#### Example

The following is a sample 802.1x port configuration output.

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

```
port-control auto
radius-plcy dotlxpolicy
re-authentication
re-auth-period 3600
max-auth-req 2
transmit-period 30
quiet-period 60
supplicant-timeout 30
server-timeout 30
-----
```

### 2.20.1.1.5 Configuring MAC authentication port parameters



**Note:**

MAC authentication is only supported on 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-T.

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

The following example shows the 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 dotlxpolicy
```

#### Example: 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 dotlxpolicy
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#

```

### 2.20.1.1.6 Configuring VLAN authentication port parameters



**Note:**

VLAN authentication is only supported on 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-T.

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

The following example shows the 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: 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
vlan-auth
-----

```

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

## 2.20.2 Configuring LAG parameters

The following guidelines and restrictions apply for LAG configurations:

- LAG configurations must include at least two ports.
- Up to eight ports can be included in a LAG, depending on the platform. 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.
- The 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12 support IP DSCP table-based classification for LAG. See "Service Ingress QoS Policies" in the 7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide for more information.

### Example: LAG configuration output

```
*A:7210SAS>config>lag# info detail
-----
no mac
mode hybrid
encap-type dot1q
no enable-dei
no enable-table-classification
port 6/1/1 priority 32768 sub-group 1
no dynamic-cost
lacp active administrative-key 32770
port-threshold 0 action down
lacp-xmit-interval fast
lacp-xmit-stdby
no selection-criteria
no hold-time
standby-signaling lacp
no shutdown
-----
*A:7210SAS>config>lag#
```

### 2.20.2.1 Configuring BFD Over LAG links

After the LAG and associated links are configured, you can configure BFD in the LAG context to create and establish the micro-BFD session per link. Before micro-BFD can be established, an IP interface must be associated with the LAG or a VLAN within the LAG, if dot1q encapsulation is used.

Perform the following to enable and configure BFD over individual LAG links.

1. Within the **lag** context, enter the **bfd** context and enable BFD.
2. Configure the address family for the micro-BFD sessions. Only one address family per LAG can be configured. On the 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12, only the IPv4 address family can be configured.
3. Configure the local IP address for the BFD sessions.

#### 4. Configure the remote IP address for the BFD sessions.

When configuring the local and remote IP address for the BFD over LAG link sessions, ensure that the *local-ip* parameter should always match an IP address associated with the IP interface to which the LAG is bound. In addition, the *remote-ip* parameter must match an IP address on the remote system and should also be in the same subnet as the *local-ip* address. If the LAG bundle is reassigned with a different IP interface, modify the *local-ip* and *remote-ip* parameters to match the new IP subnet. The *local-ip* and *remote-ip* values do not have to match a configured interface in the case of tagged LAG or ports.

The following optional parameters can be configured for BFD over LAG links:

- transmit interval
- receive interval
- multiplier
- max-wait-for-up-time — This parameter controls how long a link will remain active if BFD is enabled after the LAG and associated links are active and in a forwarding state.
- max-time-admin-down — This parameter controls how long the system will wait before bringing the associated link out of service if an admin down message is received from the far end.

#### Example

The following is a sample configuration output.

```
*A:Dut-C>config>lag# info
-----
      bfd
        family ipv4
          local-ip-address 10.120.1.2
          receive-interval 1000
          remote-ip-address 10.120.1.1
          transmit-interval 1000
          no shutdown
        exit
      exit
    no shutdown
```

### 2.20.3 Configuring access egress queue overrides

Queue override support on an access port in the egress direction allows users to override queue parameters such as adaptation rule, percent CIR and PIR rates, queue management policy, queue mode, CIR and PIR rates, and queue weight.

When the queue override feature is not used, queue parameters for the port are taken from the access egress QoS policy assigned to the port.

#### Example

The following is a sample queue override configuration output.

```
*A:dut-g>config>port>ethernet>access>egr>queue-override# info
-----
      queue "1" create
        queue-mgmt default
        queue-mode strict
        weight 7
        rate cir 3000 pir 90000
```

```

    adaptation-rule cir min pir max
    exit
    queue "5" create
    queue-mgmt 200
    queue-mode weighted
    weight 1
    percent-rate cir 5.00 pir 10.00
    adaptation-rule cir min pir closest
    exit
    queue "8" create
    exit
-----
*A:dut-g>config>port>ethernet>access>egr>queue-override#

```

## 2.20.4 CRC error monitoring

This feature allows the user to track CRC (cyclic redundancy check) errors received on a specific port. 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, and trap, but does not bring the physical port down, while the second (signal fail) threshold crossing logs an alarm, generates a trap, and brings the port operationally down.

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



### Note:

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

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

The values provided by the user for threshold and multiplier are used to compute the error ratio as  $(\text{multiplier} * (10 ^ - (\text{threshold value})))$ . Port statistics are collected once per second and accumulated over the configured window size. Each second, the oldest sample is discarded and the new sample is added to a running total. If the error ratio exceeds the configured threshold (as computed previously) over the window size for 2 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 the configured signal fail threshold value, an alarm log message, syslog event, and SNMP trap are raised, and the port is brought operationally down.

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

## 2.21 Service management tasks

This section describes the service management tasks.

### 2.21.1 Modifying or deleting an MDA

To change an MDA type already provisioned for a specific slot/card, the slot/MDA/port configuration must be shut down and then the MDA must be deleted 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
```

### 2.21.2 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.

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

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

### 2.21.3 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.

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

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

### 2.21.4 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
```

## 2.22 Card, MDA, and port command reference

### 2.22.1 Command hierarchies

- [Hardware commands](#)
- [MDA commands](#)
- [Port configuration commands for PTP port-based timestamp](#)
- [Port-based split horizon group configuration commands](#)
- [Port configuration commands for DWDM Optics](#)
- [Port loopback commands](#)
- [Port QoS slope policy commands](#)
- [Port Ethernet commands](#)
- [LAG commands](#)
- [Multi-chassis redundancy commands](#)
- [Ethernet ring commands](#)
- [Show commands](#)
- [Monitor commands](#)
- [Clear commands](#)
- [Debug commands](#)

#### 2.22.1.1 Configuration commands

##### 2.22.1.1.1 Hardware commands

```
config  
- [no] card slot-number  
  - card-type card-type  
  - sys-res-profile policy-id  
  - no sys-res-profile
```

##### 2.22.1.1.2 MDA commands

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

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

### 2.22.1.1.3 Port configuration commands for PTP port-based timestamp

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

### 2.22.1.1.4 Port-based split horizon group configuration commands

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

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

### 2.22.1.1.5 Port configuration commands for DWDM Optics

```
config
- port {port-id}
- no port
- description long-description-string
- no description
- dwdm
- channel channel
```

### 2.22.1.1.6 Port loopback commands

```
configure
- system
- loopback-no-svc-port [mac-swap mac-swap port-id] [mirror mirror-port-id]
[testhead testhead port-id] [p2mpbud p2mpbud-port-id] [p2mp-bud-classification]
- no loopback-no-svc-port [mac-swap mac-swap port-id] [mirror mirror-port-id]
[testhead testhead port-id] [p2mpbud p2mpbud-port-id]
```

### 2.22.1.1.7 Port QoS slope policy commands

```
config
- port
- no port
- access
```

```

- egress
  - [no] pool [name]
  - slope-policy name
  - no slope-policy
- uplink
  - egress
    - [no] pool [name]
    - slope-policy name
    - no slope-policy
- network
  - egress
    - [no] pool [name]
    - slope-policy name
    - no slope-policy

```

## 2.22.1.1.8 Port Ethernet commands

### 2.22.1.1.8.1 General 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}
    - encap-type {dot1q | null | qinq}
    - [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
    - hold-time {[up hold-time up] [down hold-time down] [seconds| centiseconds]}
    - no hold-time
    - [no] lacp-tunnel
    - mac ieee-address
    - no mac
    - mode {access [uplink] network| hybrid}
    - no mode
    - monitor-oper-group name
    - no monitor-oper-group
    - mtu mtu-bytes
    - no mtu
    - multicast-egress {l2-switch | l3-fwd}
    - no multicast-egress
    - multicast-ingress {l2-mc | ip-mc}
    - no multicast-ingress
    - no loopback {internal} [service svc-id sap sap-id src-mac SA dst-mac DA]
    - no oper-group
    - oper-group name
    - no poe
    - poe [plus]
    - qinq-etype 0x0600..0xffff
    - no qinq-etype
    - rs-fec-mode rs-fec-mode
    - no rs-fec-mode

```

```
- [no] report-alarm [signal-fail] [remote] [local]
- speed {10 | 100 | 1000 | 10000}
- [no] shutdown
```

## 2.22.1.1.8.2 Port Ethernet QoS commands

```
config
- [no] port {port-id}
- ethernet
- access-ingress-qos-mode {sap-mode | port-mode}
- access
- accounting-policy acct-policy-id
- no accounting-policy
- [no] collect-stats
- egress
- qos policy-id
- no qos
- [no] queue-override
- [no] queue queue-id [create]
- adaptation-rule cir {max | min | closest} [pir {max | min |
closest}]
- no adaptation-rule
- percent-rate cir cir-percent [pir pir-percent]
- no percent-rate
- queue-mgmt name
- no queue-mgmt
- queue-mode queue-mode
- no queue-mode
- rate cir cir-rate [pir pir-rate]
- no rate
- weight weight
- no weight
- ingress
- dot1p-classification policy-id
- no dot1p-classification
- dscp-classification policy-id
- no dscp-classification
- untagged-fc fc
- no untagged-fc
- qos policy-id
- no qos
- uplink
- accounting-policy acct-policy-id
- no accounting-policy
- [no] collect-stats
- qos policy-id
- no qos
- queue-policy name
- no queue-policy
- egress-rate sub-rate [max-burst size-in-kbits]
- no egress-rate
- egress-scheduler-policy port-scheduler-policy-name
- no egress-scheduler-policy
- enable-dei
- no enable-dei
- enable-table-classification
- no enable-table-classification
- network
- accounting-policy policy-id
- no accounting-policy
- [no] collect-stats
```

```
- qos policy-id
- no qos
- queue-policy name
- no queue-policy
```

### 2.22.1.1.8.3 Port Ethernet CRC Monitoring commands

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

### 2.22.1.1.8.4 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 quiet-period
- [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
```

### 2.22.1.1.8.5 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**

### 2.22.1.1.8.6 Port Ethernet EFM OAM commands

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

### 2.22.1.1.8.7 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
```

### 2.22.1.1.8.8 Port Ethernet sync commands

```
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
```

## 2.22.1.1.9 LAG commands

```

config
- [no] lag [lag-id]
- access-ingress-qos-mode {sap-mode | port-mode}
- bfd
- [no] disable-soft-reset-extension
- family {ipv4}
- [no] bfd-on-distributing-only
- local-ip-address ip-address
- no local-ip-address
- max-admin-down-time [down-interval]
- no max-admin-down-time infinite
- no max-admin-down-time
- max-setup-time [up-interval]
- no max-setup-time infinite
- no max-setup-time
- multiplier [multiplier]
- no multiplier
- receive-interval interval
- no receive-interval
- remote-ip-address ip-address
- no remote-ip-address
- [no] shutdown
- transmit-interval interval
- no transmit-interval
- description long-description-string
- no description
- [no] dynamic-cost
- enable-table-classification
- no enable-table-classification
- enable-dei
- no enable-dei
- encap-type {dot1q | null | qinq}
- no encap-type
- hold-time down hold-down-time
- no hold-time
- lacp [mode] [administrative-key admin-key] [system-id system-id] [system-priority
priority]
- lacp-xmit-interval {slow | fast}
- no lacp-xmit-interval
- [no] lacp-xmit-stdby
- load-balancing hash parameters
- mac ieee-address
- no mac
- mode access [uplink]
- no mode
- monitor-oper-group name
- no monitor-oper-group
- no oper-group
- oper-group name
- port port-id [port-id ...] [priority priority] [sub-group sub-group-id]
- no port port-id [port-id ...]
- port-threshold value [action {dynamic-cost | down}]
- port-threshold
- selection-criteria [{highest-count | highest-weight | best-port}] [slave-to-partner]
- no selection-criteria
- standby-signaling {lacp | power-off}
- no standby-signaling
- [no] shutdown
- system
- lag

```

- **lb-hash-1-version** *version*
- **no lb-hash-1-version**

### 2.22.1.1.10 Multi-chassis redundancy commands

```

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

```

### 2.22.1.1.11 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] interconnect {ring-id ring-id | vpls}
- [no] propagate-topology-change
- [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] control-sap-tag tag-range
- [no] description description-string
- [no] eth-test-enable
  - [no] test-pattern {all-zeros | all-ones} [crc-enable]
  - bit-error-threshold bit-errors
- low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon | xcon
| noXcon}
- mac-address mac-address
- one-way-delay-threshold seconds
- [no] shutdown
- [no] shutdown

```

## 2.22.1.2 Show commands

```

show
- chassis [environment] [power-supply]
- card state
- card [slot-number]
- card [slot-number] [detail]
- card [slot-number] active-resource-profile
- card [slot-number] fabric-port-status
- 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 [detail]
- port port-id description
- port port-id associations
- port port-id dot1x [detail]
- port port-id ethernet [efm-oam | detail]
- port port-id optical
- port [A1] [detail] [statistics] [description]
- port port-id acr [detail]
- port port-id ptp-hw-timestamp
  - ethernet
    - lldp [nearest-bridge | nearest-non-tpmr | nearest-customer] [remote-info]
[detail] [lldp-med]
- poe [detail]
- 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

```

## 2.22.1.3 Monitor commands

```

monitor

```

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

#### 2.22.1.4 Clear commands

```
clear  
- lag lag-id statistics  
- mda mda-id [statistics]  
- port port-id statistics
```

#### 2.22.1.5 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] [mc] [mc-pkt]  
- no lag [lag-id lag-id]
```

### 2.22.2 Command descriptions

- [Configuration commands](#)
- [Show commands](#)
- [Clear commands](#)
- [Debug commands](#)

#### 2.22.2.1 Configuration commands

- [Generic commands](#)
- [Card commands](#)
- [MDA commands](#)
- [Interface QoS commands](#)
- [General port commands](#)
- [Port loopback commands](#)
- [Ethernet port commands](#)
- [802.1x port commands](#)
- [LLDP Ethernet port commands](#)
- [Port commands](#)
- [LAG commands](#)
- [Ethernet ring commands](#)
- [Ethernet tunnel commands](#)

- [Multi-chassis redundancy commands](#)
- [MC Endpoint commands](#)
- [MC LAG commands](#)

### 2.22.2.1.1 Generic commands

#### description

##### Syntax

**description** *long description-string*

**no description**

##### Context

config>port

config>lag

##### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

##### 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*

Specifies 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>efm-oam
config>port>ethernet>ssm
config>redundancy>multi-chassis>peer>mc-lag
```

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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

card — no shutdown  
mda — no shutdown  
lag — shutdown  
mc-lag — shutdown  
port — shutdown

## Special Cases

### MC-LAG protocol handling for 7210 SAS-Mxp

When the **no shutdown** command is issued in the **config>redundancy>multi-chassis>peer>mc-lag** context, resources are allocated to enable the node to process the protocol.

The resources are deallocated when you issue the **config>redundancy>multi-chassis>peer>mc-lag>shutdown** command.

## 2.22.2.1.2 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 chassis card Input/Output Module (IOM), slot, and MDA CLI context.

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

## Default

the IOM card is equipped and provisioned for slot 1

## Parameters

### *slot-number*

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 command configures the card 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.



**Note:**

This command is not required for 7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE, and 7210 SAS-Mxp devices as the cards are preprovisioned.

In a virtual chassis (VC), when the TiMOS image boots up on the CPM-IMM and the IMM-only cards/nodes, users must provision the card type on each member node so that the software knows which hardware platforms are members of the VC. The software can then determine the logical IMM types that are part of the VC. Provisioning the card type is a mandatory step in the bring up of virtual chassis system in order for all the member nodes to be fully functional.

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

**Default**

the IOM card is equipped and preprovisioned for slot 1

**Parameters**

***card-type***

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

**Values** iom-sas (7210 SAS-Mxp, and 7210 SAS-Sx/S 1/10GE (standalone))  
imm-sas-10sfp+1xftp | imm-sas-10sfp | imm-sas-2xftp | imm-sas-b-4sfp+  
| imm-sas-b-2sfp+ | imm-sas-b-10sfp-1sfp+ | imm-sas-b-11csfp | imm-  
sas-b-16tx | imm-sas-c-1qsfp28 (7210 SAS-R6)  
imm-sas-b-4sfp+ | imm-sas-b-4xftp | imm-sas-b-2sfp+ | imm-sas-  
b-10sfp-1sfp+ | imm-sas-b-11csfp | imm-sas-b-16tx | imm-sas-  
c-1qsfp28 (7210 SAS-R12)  
sas-sx-24sfp-4sfpp | sas-sx-48sfp-4sfpp | sas-sx-24t-4sfpp | sas-  
sx-48t-4sfpp | sas-s-24sfp-4sfpp | sas-s-48sfp-4sfpp | sas-s-24t-4sfpp  
| sas-s-48t-4sfpp | sas-sx-24tp-4sfpp | sas-sx-48tp-4sfpp | sas-  
s-24tp-4sfpp | sas-s-48tp-4sfpp (7210 SAS-Sx 1/10GE (standalone-vc))

## sys-res-profile

**Syntax**

[no] **sys-res-profile** *policy-id*

**Context**

config>card

**Platforms**

7210 SAS-R6, 7210 SAS-12, and 7210 SAS-Sx/S 1/10GE (standalone-VC)

**Description**

This command attaches the system resource-profile policy. The system resource profile parameters are defined as a policy. The user must configure the system resource profile policy and associate it with the

IMM card. The software reads the configured policy and allocates resources appropriately per IMM card. It allows users to allocate resources to different features per IMM card.



**Note:**

On 7210 SAS-R6 and 7210 SAS-R12, some of the system resource profile parameters are applicable to the entire node and not per IMM card.

For more information about the CLI descriptions for System Resource Profile parameters, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide*.

## Default

system attaches the default system resource-profile to each IMM when it is booted up

## Parameters

### *policy-id*

Specifies the system resource profile policy to use for this card.

**Values** 1 to 16

## 2.22.2.1.3 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, including platforms configured in the access-uplink operating mode

## Description

This command enables the MDA CLI context to configure MDAs.



**Note:**

All 7210 SAS platforms auto-provision MDAs and do not require this command to be configured.

## Parameters

### *mda-slot*

Specifies the MDA slot number to be configured. Fixed ports on the panel of the chassis belong to MDA 1.

## Values 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 command configures 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 after the MDA is correctly provisioned.

All 7210 SAS platforms (unless noted otherwise) support a fixed MDA. The fixed MDA (addressed as mda 1) is auto-equipped and auto-provisioned on boot up. It cannot be deleted. An error message is shown in case a **no mda-type** command is executed on a fixed MDA.



#### Note:

All 7210 SAS platforms auto-provision MDAs and do not require this command to be configured.

The **no** form of this command deletes the MDA from the configuration.

#### Default

MDA 1 is auto-equipped and auto-provisioned by default during boot up

#### Parameters

**mda-type**

Specifies the type of MDA selected for the slot position.

|               |                                                                                                                             |
|---------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Values</b> | 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-Mxp — The logical MDA with fixed ports is auto-provisioned |
|               | 7210 SAS-R6, 7210 SAS-R12 — The logical MDA (which is named based on the type of IMM) is auto-provisioned                   |

### sync-e

#### Syntax

**[no] sync-e**



## Context

config>card>mda

## Platforms

7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE, 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## 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. It is highly recommended to use copper port only for distribution of synchronous Ethernet and not as a reference.

See the *7210 SAS-Mxp, R6, R12, S, Sx, T 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

## 2.22.2.1.4 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 egress and ingress pool policy parameters.

### network

## Syntax

**network**

## Context

config>port

## Platforms

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

## Description

Commands in this context configure egress and ingress pool policy parameters.

## uplink

## Syntax

uplink

## Context

config>port>access

## Platforms

7210 SAS-T

## Description

Commands in this context configure access pool parameters.

## egress

## Syntax

egress

## Context

config>port>access

config>port>network

config>port>uplink

## Platforms

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

## Description

Commands in this context specify the slope policy that is configured in the **config>qos>slope-policy** context.

## ingress

### Syntax

**ingress**

### Context

config>port>ethernet>access

### Platforms

7210 SAS-Mxp, 77210 SAS-R6, and 7210 SAS-R12.

### Description

This command configures Ethernet access ingress port QoS parameters.

## pool

### Syntax

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

### Context

config>port>access>egress

config>port>network>egress

config>port>access>uplink>egress

### Platforms

7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

### Description

Commands in this context configure the slope policy for the queues associated with this port.

### 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>pool

config>port>network>egress

### Platforms

7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

### Description



**Note:**

The **config>port>access>uplink>pool** context is only supported on 7210 SAS platforms operating in the access-uplink mode.

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

### 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

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

On 7210 SAS-T operating in access uplink mode, this policy is used to enable port-based marking and configuring port-based queue parameters. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

On 7210 SAS-T operating in network mode, this policy is used to enable port-based marking and configuring port-based queue parameters. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

On 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, when SAP based egress queuing is configured, this policy is used to configure only marking values for packets sent out of access ports. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* and the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

On 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, when port-based queues are used on access ports, this policy is used to configure marking values and to configure the port-based queue parameters. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* and the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

On 7210 SAS-Sx/S 1/10GE(standalone and standalone-VC) and 7210 SAS-Sx 10/100GE, this policy is used to enable port-based marking and configuring port-based queue parameters. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

The **no** form of this command 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

Only supported on 7210 SAS platforms configured in the access-uplink operating mode

## Description

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

On 7210 SAS-T operating in access uplink mode, this policy is used to enable marking on egress and classification and metering/policing on port ingress. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

The **no** form of this command 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>network

### Platforms

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

### 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 network port.

**Values** 1, 3 to 65535

queue-override

### Syntax

**[no] queue-override**

### Context

config>port>ethernet>access>egress

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

Commands in this context configure override values for the specified queue. These values will override the values specified in the associated access egress QoS policy.

The **no** form of this command removes all existing queue override commands.

## queue

### Syntax

**[no] queue *queue-id* [create]**

### Context

config>port>ethernet>access>egress>queue-override

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

Commands in this context modify the queue parameters associated with a particular queue.

The **no** form of this command removes the queue override commands for this queue.

### Parameters

***queue-id***

Specifies the ID of the queue.

**Values** 1 to 8

## adaptation-rule

### Syntax

**adaptation-rule cir {max | min | closest} [pir {max | min | closest}]**

**no adaptation-rule**

### Context

config>port>ethernet>access>egress>queue-override>queue

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

This command overrides the adaptation-rule CIR and PIR values defined in the access egress QoS policy assigned to the port.

This command defines the method used by the system to derive the operational CIR and PIR settings when the queue is provisioned in hardware. For the CIR and PIR parameters individually, the system attempts to derive the best operational rate depending on the defined constraint.

The **no** form of this command removes adaptation-rule override parameters on the queue and applies the adaptation-rule defined for the queue in the access egress QoS policy.

## Default

no adaptation-rule

## Parameters

### pir

Specifies the constraints enforced when adapting the PIR defined within the **queue queue-id rate** command. The **pir** parameter requires a qualifier that defines the constraint used when deriving the operational PIR for the queue. When the **rate** command is not specified, the default constraint applies.

### cir

Specifies the constraints enforced when adapting the CIR defined within the **queue queue-id rate** command. The **cir** parameter requires a qualifier that defines the constraint used when deriving the operational CIR for the queue. When the **cir** parameter is not specified, the default constraint applies.

### max | min | closest

Specifies the criteria to use to compute the operational CIR and PIR values for this queue, while maintaining a minimum offset.

**Values**

- max** — The **max** (maximum) option is mutually exclusive with the **min** and **closest** options. The hardware step size varies with the configured rate.
- min** — The **min** (minimum) option is mutually exclusive with the **max** and **closest** options. The hardware step size varies with the configured rate.
- closest** — The **closest** parameter is mutually exclusive with the **min** and **max** parameter. The hardware step size varies with the configured rate.

## percent-rate

## Syntax

**percent-rate** [**cir** *cir-percent*] [**pir** *pir-percent*]

**no percent-rate**

## Context

config>port>ethernet>access>egress>queue-override>queue



## Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

This command overrides the **percent-rate** or **rate** CIR and PIR values defined in the access egress QoS policy assigned to the port.

The **percent-rate** command enables support for configuring a queue PIR and CIR as a percentage of the egress port line rate (that is, the port limit). When the rates are expressed as a port limit, the actual rates used per instance of the queue will vary based on the port speed or the configured port egress rate. For example, when the same QoS policy is used on a 1 Gigabit and a 10 Gigabit Ethernet port, the queue rates will be 10 times greater on the 10 Gigabit port because of the difference in port speeds.

If the port speed changes after the queue is created, the queue PIR and CIR will be recalculated based on the defined percentage value.

The **rate** and **percent-rate** commands override one another. If the current rate for a queue is defined using the **percent-rate** command and the **rate** command is executed, the **percent-rate** values are deleted. Similarly, the **percent-rate** command causes any **rate** command values to be deleted. A queue rate may dynamically be changed back and forth from a percentage to an explicit rate at anytime.

The **no** form of this command, when defined within an egress **queue-override** command, reverts to the defined PIR and CIR within the access egress QoS policy associated with the queue.

## Default

no percent-rate

## Parameters

### *cir cir-percent*

Specifies the queue CIR as a percentage that is dependent on the use of the port-limit.

**Values** 0.00 to 100.00

**Default** 0.00

### *pir pir-percent*

Specifies the queue PIR as a percentage that is dependent on the use of the port-limit.

**Values** 0.01 to 100.00

**Default** 100.00

## queue-mgmt

## Syntax

**queue-mgmt** *name*

**no queue-mgmt**

## Context

config>port>ethernet>access>egress>queue-override>queue

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

This command overrides the queue management policy defined in the access egress QoS policy assigned to the port.

This command associates the specified queue management policy with this queue.

The queue management policy specifies the queue buffer parameters and queue slope policy parameters.

The **no** form of this command associates the queue management policy for this queue as defined in the access egress QoS policy.

## Default

no queue-mgmt

## Parameters

***name***

Specifies the name of the queue management policy, up to 32 characters.

## queue-mode

## Syntax

**queue-mode** *queue-mode*

**no queue-mode**

## Context

config>port>ethernet>access>egress>queue-override>queue

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

This command overrides the queue mode defined in the access egress QoS policy assigned to the port.

This command determines whether the queue operates in **strict** or **weighted** mode.

The **no** form of this command associates the *queue-mode* for this queue as defined in access egress QoS policy.

## Default

no queue-mode

## Parameters

### *queue-mode*

Specifies the queue mode.

**Values**    **strict:** Setting the queue mode to **strict** mode influences the CIR loop and the PIR loop. In both the CIR loop and the PIR loop, the scheduler schedules the queues in the order of their priority (that is, the weights are disregarded).

**weighted:** Setting the queue mode to **weighted** mode influences the CIR loop and the PIR loop as follows.

- In the CIR loop, the scheduler distributes the available bandwidth to all the strict and then to all the weighted queues in round-robin fashion, up to the configured CIR rate.
- In the PIR loop, after examining all the strict queues, the scheduler examines the weighted queues and distributes the available bandwidth, if any, in the proportion of the configured weights.

## rate

### Syntax

**rate** [*cir cir-rate*] [*pir pir-rate*]

**no rate**

### Context

config>port>ethernet>access>egress>queue-override>queue

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

### Description

This command overrides the CIR and PIR values defined in the access egress QoS policy assigned to the port.

This command defines the administrative PIR and the administrative CIR parameters for the queue. The PIR defines the maximum rate at which the queue can transmit packets through the port. Defining a PIR does not necessarily guarantee that the queue can transmit at the intended rate. The actual rate sustained by the queue can be limited by oversubscription factors or available egress bandwidth. The CIR defines the rate at which the system prioritizes the queue over other queues competing for the same bandwidth.

The **rate** command can be executed at anytime, altering the PIR and CIR for all queues created on the access ports.

The **rate** and **percent-rate** commands override one another. If the current rate for a queue is defined using the **percent-rate** command and the **rate** command is executed, the **percent-rate** values are deleted. Similarly, the **percent-rate** command causes any **rate** command values to be deleted. A queue rate may dynamically be changed back and forth from a percentage to an explicit rate at anytime.

The **no** form of this command removes the **percent-rate** parameter and applies the **rate** or **percent-rate** as specified for the queue in access egress QoS policy.

## Default

no rate

## Parameters

### *cir cir-rate*

Specifies that the **cir** parameter overrides the default administrative CIR used by the queue. If the **rate** command is not executed or the **cir** parameter is not explicitly specified, the default CIR value is used.

**Values** 0 to 1000000000, max

**Default** 0

### *pir pir-rate*

Specifies the administrative PIR rate, in kilobits, for the queue. When the **rate** command is executed, a PIR setting is optional. If the **rate** command is not executed, the default PIR of maximum value is used.

**Values** 0 to 1000000000, max

**Default** **max** — The **max** keyword implies the maximum port Ethernet speed or the egress-port rate.

## weight

## Syntax

**weight** *weight*

**no weight**

## Context

config>port>ethernet>access>egress>queue-override>queue

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

This command overrides the weight defined in the access egress QoS policy assigned to the port.

For queues configured with **queue-mode** in **weighted** mode, *weight* values are considered only in the PIR loop. That is, in the CIR loop the CIR of the queues are met if bandwidth is available, and in the PIR loop the configured *weight* values determine the proportion of available bandwidth allocated to this queue relative to other queues configured in **weighted** mode.

The **no** form of this command removes the configured **queue-override weight** value and applies the **weight** value as defined in access-egress QoS policy for that queue.

### Default

no weight

### Parameters

#### **weight**

Specifies the *weight* value. The value is an integer that specifies the proportion of available bandwidth to be allocated to this queue relative to other queues.

**Values** 1 to 15

## dot1p-classification

### Syntax

**dot1p-classification** *policy-id*

**no dot1p-classification**

### Context

config>port>ethernet>access>ingress

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

### Description

This command associates a dot1p classification policy with an Ethernet port.

The dot1p classification policy is applicable only when table-based classification is enabled on the access port. It is used to classify only bridged packets received on this port and processed in the context of an RVPLS service with a SAP configured on this port. The dot1p classification policy defines the mapping of IP dot1p values to forwarding class (FC) and profile (in-profile or out-profile).

The **no** form of this command removes the dot1p classification policy from its association with the Ethernet port.

### Default

no dot1p-classification

### Parameters

#### **policy-id**

Specifies the policy ID.

**Values** 1 to 65535

## dscp-classification

### Syntax

**dscp-classification** *policy-id*  
**no dscp-classification**

### Context

config>port>ethernet>access>ingress

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

### Description

This command associates a DSCP classification policy with an Ethernet port.

The DSCP classification policy is applicable only when table-based classification is enabled on the access port. It is used to classify only bridged packets received on this port and processed in the context of an RVPLS service with a SAP configured on this port. The DSCP classification policy defines the mapping of IP DSCP values to forwarding class (FC) and profile (in-profile or out-profile).

The **no** form of this command removes the DSCP classification policy from its association with the Ethernet port.

### Default

no dscp-classification

### Parameters

***policy-id***

Specifies the policy ID.

**Values** 1 to 65535

## untagged-fc

### Syntax

**untagged-fc** *fc*  
**no untagged-fc**

### Context

config>port>ethernet>access>ingress

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## Description

This command assigns a default FC and profile to non-IP Ethernet packets received on this port and processed in the context of an RVPLS service that has a SAP configured on this port.

Non-IP tagged and untagged packets are assigned the **untagged-fc** *fc* because they do not have a DSCP field available to match in the DSCP classification policy.



### Note:

All tagged bridged non-IP packets received on this port are processed in the context of an RVPLS service with a SAP configured on this port. FC is assigned as per the value configured using this command and profile is assigned using the DEI bit in the packet. Untagged bridged traffic will also match the **untagged-fc** *fc* and are treated as out of profile.

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

## Default

be

## Parameters

**fc**

Specifies the *fc* value.

**Values**    be | l2 | af | l1 | h2 | ef | h1 | nc

**Default**    be

qos

## Syntax

**qos** *policy-id*

**no qos**

## Context

config>port>ethernet>access>ingress

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-Sx 10/100GE (standalone)

## Description

This command associates an access ingress policy with an access port configured to use the **port-mode** option in the **configure port ethernet access-ingress-qos-mode** command.

The **qos** command is ignored if the **configure port ethernet access-ingress-qos-mode** command is configured to use the **sap-mode** option.

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

## Default

qos 1

## Parameters

### *policy-id*

Specifies the access ingress QoS policy ID.

**Values** 1 to 65535

## 2.22.2.1.5 General port commands

port

## Syntax

**port** *port-id*

**no port** *port-id*

## 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.)

## Parameters

### *port-id*

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

dwdm

## Syntax

**dwdm**

## Context

config>port



**Platforms**

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

**Description**

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

channel

**Syntax**

channel *channel*

**Context**

config>port>dwdm

**Platforms**

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

**Description**

This command configures the Dense Wavelength Division Multiplexing (DWDM) ITU channel at which a tunable MDA optical interface will be configured to operate. It is expressed in a form that is derived from the laser's operational frequency. For example, 193.40 THz corresponds to DWDM ITU channel 34 in the 100 GHz grid and 193.45 THz corresponds to DWDM ITU channel 345 in the 50 GHz grid. A provisioned MDA type must have DWDM tunable optics (m1-10gb-dwdm-tun).

The DWDM channel must set to a non-zero value before the port is set to **no shutdown**.

The port must be shut down before changing the DWDM channel.

The DWDM channel must be on a physical port.

**Parameters**

*channel*

Specifies the channel.

**Values**

0, 17 to 61, 175 to 605

where:        17 to 61 is used for 100GHz channels

              175, 185 to 605 is used for 50GHz channels

0 only valid on disabled (shutdown) ports

## enable-dei

### Syntax

**enable-dei**

**no enable-dei**

### Context

config>port>ethernet

config>lag

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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.

For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

### 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-T, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

### **Description**

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

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

The **no** form of this command removes the associated default port scheduler policy from an egress port.

### **Parameters**

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

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

## **mode**

### **Syntax**

**mode** {access [uplink]| network | hybrid}

**no mode**

### **Context**

config>port>ethernet

config>lag

### **Platforms**

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### **Description**

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

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

carried over a single access uplink port. It is supported only on 7210 SAS-T configured in access-uplink mode.

**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 encaps-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 to the dot1q encapsulation, the user configures a SAP inside a service by providing the SAP ID which must include the port-id value of the hybrid mode port and an unused VLAN tag value. The format is <port-id>:qtag1. A SAP of format <port-id>.\* is also supported. The user configures a network IP interface under **config>router>interface>port** by providing the port name which consists of the port-id of the hybrid mode port and an unused VLAN tag value. The format is <portid>:qtag1.

The user must explicitly enter a valid value for qtag1. The <port-id>.\* value is not supported on a network IP interface. The 4096 VLAN tag space on the port is shared among VLAN SAPs and VLAN network IP interfaces. When the hybrid port is configured to QinQ encapsulation, the user configures a SAP inside a service by providing the SAP ID which must include the port-id value of the hybrid mode port and the outer and inner VLAN tag values.

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

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

## Default

network

## Parameters

### network

Specifies that the Ethernet port is configured as service access (available only in network mode).

### access

Specifies that the Ethernet port is configured for transport network use.

### access uplink

Specifies that the Ethernet port is configured for transport (Ethernet uplinks available only in access-uplink mode).

### hybrid

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

## monitor-oper-group

### Syntax

**monitor-oper-group** *name*

**no monitor-oper-group**

### Context

config>port>ethernet

### Platforms

7210 SAS-T (access-uplink), 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-Sx 10/100GE (standalone)

### 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 in 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 existing group instance.

## 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, including platforms configured in the access-uplink operating mode

## Description

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

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

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

## Default

a default MAC address is assigned by the system from the chassis MAC address pool

## Parameters

### *ieee-address*

Specifies the 48-bit MAC address in the form aa:bb:cc:dd:ee:ff or aa-bb-cc-dd-ee-ff where aa, bb, cc, dd, ee and ff are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC and non-IEEE reserved MAC addresses.

## mtu

## Syntax

**mtu** *mtu-bytes*

**no mtu**

## Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command configures the maximum payload 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 larger than the MTU will be discarded. Packets that cannot be fragmented at egress and exceed the MTU are discarded.

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

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

## Default

The default MTU value depends on the (sub-)port type, mode, and encapsulation. [Table 22: Default MTU values](#) lists the default MTU values.

Table 22: Default MTU values

| Type                     | Mode    | Encap type | Default (bytes) |
|--------------------------|---------|------------|-----------------|
| 10/100, Gig, or 10GigE   | Access  | null       | 1514            |
| 10/100, Gig, or 10GigE   | Access  | dot1q      | 1518            |
| 10/100, Gig, or 10GigE   | Access  | q-in-q     | 1522            |
| 10/100 or 100FX Ethernet | Network | null       | 1514            |
| 10/100 or 100FX Ethernet | Network | dot1q      | 1518            |

## Parameters

### **mtu-bytes**

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

**Values** 512 to 9212

## multicast-egress

## Syntax

**multicast-egress** {I2-switch | I3-fwd}

**no multicast-egress**

## Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document

## Description

This command configures Layer 2 or Layer 3 multicast egress replication on a port. That is, with RVPLS IGMPv3 snooping-based multicast, a port on which receivers are present can be configured to do either Layer 2 multicast replication—where IP TTL is not decremented and the source MAC address is not replaced with the 7210 SAS chassis MAC or IP interface MAC address—or Layer 3 multicast replication—where IP TTL is decremented and the source MAC address is replaced.

This command is supported in network mode

All SAPs on the specified port have the same behavior, therefore the reference to port instead of SAP in the following behavior description:

- If the **I3-fwd** keyword is used, then for both IP multicast and RVPLS IGMP snooping multicast traffic forwarded out of the specified port, the following processing is done:

- For IP multicast traffic processed in the context of RVPLS service, the source MAC address is replaced with the chassis MAC address if no IP interface is associated with the RVPLS service. If there is an IES IP interface associated with RVPLS service, the IES interface MAC address is used. In addition, the IP TTL value is decremented by one.
- For IP multicast traffic processed in the context of IES or VPRN IP interface, the source MAC address is replaced with the MAC address of the IP interface. In addition, the IP TTL value is decremented by 1. If the IP TTL is not greater than 0, the packet is dropped.
- If the **I2-switch** keyword is used, then for both IP multicast and RVPLS IGMP snooping multicast traffic forwarded out of the specified port, the following processing is done:
  - For IP multicast traffic processed in the context of RVPLS service, the source MAC address is not replaced. Instead, the original MAC address in the packet is retained. In addition, the IP TTL value is not decremented.
  - Users must not enable IP multicast on this port.

## Default

I3-fwd

## Parameters

### I2-switch

Specifies that IGMP snooping on the port (egress) with Layer 2 multicast lookup is enabled.

### I3-fwd

Specifies that IP multicast (Layer 3) lookups on the port (egress) is enabled.

## multicast-ingress

## Syntax

**multicast-ingress** {I2-mc | ip-mc}

**no multicast-ingress**

## Context

config>port>ethernet

## Platforms

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

## Description

This command turns on either IP multicast or IGMP snooping on a port. The **I2-mc** and **ip-mc** options are mutually exclusive. On 7210 SAS port ingress, either IGMP snooping Layer 2 multicast lookup can be enabled or IP multicast Layer 3 multicast lookup can be enabled.

The **ip-mc** keyword must be enabled on ports where multicast sources are located and an RVPLS SAP is configured to receive the multicast streams.





**Note:**

The restriction of either configuring a VPLS SAP as a receiver for processing Layer 2 multicast traffic on ingress or configuring an IP interface as a receiver for processing Layer 3 multicast traffic on ingress (on a port) does not restrict the ability to configure both a VPLS SAP and an IP interface on a port with receivers connected downstream (that is, in the egress direction). Typically, the ports used for ingress and the ports used for egress are not the same.

**Default**

**l2-mc**

**Parameters**

**l2-mc**

Specifies that IGMP snooping on the port (ingress) with Layer 2 multicast lookup is enabled.

**ip-mc**

Specifies that IP multicast (Layer-3) lookups on the port (ingress) is enabled. This parameter is not supported on 7210 SAS-Sx 10/100GE platforms.

## ptp-hw-timestamp

**Syntax**

[no] ptp-hw-timestamp

**Context**

config>port

**Platforms**

7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx 1/10GE, and 7210 SAS-Sx 10/100GE

**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-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide*.

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

**Default**

ptp-hw-timestamp

## 2.22.2.1.6 Port loopback commands

### loopback-no-svc-port

#### Syntax

**loopback-no-svc-port** [**mac-swap** *mac-swap port-id*] [**mirror** *mirror-port-id*] [**testhead** *testhead-port-id*]  
[**p2mpbud** *p2mpbud-port-id* [**p2mp-bud-classification**]]  
[**no**] **loopback-no-svc-port** [**mac-swap** *mac-swap port-id*] [**mirror** *mirror-port-id*] [**testhead** *testhead-port-id*]  
[**p2mpbud** *p2mpbud-port-id*]

#### Context

config>system

#### Platforms

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

#### Description



##### Note:

The **p2mpbud** *p2mpbud-port-id* parameter is supported only on the 7210 SAS-R6 and 7210 SAS-R12. It reserves a loopback port for use with the NG-MVPN P2MP LSP feature.

This command specifies the port to assign for system use when using port loopback with the following tools: mac-swap, mirroring, testhead OAM, and NG-MVPN, when the node is acting as a P2MP bud router on the 7210 SAS-R6 or 7210 SAS-R12. When configured, the system uses the resources of the port, and the port is not available for configuring services.

A single port cannot be shared among these tools simultaneously. The system displays an error if users attempt to configure the same port for use with multiple OAM tools or use the tool without first configuring the port resources for the tool.

To use these OAM tools simultaneously, this command must be executed once for each OAM tool with a different port ID. For example, users can dedicate two ports for use by executing the **loopback-no-svc-port mirror 1/1/1** command for use with the mirroring OAM tool, followed by the **loopback-no-svc-port mac-swap 1/1/2** command for use by the mac-swap OAM tool.

Alternatively, users can dedicate two ports by executing the **loopback-no-svc-port testhead 1/1/1** command for use by the testhead OAM tool, followed by executing the **loopback-no-svc-port mac-swap 1/1/2** command for use by the mac-swap OAM tool.

The system verifies whether any services are configured on the port specified using this command; 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 the 7210 SAS-T, the two available internal ports (that is, port 1/1/27 and 1/1/28) can be used with the mac-swap, mirroring, or testhead OAM tool. To use the OAM tools

simultaneously, an additional front-panel port must be configured for use with each of the tools.

- On the 7210 SAS-R6 and 7210 SAS-R12, a fixed number of internal ports are available for use with OAM tools (such as, the testhead, mac-swap, and dot1q or remote mirroring OAM tool) that need the resources of a loopback port. The number of internal virtual port resources that are available on different types of IMM s can be obtained using the **show system internal-loopback-ports detail** command. If all the internal port resources are in use, users may need to configure the resources of a front-panel port for use with OAM tools that need loopback port resources. To use the OAM tools simultaneously, an additional front-panel port must be configured for use with each of the tools.

When configuring internal port resources or front-panel port resources for testhead and mac-swap OAM tools, the port must be on the same IMM as the test SAP.

- On the 7210 SAS-Mxp, one internal port (that is, port 1/1/29) is available for use with the mac-swap, mirroring, or testhead OAM tool. To use the OAM tools simultaneously, an additional front-panel port must be configured for use with each of the tools.

## Parameters

### ***mac-swap-port-id***

Specifies that the loopback port (in the *slot/mda/port* format) is dedicated for use by the mac-swap OAM tool.

### ***mirror-port-id***

Specifies that the loopback port (in the *slot/mda/port* format) is dedicated for use by the mirroring OAM tool.

### ***testhead-port-id***

Specifies that the loopback port (in the *slot/mda/port* format) is dedicated for use by the testhead OAM tool.

### ***p2mpbud-port-id***

Specifies the loopback port (in the *slot/mda/port* format) to use for P2MP LSP, which is used with NG-MVPN feature. Applicable only to 7210 SAS-R6 and 7210 SAS-R12 devices.

### ***p2mp-bud-classification***

Keyword to enable ingress FC classification for packets that are received on a P2MP LSP on a network port IP interface and that are replicated to IP multicast receivers. This keyword allows users to prioritize multicast traffic to IP receivers in the service. In addition, it enables the capability to mark the packet with IP DSCP values while sending the multicast stream out of the IP interface. Applicable only to 7210 SAS-R6 and 7210 SAS-R12 devices.



#### **Note:**

Before using this keyword, users must ensure that sufficient resources are available in the network ingress CAM resource pool and MPLS EXP ingress profile map resource pool. Use the **tools>dump>system-resources** command to check resource availability.

### 2.22.2.1.7 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 Ethernet port attributes.

This context can only be used when configuring Fast Ethernet, gigabit, or 10Gig Ethernet LAN ports on an appropriate MDA.

#### mode

##### Syntax

**mode {access | network | hybrid}**

**no mode**

##### Context

config>port>ethernet

##### Platforms

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

##### Description

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

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



##### Note:

ATM, frame relay, and cHDLC port parameters can only be configured in the access mode.

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

When network mode is selected on a SONET/SDH path, the appropriate control protocols are activated when the need arises. For example, configuring an IP interface on the SONET path activates IPCP while the removal of the IP interface causes the IPCP to be removed. The same applies for MPLS, MPLSCP, and OSICP. When configuring a SONET/SDH port, the mode command must be entered in the channel context or an error message is generated.

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

## Default

network

## Parameters

### access

Specifies that the Ethernet port is configured as service access.

### network

Specifies that the Ethernet port is configured for transport network use.

### hybrid

Specifies that the Ethernet port is configured for hybrid use.

## access-ingress-qos-mode

## Syntax

**access-ingress-qos-mode** {sap-mode | port-mode}

## Context

config>port>ethernet

config>lag

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-Sx 10/100GE (standalone)

## Description

This command configures either a per-SAP ingress QoS policy or a per-port access ingress QoS policy on the access port.

This command is supported only in the **high** SAP scale mode, which is configured using the **config>system>resource-profile>sap-scale-mode high** command on the 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE, and the **config>system>global-res-profile>sap-scale-mode high** command on the 7210 SAS-R6 and 7210 SAS-R12.

When the **access-ingress-qos-mode** command is configured on the access port with the **sap-mode** option specified, per-SAP ingress QoS policies are used for SAPs configured on the port. Attempts to attach an access ingress QoS policy fail.

When the **access-ingress-qos-mode** command is configured with the **port-mode** option specified, access ingress QoS policies associated with the port are used for ingress classification and metering and policing. If a user-defined access ingress QoS policy is associated with the port, the user must reset the access ingress policy ID to 1 before changing **access-ingress-qos-mode** to **sap-mode**; otherwise, the change fails.

When the user enables the **access-ingress-qos-mode** command with the **port-mode** option, the IP DSCP and dot1p classification policies configured in the context of the access port ingress QoS are used. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* and *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* for more information about the **config qos access-ingress** command.

LAG member ports can be configured to use either the **sap-mode** or **port-mode**; a mix of the two modes is not allowed. When operating in **port-mode**, all LAG members have the same access ingress QoS policy as the primary LAG member. The policy defines the classification and policing rates for all traffic received on all ports of the LAG. For example, if the user configures the classification entry dot1p 7 to FC nc and the meter 1 CIR and PIR to 100 Mb/s and 2 Gb/s respectively, traffic received on the LAG member ports with a dot1p value of 7 are assigned FC nc at ingress and are rate-limited to 2 Gb/s. For inter-card LAG scenarios, each card is programmed separately for 2 Gb/s.

A node can have a mix of ports configured as access, hybrid, and network ports, where some access ports are configured to use **sap-mode** access ingress QoS and other access ports are configured to use **port-mode** access ingress QoS.

SAPs configured on ports in hybrid port mode cannot be configured to use per-port access ingress QoS policies.

Before configuring the **access-ingress-qos-mode** command with the **port-mode** option specified, use the **configure system resource-profile ingress-internal-tcam qos-access-port-ingress-resource** command to allocate the appropriate resources from the ingress-internal-tcam resource pool for use by the access ingress QoS policies. If no resources are allocated, changing the existing access ingress QoS mode to **port-mode** will fail. In addition, if access ports are currently configured to use **port-mode** access ingress QoS, setting the **qos-access-port-ingress-resource** command to 0 is not allowed.

In addition, before executing this command, the user must ensure that access port scheduling is configured using the **configure system resource-profile qos port-scheduler-mode** command on the 7210 SAS-Mxp, and the **configure system global-res-profile qos port-scheduler-mode** command on the 7210 SAS-R6 and 7210 SAS-R12, after which **high** SAP scale mode can be configured using the **sap-scale-mode high** command. This is a per-node configuration and requires a node reboot for the change to take effect. The node must be rebooted in the **high** SAP scale mode and **qos-access-port-ingress-resource** must have enough resources to change the **access-ingress-qos-mode** command to **port-mode**.



**Note:**

- The user must change the **access-ingress-qos-mode** command to **sap-mode** before changing the **sap-scale-mode** command to **low**. Otherwise, the configuration will fail on reboot and the saved configuration will attempt to change the **access-ingress-qos-mode** to **port-mode** while in **low** SAP scale mode
- On the 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12, when the **port-scheduler-mode** command and **high** SAP scale mode are configured, the user has the option to use either per-access SAP ingress QoS policies or per-access port ingress QoS policies for the access port.

## Default

access-ingress-qos-mode sap-mode

## Parameters

### sap-mode

Keyword to enable the access ingress QoS SAP mode; that is, per-SAP ingress QoS policies are used for SAPs configured on the access port.

### port-mode

Keyword to enable the access ingress QoS port mode; that is, access ingress QoS policies associated with the access port are used for ingress classification and metering and policing.

## access

## Syntax

access

## Context

config>port>ethernet

## Platforms

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

## Description

This command configures Ethernet access port QoS parameters.

## egress

## Syntax

egress

## Context

config>port>ethernet>access

## Platforms

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

## Description

This command configures Ethernet access egress port QoS parameters.

## autonegotiate

### Syntax

**autonegotiate** [**limited**]

[**no**] **autonegotiate**

### Context

config>port>ethernet

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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:

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 that the Ethernet interface will automatically negotiate link parameters with the far end, but will only advertise the speed and duplex mode specified by the Ethernet [speed](#) and [duplex](#) commands.

## connection-type

## Syntax

**connection-type** *connection-type*

## Context

config>port>ethernet

## Platforms

7210 SAS-Mxp and 7210 SAS-Sx 1/10GE (fiber variants only)

## 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 to use.

When configured as an SFP port, the combo port 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 supports speeds of 100/1000 Mb/s and the copper port can support speeds of 10/100/1000 Mb/s.

The combo port can be configured either as an SFP port or a copper port. That is, both the interfaces cannot be used simultaneously.

## Default

connection-type sfp

## Parameters

### **connection-type**

Specifies the type of Ethernet combo port.

**Values**    sfp, copper, auto

## crc-monitor

## Syntax

**crc-monitor**

## Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command configures Ethernet CRC Monitoring parameters.

## sd-threshold

## Syntax

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

## Context

config>port>ethernet>crc-monitor

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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 revert 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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 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 revert to the default value of 1.

### Default

no sf-threshold

### Parameters

#### *threshold*

Represents the rate of CRC errored Ethernet frames.

**Values** 1 to 9

#### *multiplier*

Represents 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

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

## Default

no down-on-internal-error

## dot1q-etype

## Syntax

dot1q-etype *value*

no dot1q-etype

## Context

config>port>ethernet

## Platforms

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

## 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 dot1q-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 takes effect only for access ports and hybrid ports. On hybrid ports, it applies to all traffic (that is, traffic mapped to SAPs and network IP interfaces). It is not supported for network ports.
- Dot1q-preserve SAPs cannot be configured on dot1q encap ports configured to use Ethertype other than 0x8100.
- Priority tagged packet received with etype 0x8100 on a dot1q port configured with etype 0x9100 is classified as a priority tagged packet and mapped to a dot1q:0 SAP (if configured) and the priority tag is removed.
- Priority tagged packets received with etype 0x6666 (any value other than 0x8100) on a dot1q port configured with etype 0x9100 is classified as null-tagged packet and mapped to a dot1q:0 SAP (if configured) and the priority tag is retained and forwarded as expected.
- The maximum number of unique dot1q-etypes configurable per node is limited. The resources needed for configuration of dot1q-etype is shared by the default dot1q-etype, default qinq-etype and user configured values for qinq-etype. 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.

## Default

0x8100

## Parameters

**value**

Specifies the Ethertype to expect.

**Values** 0x0600 to 0xffff — or 1536 to 65535

## duplex

### Syntax

**duplex** {full | half}

### Context

config>port>ethernet

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command configures the duplex of a Fast Ethernet port when autonegotiation is disabled. If the port is configured to autonegotiate this parameter is ignored.

### Default

full

### Parameters

**full**

Sets the link to full duplex mode

**half**

Sets the link to half duplex mode

## efm-oam

### Syntax

**efm-oam**

### Context

config>port>ethernet

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command configures 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

### 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**

Provides capability to initiate negotiation and monitoring activities.

### **passive**

Relies on peer to initiate negotiation and monitoring activities.

## transmit-interval

## Syntax

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

## Context

config>port>ethernet>efm-oam

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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.

## Default

transmit-interval 10 multiplier 5

## Parameters

### ***interval***

Specifies the transmit interval in 100s of 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, including platforms configured in the access-uplink operating mode

## 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

## 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, including platforms configured in the access-uplink operating mode

## Description

This command configures the rate of traffic leaving the network.

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



### Note:

The **max-burst** *size in kbits* keyword configures a maximum-burst (in kilobits) associated with the **egress-rate**. This is an optional parameter and if not explicitly configured then by default it is set to 64 kbits for both 1G and 10G ports. Users cannot configure **max-burst** *size in kbits* without configuring **egress-rate**. The value should be between 32 and 16384, or default. For more information, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide*.

## Default

no egress-rate

## Parameters

### *sub-rate*

Specifies the egress rate, in kilobits per second (kbps).

**Values** 1 to 10000000

### *max-burst size-in-kbits*

Specifies the maximum egress burst, in kilobits (Kbits).

**Values** 32 to 16384

## enable-table-classification

## Syntax

[no] **enable-table-classification**

## Context

config>port>ethernet

config>lag

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12.

## Description

This command enables the use of a table-based IP DSCP classification policy to assign FC and profile to RVPLS bridged IP packets received on access port ingress. This command works in conjunction with the SAP ingress QoS policy associated with the RVPLS service. The match-criteria entries from the RVPLS SAP ingress policy are ignored and instead the IP DSCP classification is used to assign the FC and profile. Only meters from the SAP ingress policy are used to rate-limit the traffic mapped to different FCs.

The DSCP classification policy that is enabled by the **enable-table-classification** command is specified in the **config>port>ethernet>access>ingress** context, using the **dscp-classification** command.



### **Note:**

The **enable-table-classification** command—as well as the DSCP classification policy—takes effect only if **enable-table-classification** is enabled in the respective RVPLS SAP and in the context of the IP interface associated with the RVPLS service.

This command has no effect on a network port.

The **no** form of this command disables the use of a DSCP classification policy for RVPLS bridged packets.

## Default

no enable-table-classification

## 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, including platforms configured in the access-uplink operating mode

### Description

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

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

### Default

null

### Parameters

#### dot1q

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

#### null

Specifies that 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-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## 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-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## 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-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## 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-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## 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-Mxp, 7210 SAS-R6, and 7210 SAS-R12

## 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-Mxp, 7210 SAS-R6, and 7210 SAS-R12

### 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

## hold-time

### Syntax

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

**no hold-time**

### Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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 0, but if the hold-time down interval is greater than 0, interface down transitions are not advertised to upper layers until the hold-time down interval has expired. When an interface transitions from a down state to an up state, it immediately advertised to the rest of the system if the hold-time up interval is 0, but if the hold-time up interval is greater than 0 interface, up transitions are not advertised until the hold-time up interval has expired.

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

## Default

**down 0** seconds — No port link down dampening is enabled, link down transitions are immediately reported to upper layer protocols

**up 0** seconds — No port link up dampening is enabled, link up transitions are immediately reported to upper layer protocols

## Parameters

### **up hold-timeup**

Specifies the interval, in seconds or centiseconds, before an interface transitions from a down state to an up state is reported to upper layer protocols.

**Values** 0 to 36000 seconds  
0, 10 to 3600000 in centiseconds in 5-centisecond increments

### **down hold-time down**

Specifies the interval, in seconds or centiseconds, before an interface transitions from an up state to a down state is reported to upper layer protocols.

**Values** 0 to 36000 seconds  
0, 10 to 3600000 in centiseconds in 5-centisecond increments

### **seconds | centiseconds**

Specifies the unit of measurement for the hold time.

lACP-tunnel

## Syntax

[no] lACP-tunnel

## Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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

poe

## Syntax

poe [plus]

no poe

## Context

config>port>ethernet

## Platforms

7210 SAS-T ETR, 7210 SAS-Mxp, 7210 SAS-Sx 1/10GE fiber variants (standalone mode), and 7210 SAS-Sx/S 1/10GE copper PoE variants (standalone mode)

## Description

This command enables PoE on this port and allows only 802.3af (Type 1) low-power devices to be connected to the port.

Using the **plus** parameter enables users to connect Type 2 devices (that is, high-powered devices) compliant to 802.3at standards to the port.

This command must be used to enable PoE on a port before connecting a PoE device to the port. After a port is enabled for PoE, software attempts to detect the type of PoE device (that is, PoE or PoE+ device) connected to the port and the power it is requesting when a PoE device is connected to the port. If the detection is successful and the power request is within the budget that the platform supports, then power is supplied to the connected device. If not, power is not supplied to the port.

The **no** form of this command disables PoE and PoE+ on this port. If PoE is disabled, the software does not attempt to detect the characteristics of the PoE device connected to the port and not supply power to the port.



## Parameters

### plus

Specifies the parameter poe-plus to allow support of 802.3at (Type-2) high power devices to be connected to the port.

## oper-group

## Syntax

**oper-group** *name*

**no oper-group**

## Context

config>port>ethernet

config>lag

## Platforms

Only supported on 7210 SAS platforms configured in the access-uplink operating mode

## Description

This command associates the context 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.

## 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, including platforms configured in the access-uplink operating mode

## Description

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

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



### Note:

- This command takes effect only for access ports and hybrid ports. On hybrid ports, it applies to all traffic (that is, traffic mapped to SAPs and network IP interfaces). It is not supported for network ports.
- The maximum number of unique qinq-etypes configurable per node is limited. The resources needed for configuration of qinq-etype is shared by the default dot1q-etype, default qinq-etype and user configured values for qinq-etype. 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 qinq-etype change is not allowed on hybrid port, if there is an interface or a SAP configured on the port.

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

## Default

0x8100

## Parameters

**value**

Specifies the qinq-etype to expect.

**Values** 0x0600 to 0xffff or 1536 to 65535

Ensure that the values do not match any of the IEEE reserved Ethertype values such as 0x8a88, 0x9100, and 0x9200.

## rs-fec-mode

## Syntax

**rs-fec-mode** *rs-fec-mode*

**no rs-fec-mode**

## Context

config>port>ethernet

## Platforms

7210 SAS-R6 and 7210 SAS-R12 with IMM-c QSFP28 card, and 7210 SAS-Sx 10/100GE QSFP28

## Description

This command enables Reed–Solomon Forward Error Correction (RS-FEC) on the Ethernet port.

The **no** form of this command disables RS-FEC.

## Default

no rs-fec-mode

## Parameters

### **rs-fec-mode**

Specifies the RS-FEC mode to support.

**Values**    c191-514-528

## report-alarm

## Syntax

[no] report-alarm [signal-fail] [remote] [local]

## Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

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



### **Note:**

The **report-alarm** command is only supported for 10G ports on applicable platforms.

## Parameters

### **signal-fail**

Specifies an Ethernet signal lost alarm.

### **remote**

Specifies remote faults.

### **local**

Specifies local faults.

## port-clock

### Syntax

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

### Context

config>port>ethernet

### Platforms

7210 SAS-T (network and access-uplink), 7210 SAS-R6 and 7210 SAS-R12 (16-port copper IMM-sas-r-b (IMMv2), Combo ports of 7210 SAS-Mxp, Combo ports on 7210 SAS-Sx 1/10GE fiber variant (standalone), and all copper variants of 7210 SAS-Sx/S 1/10GE (standalone)

### Description

This command forces the copper port to be a master or slave. 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 auto-negotiation of the link parameters and is automated; there is no management intervention in this process. Once this process is complete, the master port 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.

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

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

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 the command is used.



#### Note:

For 7210 SAS-Mxp and 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), the user must first configure the combo port **connection-type** to **copper** before using the **port-clock** command. The **port-clock** command cannot be configured without first configuring **connection-type copper**.

## 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.

## speed

## Syntax

**speed {10 | 100 | 1000 | 10000}**

## Context

config>port>ethernet

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command configures the port speed of an Ethernet port when autonegotiation is disabled. If the port is configured to autonegotiate, this parameter is ignored.

Speed cannot be configured for ports that are part of a Link Aggregation Group (LAG).

Supported values depend on the speed of the Ethernet interface supported on the platform.

On the 7210 SAS-S 1/10GE and 7210 SAS-Sx 1/10GE (copper variants), and on the 7210 SAS-Sx 10/100GE, if 1GE fiber-optic SFPs are used in SFP+ ports, the SFP+ ports must be set to 1000 Mb/s.

SFP+ ports that support SFPs do not support speeds of 10 Mb/s or 100 Mb/s.

## Default

varies depending on platform

## Parameters

### 10

Sets the link to 10 Mb/s.

### 100

Sets the link to 100 Mb/s.

### 1000

Sets the link to 1000 Mb/s.

### 10000

Sets the link to 10 000 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, including platforms configured in the access-uplink operating mode

### Description

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

The command when used with service-id and MAC address, provides the port loopback with mac-swap functionality. It enables a physical layer loopback, so that packets which egress on the SAPs created on 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 in different for different platforms and can be obtained using the command **show> system> internal-loopback-ports** detail. Based on the number of internal virtual port resources and the use of other OAM tool that require the resources of another port, 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 platforms.

Physical layer loopback is used with external third-party Ethernet test devices to diagnose provisioning issues and test end-to-end performance metrics of a service.

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 resulting from 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 loop back to be functional, the following are not required:
  - SFP or XFPs need not be inserted into the device.
  - Ethernet cables need not be plugged in for copper ports.
- When the loop back command is enabled, ensure that Ethernet parameters such as, speed, duplex, auto-negotiation and so on are not modified.

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 because of 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 since forwarding of these packets after loopback can potentially cause network wide problems.
- For loop back to be functional, the following are not required:
  - SFP or XFPs need not be inserted into the device.
  - Ethernet cables need not be plugged in for copper ports.
- When the loop back is enabled, ensure that Ethernet parameters such as, speed, duplex, auto-negotiation and so on are not modified.
- When the loopback is enabled, ensure that service parameter and attributes such as ingress qos policy, accounting records, ingress/egress ACLs, and so on are not modified.
  - With port loopback in use, the SAP ingress ACLs with IP-criteria is not recommended for use, since only MAC addresses are swapped.

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

- Configure the service and SAP on which loopback is to be enabled.
- Configure the assigned loopback port to be used.
- Send 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 resulting from MAC movement and flooding issues in other services/SAPs because the whole port is in loopback.

- When the port is in loopback, software disable learning and aging on the specified SAP. After 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 loop back command is not saved in the configuration file across a reboot.

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

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

Listed below is the recommended sequence of commands to be executed to perform loop back when SFP or XFPs are inserted into the device:

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

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

1. Disable the port, execute the command **config>port>shutdown**.
2. Insert the new SFP or XFP.
3. Enable the port and execute the command **config>port>no shutdown**.
4. Disable the port and execute the command **config>port>shutdown**.



- 5. Enable loop back and execute the command **config>port>ethernet>loopback internal**.
- 6. Enable the port and execute the command **config>port>no shutdown**.
- 7. Perform the required tests.
- 8. Disable the port and execute the command **config>port>shutdown**.
- 9. Disable loop back and execute the command **config>port>ethernet>no loopback internal**.
- 10. Enable the port and execute the command **config>port>no shutdown**.
- 11. Enable the required services.

Parameters

**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** service-id 1 to 2147483648

**sap <sap-id>**

Specifies the physical port identifier portion of the SAP.

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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command enables Ethernet Synchronous Status Message (SSM).

## code-type

### Syntax

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

### Context

config>port>ethernet>ssm

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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-Mxp, 7210 SAS-R, 7210 SAS-Sx 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

### 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

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

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

### Default

no tx-dus

## 2.22.2.1.8 802.1x port commands

### dot1x

#### Syntax

**dot1x**

#### Context

config>port>ethernet

#### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

#### Description

Commands in this context configure port-specific 802.1x authentication attributes. This context can only be used when configuring a Fast Ethernet, Gigabit or 10Gig Ethernet or 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-Sx/S 1/10GE (standalone)

#### 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-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-T

## 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-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-T

### 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, including platforms configured in the access-uplink operating mode

### 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 of attempts, the 802.1x authentication procedure is considered to have failed.

## 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, including platforms configured in the access-uplink operating mode

## Description

This command configures the 802.1x authentication mode.

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

## 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 the 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, including platforms configured in the access-uplink operating mode

### 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 the value to the default.

### 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, including platforms configured in the access-uplink operating mode



## 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, including platforms configured in the access-uplink operating mode

## 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 the value to the default.

## 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, including platforms configured in the access-uplink operating mode

### Description

This command enables and disables periodic 802.1x reauthentication.

When re-authentication is enabled, the 7210 SAS will reauthenticate clients on the port every re-auth-period seconds.

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

### 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-Sx/S 1/10GE (standalone)

### 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, including platforms configured in the access-uplink operating mode

## Description

This command configures the period during which the 7210 SAS waits for the RADIUS server to respond to its access request message. When this timer expires, the 7210 SAS will resend the access request message, up to the specified number times.

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

## 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, including platforms configured in the access-uplink operating mode

## 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 the value to the default.

## 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, including platforms configured in the access-uplink operating mode

## Description

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

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

## 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command enables the 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 **configure>port>ethernet>dot1x>port-control force-auth** command) before dot1x tunneling can be enabled using this command. If dot1x is configured to use either **force-unauth** or **auto**, then dot1x tunneling cannot be enabled. Conversely, if dot1x tunneling is enabled, then **port-control force-unauth** or **port-control auto** cannot be configured.

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-Mxp, 7210 SAS-R6, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-T

### 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

### Description

This command configures the minimum wait time before reenabling port after loop detection.

### Default

no retry-timeout

### Parameters

#### *timer*

Specifies the minimum wait time, in seconds, before reenabling port after loop detection.

**Values** 0, 10 to 160

## 2.22.2.1.9 LLDP Ethernet port commands

### lldp

### Syntax

lldp

### Context

config>port>ethernet

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command configures tunneling for LLDP frames that use the nearest-bridge-dest-mac as destination MAC address. If enabled using the command tunnel-nearest-bridge-dest-mac, all frames received with



the appropriate destination mac address are forwarded transparently to the remote end of the service. To forward these frames transparently, the port on which tunneling is enabled must be configured with NULL SAP and the NULL SAP must be configured in an Epipe service. Tunneling is not supported for any other port encapsulation or when using any other service.

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

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

Table 23: 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. Nokia recommends 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** {*bridge-mac*}

Context

config>port>ethernet>lldp

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command configures destination MAC address parameters.

## Parameters

### bridge-mac

Specifies destination bridge MAC type to use by LLDP.

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

## admin-status

## Syntax

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

## Context

config>port>ethernet>lldp>dstmac

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

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

## Parameters

### rx

Specifies the LLDP agent will receive, but will not transmit LLDP frames on this port.

### tx

Specifies that the LLDP agent will transmit LLDP frames on this port and will not store any information about the remote systems connected.

### tx-rx

Specifies that the LLDP agent 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-Sx 1/10GE: standalone and standalone-VC

### 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-Sx 1/10GE: standalone and standalone-VC

### 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 that configures 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-Sx 1/10GE: standalone and standalone-VC

### 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 will match 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-Sx 1/10GE: standalone and standalone-VC

### 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, including platforms configured in the access-uplink operating mode

### 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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** (ifIndex 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

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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, including platforms configured in the access-uplink operating mode

## Description

This command specifies which LLDP TLVs to transmit.

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

Specifies that the LLDP agent should transmit system capabilities TLVs.

## 2.22.2.1.10 Port commands

### network

#### Syntax

**network**

#### Context

config>port>ethernet

#### Platforms

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

#### Description

Commands in this context configure network port parameters.

### uplink

#### Syntax

**uplink**

#### Context

config>port>access

config>port>ethernet>access>uplink

#### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode



## Description

Commands in this context configure access uplink port parameters.

## accounting-policy

### Syntax

**accounting-policy** *policy-id*

**no accounting-policy**

### Context

config>port>ethernet>network

config>port>ethernet>access>uplink

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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.

### 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>network  
config>port>ethernet>access>uplink
```

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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 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>access>uplink  
config>port>ethernet>access>network
```

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command associates a network queue policy with access-uplink port in access-uplink mode or a network port or hybrid port in network mode of operation.

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.

**Parameters**

*name*  
Specifies an existing network-queue policy name.

**2.22.2.1.11 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 configures Link Aggregation Group (LAG) attributes.

A LAG can be used to group two or more ports into one logical link. The number of ports supported in a LAG depends on the platform. The aggregation of multiple physical links allows for load sharing and provides seamless redundancy. If one of the links fails, traffic is redistributed over the remaining links.

The **no** form of this command deletes the LAG from the configuration. Deleting a LAG is only allowed while the LAG is administratively shut down. Any dependencies, such as IP interface configurations, must be removed from the configuration before the **no lag** command can be issued.

**Parameters**

*lag-id*  
Specifies the LAG identifier, expressed as a decimal integer.

|               |                                                          |
|---------------|----------------------------------------------------------|
| <b>Values</b> | 1 to 25 (7210 SAS-T, 7210 SAS-Mxp)                       |
|               | 1 to 125 (7210 SAS-R6 and 7210 SAS-R12)                  |
|               | 1 to 125 (7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE) |

bfd

**Syntax**

bfd

**Context**

config>lag

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command enables the context to configure BFD over the associated LAG links.

## disable-soft-reset-extension

## Syntax

[no] **disable-soft-reset-extension**

## Context

config>lag>bfd

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command enables BFD over LAG links; additional parameter configuration is required to make the links operational.

BFD session timers are automatically extended during a soft-reset operation on IOMs and IMMs to prevent BFD sessions from timing out and causing protocol events. However, in some cases this behavior is not wanted because it can delay fast reroute transitions, if they are in place. The optional **disable-soft-reset-extension** command disables the behavior so that the BFD timers are not automatically extended.

The **no** form of this command disables the automatic extension of BFD timers during an IOM/IMM soft-reset.

## Default

no disable-soft-reset-extension

## family

## Syntax

**family {ipv4}**

## Context

config>lag>bfd

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command configures the address family for the micro-BFD session over the associated LAG links.

## Default

family ipv4

## Parameters

**ipv4**

Keyword to configure IPv4 encapsulation for the micro-BFD session.

## bfd-on-distributing-only

## Syntax

[no] bfd-on-distributing-only

## Context

config>lag>bfd>family

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command enables restricting micro-BFD sessions to links in Link Aggregation Control Protocol (LACP) state distributing.

The **no** form of this command disables restricting micro-BFD sessions.

## Default

no bfd-on-distributing-only

## local-ip-address

## Syntax

**local-ip-address** *ip-address*

**no local-ip-address**

## Context

config>lag>bfd>family

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command specifies the IPv4 address of the BFD source.

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

## Default

no local-ip-address

## Parameters

### *ip-address*

Specifies the IP address.

### Values

ipv4-address: a.b.c.d

## max-admin-down-time

## Syntax

**max-admin-down-time** [*down-interval*]

**max-admin-down-time** infinite

**no max-admin-down-time**

## Context

config>lag>bfd>family

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command specifies the maximum interval of time the router will continue to forward traffic over a link after the micro-BFD sessions have transitioned to a down state because the router received an ADMIN-DOWN state from the far end. The timer provides the administrator the configured amount of time to disable or deprovision the micro-BFD session on the local node before forwarding is halted over the associated links.

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

## Default

max-admin-down-time 0

## Parameters

### *down-interval*

Specifies the amount of time, in seconds.

**Values** 1 to 3600

**infinite**

Keyword to specify that there is no end time to forward traffic.

## max-setup-time

### Syntax

**max-setup-time** [*up-interval*]

**max-setup-time infinite**

**no max-setup-time**

### Context

config>lag>bfd>family

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

### Description

This command specifies the maximum interval of time the router will forward traffic over a link that has transitioned from standby to active state before the micro-BFD session must be fully established (up state).

The **no** form of this command reverts the *up-interval* parameter to the default, which indicates that forwarding will not start until the BFD session is established.

### Default

max-setup-time infinite

### Parameters

***up-interval***

Specifies the amount of time, in milliseconds.

**Values** 1 to 60000

**Default** 0

**infinite**

Keyword to specify that there is no end time to forward traffic over the link; the router will continue to forward traffic over the link infinitely after the micro-BFD session transitions to the down state.

## multiplier

### Syntax

**multiplier** [*multiplier*]

**no multiplier**

### Context

config>lag>bfd>family

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

### Description

This command specifies the detect multiplier used for a micro-BFD session over the associated LAG links. The session is declared administratively down if a BFD control packet is not received for a period determined by the following equation:

$$\text{multiplier} \times \text{receive-interval}$$

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

### Default

multiplier 3

### Parameters

***multiplier***

Specifies the multiplier value.

**Values** 3 to 20

## receive-interval

### Syntax

**receive-interval** *interval*

**no receive-interval**

### Context

config>lag>bfd>family



## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command specifies the receive timer used for micro-BFD sessions over the associated LAG links.

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

## Default

receive-interval 100

## Parameters

### *interval*

Specifies the interval value, in milliseconds.

**Values** 10 to 100000

**Default** 100 for CPM3 or later, 1000 for all others

## remote-ip-address

## Syntax

**remote-ip-address** *ip-address*

**no remote-ip-address**

## Context

config>lag>bfd>family

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

## Description

This command configures the IPv4 address of the BFD destination.

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

## Default

no remote-ip-address

## Parameters

### *ip-address*

Specifies the IP address.

**Values**                      ipv4-address:    a.b.c.d

## shutdown

### Syntax

**shutdown**

**no shutdown**

### Context

config>lag>bfd>family

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

### Description

This command disables micro-BFD sessions for this address family.

The **no** form of this command re-enables micro-BFD sessions for this address family.

### Default

shutdown

## transmit-interval

### Syntax

**transmit-interval** *transmit-interval*

**no transmit-interval**

### Context

config>lag>bfd>family

### Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE (standalone), and 7210 SAS-T

### Description

This command specifies the transmit timer used for a micro-BFD session over the associated LAG links.

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

## Default

transmit-interval 100

## Parameters

### *transmit-interval*

Specifies the transmit interval value, in milliseconds.

**Values** 10 to 100000

**Default** 100 for CPM3 or later, 1000 for all others

## dynamic-cost

## Syntax

[no] dynamic-cost

## Context

config>lag

## Platforms

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

## 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. This is provided that 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, including platforms configured in the access-uplink operating mode

### 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.

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

### Default

null

### Parameters

#### dot1q

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

#### null

Specifies that 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.

## 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

## Description

This command specifies 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.

## Default

no lacp

## Parameters

### *mode*

Specifies the mode in which LACP will operate.

**Values**    **passive** — Starts transmitting LACP packets only after receiving packets.

**active** — Initiates the transmission of LACP packets.

### *administrative-key admin-key*

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

**Values**    1 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, including platforms configured in the access-uplink operating mode

## 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 are transmitted every 30 seconds.

### fast

Specifies that packets are transmitted 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, including platforms configured in the access-uplink operating mode

## 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-Mxp, 7210 SAS-Sx/S 1/10GE (standalone)

## 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.

lag

## Syntax

lag

## Context

config>system

## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE (standalone)

## Description

Commands in this context configure the system-wide LAG hashing algorithm version.

lb-hash-1-version

## Syntax

**lb-hash-1-version** *version*

**no lb-hash-1-version**

## Context

config>system>lag



## Platforms

7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE (standalone)

## Description

This command configures the LAG load-balancing hash-1 algorithm version.

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

## Default

lb-hash-1-version v1

## Parameters

### *version*

Specifies the version of the hash-1 algorithm. The **v1** and **v2** options are supported only when **configure>lag>load-balancing** is set to **hash-1**. If **load-balancing** is set to **hash-2**, the system ignores the **v1** or **v2** configuration.

- Values**
- v1** — Configures version 1 of the hash-1 algorithm. This version maintains backwards compatibility with earlier releases of the 7210 SAS.
  - v2** — Configures version 2 of the hash-1 algorithm. This version enables the use of IP address fields and L4 ports with the hash-1 algorithm, which provides better load-balancing of IP traffic in specific scenarios.

## load-balancing

## Syntax

**load-balancing** *hash parameters*

## Context

config>lag

## Platforms

Supported on all 7210 SAS platforms as described in this document

## Description

This command provides an option per LAG to select the load-balancing hash function to use. For more details about the packet header fields used when the hash function is set to one of these values, see [LAG and ECMP hashing](#).



**Note:**

For non-unicast traffic, the hashing parameters are used as an input to the hash-2 algorithm regardless of the setting for this value on platforms that support use of packet fields and perform hash computation in hardware.

**Default**

default

**Parameters**

***hash parameters***

Specifies the load-balancing hashing options.

**Values**    **hash-1** — Specifies that the load-balancing function uses hash-1.  
              **hash-2** — Specifies that the load-balancing function uses hash-2.  
              **default** — Specifies that, for unicast traffic with LAG mode set to access or hybrid, the default value is hash-1; for all other traffic, the default is hash-2.

## port

**Syntax**

**port** *port-id* [*port-id...*] [**priority** *priority*] [**subgroup** *sub-group-id*]  
**no port** *port-id* [*port-id...*]

**Context**

config>lag

**Platforms**

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

**Description**

This command adds ports to a Link Aggregation Group (LAG).

Multiple ports can be added in one command as long as the limit is not exceeded. On the 7210 SAS-Mxp and 7210 SAS-T, up to four ports can be added to a LAG. On the 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC) and 7210 SAS-Sx 10/100GE, up to eight ports can be added.

The port configuration of the first port added to the LAG is used as a basis to compare with subsequently added ports. If a discrepancy is found with a newly added port, that port will not be added to the LAG.

All ports added to a LAG must share the same characteristics (speed, duplex mode, and so on). An error message is displayed when adding ports that do not share the same characteristics.



**Note:**

All ports in a LAG group must have autonegotiation disabled or set to limited mode to guarantee a specific port speed. Autonegotiation is configured using the [autonegotiate](#) command under the **config>port>ethernet** context.

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

## Parameters

### **port-id**

Specifies the physical port ID 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 lowest port ID becomes the primary port.

**Values** 1 to 65535

### **subgroup sub-group-id**

Specifies the LAG subgroup identifier. When using subgroups in a LAG, they should only be configured on one side of the LAG, not both. Only having one side perform the active/standby selection will guarantee a consistent selection and fast convergence. The active/standby selection will be 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 case no links are usable for a short time, especially if a subgroup consists of one member.

**Values** 1 to 2

## port-threshold

## Syntax

**port-threshold** *value* [**action** {**dynamic-cost** | **down**}]

**no port-threshold**

## Context

config>lag

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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 [{dynamic-cost | down}]**

Specifies the action to take if the number of active links in the LAG is at or below the threshold value.

When the **dynamic-cost** action is specified, then dynamic costing will be activated. As a result the LAG will remain operationally up with a cost relative to the number of operational links. The link will only be regarded as operationally down when all links in the LAG are down.

When the **down** action is specified, then the LAG will be brought operationally down if the number of operational links is equal to or less than the configured threshold value. The LAG will only be regarded as up once the number of operational links exceeds the configured threshold value.



#### **Note:**

- The **down** parameter is supported on all 7210 SAS platforms as described in this document, including those operating in access-uplink mode.
- The **dynamic-cost** parameter is only supported on 7210 SAS platforms operating in network mode.

## 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, including platforms configured in the access-uplink operating mode

## 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 this latter condition is taken into account.

## standby-signaling

## Syntax

**standby-signaling** {lacp | power-off}

**no standby-signaling**

## Context

config>lag

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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***

Specifies that the lasers 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. This parameter is not supported on 7210 SAS platforms configured in the access-uplink operating mode.

## 2.22.2.1.12 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, including platforms configured in the access-uplink operating mode

**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

### description

**Syntax**

**description** *description-string*

**no description**

## Context

config>eth-ring

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command adds a text description for the ring.

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

## Parameters

**string**

Specifies the text description up to 160 characters.

## 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, including platforms configured in the access-uplink operating mode

## Description

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

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

## Default

5

## Parameters

**value**

Specifies the guard-time in deciseconds.

**Values** 1 to 20

## 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode



## Description

This command configures Eth-ring dampening timers.

The **no** form of this command sets the up and down timers to the default values.

**down**

## Syntax

**down** *down-timeout*

## Context

config>eth-ring>ccm-hold-time

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

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



### Note:

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

## Default

0

## Parameters

**value**

Specifies the down timeout in deciseconds.

**Values** 0 to 5000

**up**

## Syntax

**up** *up-timeout*

## Context

config>eth-ring>ccm-hold-time

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

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



### Note:

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

## Default

20 deciseconds

## Parameters

*value*

Specifies the hold-time, in deciseconds, for reporting the recovery.

**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, including platforms configured in the access-uplink operating mode

## 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

## 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, including platforms configured in the access-uplink operating mode

### 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*

<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

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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, including platforms configured in the access-uplink operating mode

## 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

## interconnect

### Syntax

**interconnect** {*ring-id ring-index* | **vpls**}

**[no] interconnect**

### Context

config>eth-ring>sub-ring

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command links the G.8032 sub-ring to a ring instance or to a VPLS instance. The ring instance must be a complete ring with two paths but may be a sub-ring or a major ring (declared by its configuration on another node). When the interconnection is to another node, the sub-ring may have a virtual link or a non-virtual-link. When the sub-ring has been configured with a non-virtual link, the sub ring may be alternatively be connected to a VPLS service. This command is only valid on the interconnection node where a single sub-ring port connects to a major ring or terminates on a VPLS service.

The **no** form of this command removes interconnect node.

### Default

no interconnect

### Parameters

#### *ring-index*

Specifies the ring index of the connection ring for this sub-ring on this node.

**Values** 1 to 128

#### **vpls**

Specifies that the sub- ring is connected to the VPLS instance that contains the sub-ring SAP. This parameter is not supported on 7210 SAS platforms configured in the access-uplink operating mode.

## propagate-topology-change

### Syntax

**propagate-topology-change**

**[no] propagate-topology-change**

## Context

config>eth-ring>sub-ring>interconnect

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command configures the G.8032 sub-ring to propagate topology changes. From the sub-ring to the major ring as specified in the G.8032 interconnection flush logic. This command is only valid on the sub-ring and on the interconnection node. Because this command is only valid on a Sub-ring, a virtual link or non-virtual link must be specified for this command to be configured. The command is blocked on major rings (when both path a and b are specified on a ring).

The **no** form of this command sets propagate to the default

## Default

no propagate-topology-change

## 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, including platforms configured in the access-uplink operating mode

## 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**     Dot1q: 1 to 4094

**Values**     QinQ: (1 to 4094).(1 to 4094)

description

**Syntax**

**description** *long-description-string*

**no description**

**Context**

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

**Platforms**

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

**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.

## 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, including platforms configured in the access-uplink operating mode

### Description

This command configures the G.8032 path as a Ring Protection Link (RPL) 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 reverts to default.

### 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

## 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, including platforms configured in the access-uplink operating mode

## 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

### Description

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

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

### Default

no control-mep

## control-sap-tag

### Syntax

**control-sap-tag** *tag-range*

**no control-sap-tag**

### Context

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

### Platforms

7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), 7210 SAS-Mxp, 7210 SAS-R6 and 7210 SAS-R12

### Description

To support subsecond CCM timers in hardware for G.8032 MEPs, users must reserve a VLAN tag value for exclusive use by G.8032 MEPs configured for a specific ring port (for the MEP configured under the path command). This command tells the system which VLAN tag is reserved for use with this G.8032 MEP. This *tag-range* value must be different from the value configured for the **raps-tag**. This command turns on the subsecond CCM timers for this MEP. The system checks that the configured value is not in use by any SAP (as a SAP tag) configured on the port and not in use as a **control-sap-tag** by any other G.8032 instance on that port. A maximum of four hardware-based control MEPs can be configured on a port.

The VLAN should be reserved for all port encapsulation types. NULL encapsulated port, dot1q encapsulated port, and QinQ encapsulated ports that need to use G.8032 MEPs with subsecond CCM timers need to reserve a VLAN for use. Every G.8032 instance configured for the port needs a VLAN value reserved for its use. Each G.8032 ring instance must use a different VLAN value, not in use currently by any other G.8032 instance on the same port.



#### Note:

- Users must ensure that the VLAN value specified as **control-sap-tag** must not be received as the outermost VLAN tag on any of the SAPs in use on the same port. For example, if **control-sap-tag** is configured as 550, any SAP (NULL, dot1q, dot1q Default SAP, Q1.Q2 SAP, Q1.\* SAP) configured on the port cannot receive a CFM packet that matches the VLAN tag 550.
- Configuration of the **control-sap-tag** command is interoperable with other devices. This is an internal tag used for processing CCMs in the fastpath. This tag is not sent on the wire.

The **no** form of this command reverts the ring port to use the **raps-tag** value configured for the path and use of 1-second CCM timers.

## Parameters

### **tag-range**

Specifies the tag range.

**Values** 512 to 768, 10 ms and 100 ms CCM timer support (7210 SAS-Mxp)  
512 to 768, 100 ms CCM timer support (7210 SAS-T in network mode)  
512 to 768, 10 ms and 100 ms CCM timer support; **control-sap-tag**  
range must be mentioned under resource profile (7210 SAS-Sx/S  
1/10GE)  
3000 to 3512, 10 ms and 100 ms CCM timer support, **control-sap-tag**  
range must be mentioned under resource profile (7210 SAS-R6 and  
7210 SAS-R12)

## 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, including platforms configured in the access-uplink operating mode

### 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, including platforms configured in the access-uplink operating mode

## 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 is 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, including platforms configured in the access-uplink operating mode

## 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

## low-priority-defect

### Syntax

**low-priority-defect** {allDef | macRemErrXcon | remErrXcon | errXcon | xcon | noXcon}

### Context

config>eth-tunnel>path>eth-cfm>mep

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

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

### Default

remErrXcon

### Parameters

#### allDef

Specifies that the lowest priority defects allowed to generate a fault alarm are DefRDICCM, DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM.

#### macRemErrXcon

Specifies that the lowest priority defects allowed to generate a fault alarm are DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM.

#### remErrXcon

Specifies that the lowest priority defects allowed to generate a fault alarm are DefRemoteCCM, DefErrorCCM, and DefXconCCM.

#### errXcon

Specifies that the lowest priority defects allowed to generate a fault alarm are DefErrorCCM and DefXconCC.

#### xcon

Specifies that the lowest priority defect allowed to generate a fault alarm is DefXconCCM.

#### noXcon

Specifies that no defects DefXcon or lower are to be reported.

## 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, including platforms configured in the access-uplink operating mode

### **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 6-byte unicast MAC address of the MEP.

**Values**    xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx (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, including platforms configured in the access-uplink operating mode

### **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, including platforms configured in the access-uplink operating mode

### Description

This command administratively enables or disables the MEP.

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

### Default

shutdown

## shutdown

### Syntax

[no] shutdown

### Context

config>eth-ring>path

config>eth-ring

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command administratively enables or disables the path.

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

### Default

shutdown



## resource-profile

### Syntax

**resource-profile**

### Context

config>system

### Platforms

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

### Description

This command configures the system resource profile.

## g8032-fast-flood-enable

### Syntax

**g8032-fast-flood-enable**

**no g8032-fast-flood-enable**

### Context

config>system>resource-profile

### Platforms

7210 SAS-T

### Description

This command enables the G.8032 fast-flood feature. When this command is executed it is stored in the configuration file after **admin save** is executed. A system reboot is required for this command to take effect.

Nokia recommends to enable this command to improve service failover time due to failures in the ring path. When fast flood is enabled, on a failure detection in one of the paths of the eth-ring, along with MAC flush the system starts to flood the traffic onto the available path.

If this command is present in the configuration file, on reboot the system allocates resources for G.8032, by reducing the amount of resources available for use with ACLs. When this command is used, G.8032 fast-flood needs an entire chunk with "512" entries; therefore, the amount of resources available for use with ACLs is reduced by "512". The user needs to free up resources used by ACLs and make them available for use by G.8032, before enabling this command. The user should ensure that the resource usage of ACLs has been appropriately modified before reboot, to make way for use of this feature. User can free up resources either disabling the use of ACLs with a SAP or deleting a SAP, so that an entire chunk of 512 entries is available.

Before enabling the **g8032-fast-flood-enable** command the user must check if sufficient resources are available. The **tools>dump>system-resources** command is available to check if sufficient resources are available. The field 'Ingress Shared CAM Entries' shown in the output below of **tools>dump>system-resources** command, must be more than or equal to 512 (free column in the output shown below).

|                            | Total | Allocated | Free |
|----------------------------|-------|-----------|------|
| -----+-----+-----+-----    |       |           |      |
| Ingress Shared CAM Entries | 0     | 0         | 512  |

If the configuration file contains a **no** form of this command, then the system does not allocate any resources for use by G.8032. The entire resource pool is available for use by ACLs.

The **no** form of this command takes effect only on reboot.

### Default

no g8032-fast-flood-enable

## 2.22.2.1.13 Ethernet tunnel commands

### split-horizon-group

#### Syntax

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

#### Context

config>lag  
config>port

#### Platforms

7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE, 7210 SAS-T

#### 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.

## 2.22.2.1.14 Multi-chassis redundancy commands

### redundancy

#### Syntax

**redundancy**

#### Context

config

#### Platforms

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

#### Description

Commands in this context configure redundancy operations.

### multi-chassis

#### Syntax

**multi-chassis**

#### Context

config>redundancy

#### Platforms

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

#### Description

Commands in this context configure multi-chassis parameters.

### peer

#### Syntax

**[no] peer *ip-address* create**

## Context

config>redundancy>multi-chassis

## Platforms

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

## Description

This command configures the MC-LAG peer.



### Note:

This command only applies for mc-lag (20), not for mc-sync (4).

## Parameters

### *ip-address*

Specifies the IP address.

**Values**    ipv4-address: a.b.c.d

### *create*

Specifies to create the peer.

## authentication-key

## Syntax

**authentication-key** [*authentication-key* | *hash-key*] [**hash** | **hash2**]

**no authentication-key**

## Context

config>redundancy>multi-chassis>peer

## Platforms

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

## 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 than 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.

## **2.22.2.1.15 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**

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

#### **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

### 2.22.2.1.16 MC LAG commands

#### mc-lag

##### Syntax

**[no] mc-lag**

##### Context

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

##### Platforms

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

##### 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

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

##### 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 switchover 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 will wait 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

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

## Description

This command sets the interval at which keep-alive messages are exchanged between two systems participating in MC-LAG. These keep-alive messages are used to determine remote-node failure and the interval is set in deci-seconds.

The **no** form of this command 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

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

## 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 200

### *lacp-key admin-key*

Specifies a 16 bit key that needs to be configured in the same manner on both sides of the MC-LAG in order for the MC-LAG to come up.

**Values** 1 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 200  
1 to 64

**system-priority *system-priority***

Specifies the system priority to be used in the context of the MC-LAG. The partner system will consider all ports using the same *lacp-key*, *system-id*, and *system-priority* as part of the same LAG.

**Values** 1 to 65535

## source-address

### Syntax

**source-address** *ip-address*  
**no source-address**

### Context

config>redundancy>multi-chassis>peer

### Platforms

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

### 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

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

## 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

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

## Description

Commands in this context configure synchronization parameters.

**igmp-snooping**

## Syntax

[no] igmp-snooping

## Context

config>redundancy>multi-chassis>peer>sync

## Platforms

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

## 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

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

### 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

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

### 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><br>- <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 be used when synchronizing this encapsulation value range with the multi-chassis peer.

2.22.2.2 Show commands

2.22.2.2.1 Hardware commands

chassis

Syntax

chassis [environment] [power-supply]

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## Description

This command displays general chassis status information.

For a virtual chassis (VC), this command displays information about the entire VC. Hardware information can be displayed for individual CPMs, IMM, power supplies, and fans.

## Default

displays all chassis 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 status information, and [Table 24: Output fields: chassis](#) describes the output fields.

### Sample output for a 7210 SAS in standalone-VC mode

```
A:NS1# show chassis
=====
Chassis Information
=====
Name                : NS1
Type                : 7210 SAS-VC
HW Type             : SAS-S 48F45FP+
Location            :
Coordinates          :
CLLI code            :
Number of slots      : 10
Number of ports      : 216
  System LED state    : Red
Over Temperature state : OK
VC Stack name        : VCmix
Number of VC Nodes    : 6
Number of IMM-only Nodes : 5
Number of CPM-IMM Nodes : 1
VC Chassis MAC address (active) : ab:cd:ef:ab:cd:ef
Number of MAC addresses (active) : 10
VC Chassis MAC address (config) : ab:cd:ef:ab:cd:ef
Number of MAC addresses (config) : 10
Temperature          : 67C
Current alarm state   : alarm active
Fan Status            : 0k
Power Status          : Failed(Slots:7)
=====
```

Table 24: Output fields: chassis

| Label | Description                     |
|-------|---------------------------------|
| Name  | The system name for the router. |

| Label                | Description                                                                                                                                                                                                                                    |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                 | Displays the model number.                                                                                                                                                                                                                     |
| Location             | The system location for the device.                                                                                                                                                                                                            |
| Coordinates          | A user-configurable string that indicates the Global Positioning System (GPS) coordinates for the location of the chassis.<br>For example:<br>N 45 58 23, W 34 56 12<br>N37 37' 00 latitude, W122 22' 00 longitude<br>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<br>Not user modifiable                                                                                                                                                                                                     |
| Manufacture date     | The chassis manufacture date<br>Not user modifiable                                                                                                                                                                                            |
| Manufacturing string | Factory-inputted manufacturing text string<br>Not user modifiable                                                                                                                                                                              |
| Administrative state | Up — The card is administratively up<br>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                  |
| 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 state**

**card** [*slot-number*]

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

**card** [*slot-number*] **active-resource-profile**

**card** [*slot-number*] **fabric-port-status**

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

Description



**Note:**  
The **card [slot-number] active-resource-profile** and **card [slot-number] fabric-port-status** commands are supported only on the 7210 SAS-R6 and 7210 SAS-R12.

This command displays card information.

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

For a 7210 SAS-Sx 1/10GE or 7210 SAS-S 1/10GE configured for standalone-vc, this command shows a summary status of the nodes in the virtual chassis (VC) when no optional command parameters have been specified; see [Sample output — show card: 7210 SAS virtual chassis \(VC\)](#).

IMM-only nodes that are preprovisioned show as provisioned but not equipped.

When a slot number is specified along with the **detail** keyword, this command displays more information about a specific node in a VC; see [Sample output — show card \(detail\): 7210 SAS virtual chassis \(VC\)](#).

VC-Stack information appears only when the node **chassis-role** parameter is configured as **standalone-vc**.

Parameters

**slot-number**

Displays information for the specified card slot.

**Values**    1 to 12, A, B

**detail**

Displays detailed card information.

**state**

Displays provisioned and equipped card and MDA information.

**active-resource-profile**

Displays the active resource profile currently in use by the system. This keyword is supported only on the 7210 SAS-R6 and 7210 SAS-R12.

**fabric-port-status**

Displays the status of the fabric port. This keyword can be used only with slot A or B. This keyword is supported only on the 7210 SAS-R6 and 7210 SAS-R12.

Output

The following outputs are examples of card information, and the corresponding tables describe the output fields.

- [Sample output — show card](#), [Table 25: Output fields: show card](#)



- Sample output — show card: 7210 SAS-R6, IMM-SAS-R and IMM-SAS-R-b
- Sample output — show card: 7210 SAS virtual chassis (VC)
- Sample output — show card (detail): 7210 SAS virtual chassis (VC), Table 27: Output fields: card detail
- Sample output — show card: 7210 SAS in standalone VC mode
- Sample output — show card: 7210 SAS in standalone VC mode, power supply
- Sample output — show card: 7210 SAS in standalone VC mode, environment
- Sample output — show card (detail): 7210 SAS in standalone VC mode
- Sample output — show card: 7210 SAS-R12, IMM-SAS-R-b
- Sample output — show card: 7210 SAS-Sx 10/100GE
- Sample output — show card (detail): 7210 SAS-R6 and 7210 SAS-R12
- Sample output — show card State, Table 26: Output fields: card state
- Sample output — show card CPM, Table 28: Output fields: card CPM
- Sample output — active resource profile, Table 29: Output fields: card active resource profile
- Sample output — fabric port status, Table 30: Output fields: card fabric port status

#### Sample output — show card

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

*A:MTU-A#

*A:ces-A# show card
=====
Card Summary
=====
Slot      Provisioned      Equipped      Admin      Operational
Card-type  Card-type
-----
1         iom-sas         iom-sas         up         up
A         sfm-sas         sfm-sas         up         up/active
=====
```

Table 25: Output fields: show card

| Label                 | Description                                                   |
|-----------------------|---------------------------------------------------------------|
| Slot                  | Displays the slot number of the card in the chassis           |
| Provisioned Card-type | Displays the card type that is configured for the slot        |
| Equipped Card-type    | Displays the card type that is actually populated in the slot |

| Label             | Description                                                                      |
|-------------------|----------------------------------------------------------------------------------|
| Admin State       | Up — the card is administratively up<br>Down — the card is administratively down |
| Operational State | Up — the card is operationally up<br>Down — the card is operationally down       |

**Sample output — show card: 7210 SAS-R6, IMM-SAS-R and IMM-SAS-R-b**

```
*A:dut-b>show# card

=====
Card Summary
=====
Slot   Provisioned Type           Admin Operational  Comments
       Equipped Type (if different) State State
-----
1      imm-sas-b-10sfp-1sfp+      up    up
2      imm-sas-b-11csfp           up    up
3      imm-sas-b-11csfp           up    up
4      imm-sas-b-11csfp           up    up
5      imm-sas-b-10sfp-1sfp+      up    up
6      imm-sas-b-10sfp-1sfp+      up    up
A      cpm-sf-b-sas-R6             up    up/active
B      cpm-sf-b-sas-R6             up    up/standby
=====
*A:dut-b>show#
```

**Sample output — show card: 7210 SAS virtual chassis (VC)**

```
*A:sas-vc-dutb>show# card

=====
Card Summary
=====
Slot   Provisioned Type           Admin Operational  Comments
       Equipped Type (if different) State State
-----
1      sas-s-24t-4sfpp             up    up             CPMA-IMM
2      sas-s-24sfp-4sfpp           up    up             CPMB-IMM
3      sas-sx-24sfp-4sfpp          up    up             IMM-ONLY
A      sfm-sas                      up    up/active
B      sfm-sas                      up    up/standby
=====
*A:sas-vc-dutb>show#
```

**Sample output — show card (detail): 7210 SAS virtual chassis (VC)**

```
A:NS1653T0051# show card 1 detail

=====
Card 1
=====
Slot   Provisioned Type           Admin Operational  Comments
       Equipped Type (if different) State State
-----
1      sas-s-48t-4sfpp             up    up
IOM Card Specific Data
Clock source : none
```

```

Named Pool Mode           : Disabled
Available MDA slots       : 1
Installed MDAs            : 1
System Resource Profile   : 1
Hardware Data
Platform type             : N/A
Part number               : 3HE10535AARA01
CLEI code                 :
Serial number             : NS1653T0051
Manufacture date          : 01032017
Manufacturing deviations  : (Not Specified)
Manufacturing assembly number :
Administrative state       : up
Operational state         : up
Temperature               : 63C
Temperature threshold     : 85C
Software boot (rom) version : X-9.0.S249 on Thu Mar 23 03:33:30 IST 2017
                           by builder
Software version          : TiMOS-B-0.0.private both/hops Nokia SAS-S
                           48T4SFP+ 7210 Copyright (c) 2000-2017
                           Nokia.
                           All rights reserved. All use subject to
                           applicable license agreements.
                           Built on Tue Oct 24 16:40:11 IST 2017 by
                           sch001 in /home/sch001/ws/GitWs/00/panos/
                           main
Time of last boot         : 2000/01/01 00:52:34
Current alarm state       : alarm cleared
Base MAC address          : d0:99:d5:92:70:41
Firmware revision status  : acceptable
Last bootup reason        : hard boot
Memory capacity           : 2,048 MB
-----
VC-Stack Information
VC Stack Name             : VCpoeMix
VC Stack Node Type        : imm-only
VC Stack Node Slot Number : 1
VC Stack Node Description :
VC Stack Port#1 Oper State : Up
VC Stack Port#2 Oper State : Down
Neighbor to VC Stack Port#1 : 6
Neighbor to VC Stack Port#2 : None
-----
Environment Information
Number of fans             : 3
Speed                     : half speed
Status                     : up or failed (Fan #1 failed)
-----
Power Supply Information
Number of power supplies   : 2
Power supply number        : 1
Configured power supply type : dc
Status                     : failed
DC power                   : out of range
Power supply number        : 2
Configured power supply type : ac single
Status                     : up
DC power                   : within range
=====
A:NS1653T0051#

```

### Sample output — show card: 7210 SAS in standalone VC mode

```
A:NS1# show card
=====
Card Summary
=====
Slot      Provisioned Type      Admin Operational  Comments
          Equipped Type (if different)  State  State
-----
1          sas-s-24sfp-4sfpp      up    up              IMM-ONLY
2          sas-s-48sfp-4sfpp      up    up              CPMA-IMM
3          sas-s-24t-4sfpp          up    up              IMM-ONLY
4          sas-s-24t-4sfpp          up    provisioned     Unknown
          (not equipped)
5          sas-sx-48sfp-4sfpp     up    up              IMM-ONLY
6          sas-sx-24t-4sfpp      up    up              IMM-ONLY
7          sas-s-24t-4sfpp          up    up              IMM-ONLY
A          sfm-sas              up    up/active
B          sfm-sas              up    down/standby    Unknown
          (not equipped)
=====
A:NS1#
```

### Sample output — show card: 7210 SAS in standalone VC mode, power supply

```
A:NS1# show card 1 power-supply
=====
Power Supply Information - Card 1
=====
Power Supply Information
  Number of power supplies      : 2

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

  Power supply number          : 2
  Configured power supply type  : dc
  Status                       : up
  DC power                     : within range
=====
A:NS1#
```

### Sample output — show card: 7210 SAS in standalone VC mode, environment

```
A:NS1# show card 2 environment
=====
Environment Information - Card 2
=====
Environment Information
  Number of fan trays          : 1
  Number of fans               : 2

  Fan tray number              : 1
  Speed                       : half speed
  Status                      : up
=====
A:NS1#
```

### Sample output — show card (detail): 7210 SAS in standalone VC mode

```
A:NS1# show card 1 detail
=====
Card 1
=====
Slot      Provisioned Type      Admin Operational  Comments
          Equipped Type (if different)  State State
-----
1          sas-s-24sfp-4sfpp      up    up             IMM-ONLY
IOM Card Specific Data
  Clock source           : none
  Named Pool Mode        : Disabled
  Available MDA slots     : 1
  Installed MDAs         : 1
  System Resource Profile : 1
Hardware Data
  Platform type          : N/A
  Part number            : 3HE10000AAAA01
  CLEI code              : INM0000ERA
  Serial number          : NS0000A0000
  Manufacture date       : 07182017
  Manufacturing deviations : (Not Specified)
  Manufacturing assembly number :
  Administrative state   : up
  Operational state      : up
  Temperature            : 58C
  Temperature threshold  : 85C
  Software boot (rom) version : X-10.0.R5 on Fri Jun 29 12:20:22 IST 2018
                               by sasbuild
  CPU Control FPGA version : 0x8
  Software version       : TiM0S-B-10.0.R5 both/hops Nokia SAS-S
                               24F4SFP+ 7210 Copyright (c) 2000-2018
                               Nokia.
                               All rights reserved. All use subject to
                               applicable license agreements.
                               Built on Fri Jun 29 12:21:09 IST 2018 by
                               sasbuild in /test/sasbuild/
  Time of last boot      : 2018/07/10 16:04:03
  Current alarm state    : alarm cleared
  Base MAC address       : d0:99:d5:9c:98:41
  Firmware revision status : acceptable
  Last bootup reason     : hard boot
  Memory capacity        : 2,048 MB
-----
VC-Stack Information
  VC Stack Name          : VCmix
  VC Stack Node Type     : imm-only
  VC Stack Node Slot Number : 1
  VC Stack Node Description :
  VC Stack Port#1 Oper State : Up
  VC Stack Port#2 Oper State : Up
  Neighbor to VC Stack Port#1 : 3
  Neighbor to VC Stack Port#2 : 6
-----
Power Supply Information
  Number of power supplies : 2
  Power supply number      : 1
    Configured power supply t*: ac single
    Status                 : up
    AC power               : within range
```

```

Power supply number      : 2
Configured power supply t*: dc
Status                  : up
DC power                : within range
-----
Environment Information
Number of fan trays      : 1
Number of fans           : 2

Fan tray number          : 1
Speed                   : half speed
Status                  : up
* indicates that the corresponding row element may have been truncated.
=====
A:NS1#

A:NS1# show card 7 detail
=====
Card 7
=====
Slot      Provisioned Type      Admin Operational  Comments
          Equipped Type (if different)  State State
-----
7         sas-s-24t-4sfpp        up    up             IMM-ONLY
IOM Card Specific Data
Clock source              : none
Named Pool Mode           : Disabled
Available MDA slots       : 1
Installed MDAs            : 1
System Resource Profile   : 1
Hardware Data
Platform type             : N/A
Part number               : 3HE10000AAAA01
CLEI code                 : INM3A00AAA
Serial number             : NS1000A0000
Manufacture date          : 06052017
Manufacturing deviations   : (Not Specified)
Manufacturing assembly number :
Administrative state       : up
Operational state         : up
Temperature               : 65C
Temperature threshold     : 85C
Software boot (rom) version : X-10.0.R5 on Fri Jun 29 12:20:22 IST 2018
                          by sasbuild
CPU Control FPGA version  : 0x8
Software version           : TiM0S-B-10.0.R5 both/hops Nokia SAS-S
                          24T4SFP+ 7210 Copyright (c) 2000-2018
                          Nokia.
                          All rights reserved. All use subject to
                          applicable license agreements.
                          Built on Fri Jun 29 12:21:09 IST 2018 by
                          sasbuild in /test/sasbuild/
Time of last boot         : 2018/07/10 16:11:06
Current alarm state       : alarm cleared
Base MAC address          : d0:99:d5:9a:64:41
Firmware revision status  : acceptable
Last bootup reason        : hard boot
Memory capacity           : 2,048 MB
-----
VC-Stack Information
VC Stack Name             : VCmix
VC Stack Node Type        : imm-only

```

```

VC Stack Node Slot Number      : 7
VC Stack Node Description      :
VC Stack Port#1 Oper State     : Up
VC Stack Port#2 Oper State     : Down
Neighbor to VC Stack Port#1    : 6
Neighbor to VC Stack Port#2    : None
-----
Power Supply Information
  Number of power supplies      : 2

  Power supply number           : 1
    Defaulted power supply ty*: ac single
    Status                      : failed
    AC power                    : out of range

  Power supply number           : 2
    Defaulted power supply ty*: dc
    Status                      : up
    DC power                    : within range
-----
Environment Information
  Number of fan trays           : 1
  Number of fans                : 2

  Fan tray number               : 1
    Speed                      : half speed
    Status                     : up
* indicates that the corresponding row element may have been truncated.
=====
A:NS1#

```

### Sample output — show card: 7210 SAS-R12, IMM-SAS-R-b

```

*A:A6144909484>show# card

=====
Card Summary
=====
Slot   Provisioned Type           Admin Operational  Comments
       Equipped Type (if different) State State
-----
8      (not provisioned)         up    unprovisioned
       imm-sas-b-4sfp+
A      cpm-sf-sas-R12           up    up/active
B      cpm-sf-sas-R12           up    up/standby
=====
*A:A6144909484>show#

```

### Sample output — show card: 7210 SAS-Sx 10/100GE

```

*A:7210SAS>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:7210SAS>show#

```

### Sample output — show card State

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

Table 26: Output fields: card state

| Label             | Description                                                        |
|-------------------|--------------------------------------------------------------------|
| Slot/MDA          | Displays the slot number of the card in the chassis                |
| Provisioned Type  | Displays the card type that is configured for the slot             |
| Equipped Type     | Displays 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 is preconfigured |
| Num Ports         | Displays the number of ports available on the MDA                  |
| Num MDA           | Displays the number of MDAs installed                              |
| Comments          | Indicates whether the SF/CPM is active or standby                  |

### Sample output — show card (detail)

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

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

Hardware Data
  Part number            :
  CLEI code              :
```



```

Serial number          : MTUSN107210
Manufacture date       :
Manufacturing string   :
Manufacturing deviations :
Administrative state    : up
Operational state      : up
Temperature            : 40C
Temperature threshold  : 50C
Software boot (rom) version : 7
Software version       : TiM0S-B-1.1.S29 both/mpc NOKIA SAS 721*
Time of last boot      : 2001/06/27 11:15:07
Current alarm state    : alarm cleared
Base MAC address       : 00:11:00:22:bc:11
Memory capacity        : 1,024 MB
=====
*A:SAS#

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

BOF last modified      : N/A
Config file version    : WED JUN 27 11:12:21 2008 UTC
Config file last modified : 2008/06/27 11:42:06
Config file last saved  : N/A
M/S clocking ref state  : primary

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

Hardware Data
  Part number          :
  CLEI code            :
  Serial number        : MTUSN107210
  Manufacture date     :
  Manufacturing string  :
  Manufacturing deviations :
  Administrative state  : up
  Operational state     : up
  Temperature          : 40C
  Temperature threshold : 50C
  Software boot (rom) version : 7
  Software version      : TiM0S-B-1.1.S29 both/mpc NOKIA SAS 721*
  Time of last boot    : 2008/06/27 11:14:43
  Current alarm state   : alarm cleared
  Base MAC address      : 00:11:00:22:bc:11
  Memory capacity       : 1,024 MB
=====
*A:SAS#

```

#### Sample output — show card (detail): 7210 SAS-R6 and 7210 SAS-R12

```
A:NS1653C0258# show card detail
=====
Card 1
=====
Slot      Provisioned Type      Admin Operational  Comments
          Equipped Type (if different)  State State
-----
1          imm-sas-b-16tx          up    up
IOM Card Specific Data
  Clock source          : none
  Named Pool Mode       : Disabled
  Available MDA slots   : 1
  Installed MDAs        : 1
  System Resource Profile : 1
Hardware Data
  Platform type         : N/A
  Part number           :
  CLEI code             :
  Serial number         : 01144600022
  Manufacture date      :
  Manufacturing deviations : (Not Specified)
  Manufacturing assembly number : 82-0723-01
  Administrative state   : up
  Operational state      : up
  Temperature           : 36C
  Temperature threshold : 96C
  Software boot (rom) version : X-11.0.B1-213 on Mon Feb 3 15:36:59 IST
                               2020 by sasbuild
  CPU Control FPGA version : 0x4
  Software version       : TiMOS-I-11.0.B1-213 iom/arc Nokia SAS-R
                               7210 Copyright (c) 2000-2020 Nokia.
                               All rights reserved. All use subject to
                               applicable license agreements.
                               Built on Mon Feb 3 15:45:58 IST 2020 by
                               sasbuild in /home/sasbuild/11.0B1/panos/
                               main
  Time of last boot      : 2020/02/04 14:32:56
  Current alarm state    : alarm cleared
  Base MAC address       : e4:81:84:24:1a:1d
  Firmware revision status : acceptable
  Last bootup reason     : hard boot
  Memory capacity        : 1,024 MB
  Port Status to CPM-A Fabric : up
  Port Status to CPM-B Fabric : up
```

Table 27: Output fields: card detail

| Label               | Description                                                                        |
|---------------------|------------------------------------------------------------------------------------|
| Available MDA slots | Displays the number of MDA slots available on the IOM                              |
| Installed MDAs      | Displays the number of MDAs installed on the IOM                                   |
| Part number         | Displays the IOM part number                                                       |
| CLEI code           | Displays the Common Language Location Identifier (CLLI) code string for the router |
| Serial number       | Displays the serial number                                                         |

| Label                    | Description                                                                                                                     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|                          | Not user modifiable                                                                                                             |
| Manufacture date         | Displays the chassis manufacture date<br>Not user modifiable                                                                    |
| Manufacturing string     | Displays a factory-inputted manufacturing text string<br>Not user modifiable                                                    |
| Manufacturing deviations | Displays a record of changes by manufacturing to the hardware or software, 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              | Displays the internal chassis temperature                                                                                       |
| Temperature threshold    | Displays the value above which the internal temperature must rise to indicate that the temperature is critical                  |
| Software boot version    | Displays the version of the boot image                                                                                          |
| Software version         | Displays the software version number                                                                                            |
| Time of last boot        | Displays the date and time the most recent boot occurred                                                                        |
| Current alarm state      | Displays the alarm conditions for the specific board                                                                            |
| Base MAC address         | Displays the base MAC address of the hardware component                                                                         |
| Memory Capacity          | Displays the memory capacity of the card                                                                                        |

### Sample output — show card CPM

```
A:NS1653C0258# show card "A" detail
=====
Card A
=====
Slot      Provisioned Type      Admin Operational  Comments
          Equipped Type (if different)  State State
-----
A          cpm-sf-sas-R12          up    up/active
BOF last modified      : N/A
Config file version    : FRI NOV 08 15:09:44 2019 UTC
Config file last modified : N/A
Config file last saved  : N/A
M/S clocking ref state  : primary
Flash - cfl:
  Type                 : Flash
  Administrative State : up
  Operational state    : up
```

```

Serial number      : AA00000000014324
Firmware revision  : 1100
Model number       : Flash 1
Size               : 1,964 MB
Free space         : 1,493 MB
Flash - cf2:
  Type             : Compact Flash
  Administrative State : up
  Operational state  : up
  Serial number     : 000060069995A600005A
  Firmware revision  : 110301a
  Model number       : SFCF4096H1B02T0-I-D1-543-ALU
  Size              : 3,904 MB
  Free space        : 3,795 MB
Flash - ufl:
  Type             : USB
  Administrative State : up
  Operational state  : up
  Serial number     : 4C530300241020122174
  Firmware revision  : 1.27
  Model number       : Cruzer Switch
  Size              : 7,481 MB
  Free space        : 7,372 MB
Hardware Data
  Platform type     : N/A
  Part number       : 82-0840-01
  CLEI code         :
  Serial number     : 01153100011
  Manufacture date   : 09182015
  Manufacturing deviations : (Not Specified)
  Manufacturing assembly number :
  Administrative state : up
  Operational state  : up
  Temperature       : 67C
  Temperature threshold : 96C
  Software boot (rom) version : X-11.0.B1-213 on Mon Feb 3 15:43:37 IST
                                   2020 by sasbuild
  CPU Control FPGA version : 0x7
  Peripheral Control FPGA versi*: 0x3
  Software version   : TiMOS-C-11.0.B1-213 cpm/hops Nokia SAS-R
                                   7210 Copyright (c) 2000-2020 Nokia.
                                   All rights reserved. All use subject to
                                   applicable license agreements.
                                   Built on Mon Feb 3 15:46:13 IST 2020 by
                                   sasbuild in /home/sasbuild/11.0B1/panos/
                                   main
  Time of last boot   : 2020/02/04 14:29:31
  Current alarm state : alarm cleared
  Base MAC address    : a4:7b:2c:07:49:87
  Firmware revision status : acceptable
  Last bootup reason  : hard boot
  Memory capacity     : 2,048 MB
  System timing oscillator type : OCX0
  Port Status to CPM-A Fabric : up
  Port Status to CPM-B Fabric : up
* indicates that the corresponding row element may have been truncated.
=====
A:NS1653C0258# show card "B" detail
=====
Card B
=====
Slot      Provisioned Type      Admin Operational   Comments
          Equipped Type (if different) State State
-----

```

```

B          cpm-sf-sas-R12          up    up/standby
BOF last modified          : N/A
Config file version        :
Config file last modified  : N/A
Config file last saved     : N/A
M/S clocking ref state     : secondary
Flash - cf1:
  Type                     : Flash
  Administrative State     : up
  Operational state        : up
  Serial number            : AA00000000014325
  Firmware revision        : 1100
  Model number             : Flash 1
  Size                    : 1,964 MB
  Free space               : 1,726 MB
Flash - cf2:
  Type                     : Compact Flash
  Administrative State     : up
  Operational state        : up
  Serial number            : 000060093464B00000FF
  Firmware revision        : 110301a
  Model number             : SFCF32GBH1B04T0-I-NC-543-ALU
  Size                    : 31,248 MB
  Free space               : 31,137 MB
Flash - ufl:
  Type                     : USB
  Administrative State     : up
  Operational state        : up
  Serial number            : 4C532000070108113102
  Firmware revision        : 1.26
  Model number             : Cruzer Blade
  Size                    : 3,811 MB
  Free space               : 3,772 MB
Hardware Data
  Platform type            : N/A
  Part number              :
  CLEI code                :
  Serial number            :
  Manufacture date         :
  Manufacturing deviations  : (Not Specified)
  Manufacturing assembly number :
  Administrative state      : up
  Operational state        : up
  Temperature              : 88C
  Temperature threshold    : 96C
  Software boot (rom) version : X-11.0.B1-213 on Mon Feb 3 15:43:37 IST
                           2020 by sasbuild
  CPU Control FPGA version : 0x7
  Peripheral Control FPGA versi*: 0x3
  Software version         : TiM0S-C-11.0.B1-213 cpm/hops Nokia SAS-R
                           7210 Copyright (c) 2000-2020 Nokia.
                           All rights reserved. All use subject to
                           applicable license agreements.
                           Built on Mon Feb 3 15:46:13 IST 2020 by
                           sasbuild in /home/sasbuild/11.0B1/panos/
                           main
  Time of last boot        : 2020/02/14 16:03:57
  Current alarm state      : alarm cleared
  Base MAC address         : a4:7b:2c:07:49:9f
  Firmware revision status : acceptable
  Last bootup reason       : hard boot
  Memory capacity          : 2,048 MB
  System timing oscillator type : OCX0
  Port Status to CPM-A Fabric : up

```

```

Port Status to CPM-B Fabric : up
* indicates that the corresponding row element may have been truncated.
=====
A:NS1653C0258#

```

Table 28: Output fields: card CPM

| Label                     | Description                                                                       |
|---------------------------|-----------------------------------------------------------------------------------|
| Slot                      | Displays the slot of the card in the chassis                                      |
| Card Provisioned          | Displays the SF/CPM type that is configured for the slot                          |
| Card Equipped             | Displays 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         | Displays the date and time of the most recent BOF modification                    |
| Config file version       | Displays the configuration file version                                           |
| Config file last modified | Displays the date and time of the most recent config file modification            |
| Config file last modified | Displays the date and time of the most recent config file modification            |
| Config file last saved    | Displays 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             | Displays the compact flash part number<br>Not user modifiable                     |
| Firmware revision         | Displays the firmware version<br>Not user modifiable                              |

| Label                 | Description                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------------------|
| Model number          | Displays the compact flash model number<br>Not user modifiable                                                 |
| Size                  | Displays the amount of space available on the compact flash card                                               |
| Free space            | Displays the amount of space remaining on the compact flash card                                               |
| Part number           | Displays the SF/CPM part number                                                                                |
| CLEI code             | Displays the code used to identify the router                                                                  |
| Serial number         | Displays the SF/CPM part number<br>Not user modifiable                                                         |
| Manufacture date      | Displays the chassis manufacture date<br>Not user modifiable                                                   |
| Manufacturing string  | Displays the factory-inputted manufacturing text string<br>Not user modifiable                                 |
| Administrative state  | Up — the card is administratively up                                                                           |
|                       | Down — the card is administratively down                                                                       |
| Operational state     | Up — the card is operationally up                                                                              |
|                       | Down — the card is operationally down                                                                          |
| Time of last boot     | Displays 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           | Displays the internal chassis temperature                                                                      |
| Temperature threshold | Displays the value above which the internal temperature must rise to indicate that the temperature is critical |
| Software boot version | Displays the version of the boot image                                                                         |
| Memory capacity       | Displays the total amount of memory                                                                            |

#### Sample output — active resource profile

```
7210SAS>show# card 1 active-resource-profile
```

```
=====
Active System Resource Profile For Card : 1
=====
```

```

-----
Configured System Resource Profile Policy Id : 1
-----
G8032 Control Sap Tags      : 0-0
-----
Ingress Internal CAM       : 9
-----
Sap Ingress Qos resource   : 3 (def)    Sap Aggregate Meter (#) : 2 (def)
-----
IPv4 Resource              : max         Mac Resource              : max
IPv4-IPv6 Resource         : max         IPv4-Mac Resource          : max
-----
Net Ingress Qos resource   : 2 (def)
-----

-----
Sap Ingress ACL resource   : 2 (def)
-----
IPv4 Resource              : max         Mac Resource              : max
IPv4-IPv6 128 bit Resource : max         IPv6 64 bit Resource       : max
-----

-----
Eth CFM                    : 1 (def)
-----
down-mep                   : 1           up-mep                   : disable
-----
Sap Egress QoS resource    : 1 (def)
-----

-----
Egress Internal CAM        : 0
-----

-----
Sap Egress ACL resource    : 2 (def)
-----
Mac and IPv4 Resource      : 2           Mac-only Resource         : disable
IPv6 128 bit Resource      : disable     Mac and IPv6 64 bit Resour*: disable
-----
=====
* indicates that the corresponding row element may have been truncated.
# indicates that the value will take effect only after reboot or clear card.
7210SAS>show#

```

Table 29: Output fields: card active resource profile

| Label                                        | Description                                                                                                 |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Active System Resource Profile For Card      | Policy ID: The policy ID of the active system resource profile                                              |
| Configured System Resource Profile Policy ID | Policy ID of the configured system resource profile. This takes affect after a reboot or reset of the card. |
| G8032 Control Sap Tags                       | Displays the Control VLANs reserved for use by G8032                                                        |



| Label                      | Description                                                                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ingress Internal CAM       | Resources allocated toward the Ingress internal TCAM pool                                                                                                                          |
| Sap Ingress Qos resource   | Resources allocated toward SAP ingress classification and SAP ingress policing                                                                                                     |
| SAP Aggregate Meter        | Resources allocated toward SAP aggregate meter support                                                                                                                             |
| IPv4 Resource              | Resources allocated toward SAP ingress IPv4-IPv6 classification. See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide</i> .                                         |
| IPv4-IPv6 Resource         | Resources allocated toward SAP ingress IPv4-IPv6 classification. See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide</i> .                                         |
| Mac Resource               | Resources allocated toward SAP ingress MAC classification. See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide</i> .                                               |
| IPv4-Mac Resource          | Resources allocated toward SAP ingress IPv4 and MAC classification. See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide</i> .                                      |
| Net Ingress Qos resource   | Resources allocated toward Network Ingress Qos classification (both port-based and IP -interface based). See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide</i> . |
| Sap Ingress ACL resource   | Resources allocated toward ingress ACLs (both SAP and network ingress). See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Router Configuration Guide</i> .                                |
| IPv4-IPv6 128 bit Resource | Resources allocated toward ingress ACLs using IPv4 or IPv6 (with 128-bit IP addresses) classification. See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Router Configuration Guide</i> . |
| IPv6 64 bit Resource       | Resources allocated toward ingress ACLs using IPv4 or IPv6 (with 64-bit IP addresses) classification. See the <i>7210 SAS-Mxp, R6, R12, S, Sx, T Router Configuration Guide</i> .  |
| Eth CFM                    | Resources allocated toward Ethernet CFM (UP MEP, Down MEP, MIPs, and so on)                                                                                                        |
| down-mep                   | Resources allocated toward ETH-CFM Down MEP                                                                                                                                        |
| Sap Egress QoS resource    | Resources allocated toward SAP Egress queues                                                                                                                                       |
| Egress Internal CAM        | Resources allocated toward egress internal tcam pool                                                                                                                               |
| Sap Egress ACL resource    | Resources allocated for egress ACLs (SAP and IP interface)                                                                                                                         |

| Label                        | Description                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------|
| MAC and IPv4 Resource        | Resources allocated toward egress ACLs with IPv4 or MAC criteria                                     |
| Mac-only Resource            | Resources allocated toward egress ACLs with MAC criteria                                             |
| IPv6 128 bit Resource        | Resources allocated toward egress ACLs with IPv6 (with 128-bit IP addresses) criteria                |
| MAC and IPv6 64 bit Resource | Resources allocated toward egress ACLs with IPv6 (with 64-bit IP addresses) criteria or MAC criteria |

### Sample output — fabric port status

```

A:NS1653C0258# show card "A" fabric-port-status
=====
Fabric Connectivity Information
=====
Slot No   Equipped Type                Fabric Port State
-----
1         imm-sas-b-16tx              up
2         imm-sas-b-11csfp           up
3         imm-sas-b-11csfp           up
4         imm-sas-b-16tx              up
5         imm-sas-b-16tx              up
6         imm-sas-b-4sfp+           up
7         imm-sas-b-2sfp+           up
8         imm-sas-b-10sfp-1sfp+   up
9         imm-sas-b-10sfp-1sfp+   up
10        imm-sas-b-2sfp+           up
11        imm-sas-b-11csfp           up
12        imm-sas-b-10sfp-1sfp+   up
A         cpm-sf-sas-R12             up
B         cpm-sf-sas-R12             up
-----
Entries found: 14
=====

A:NS1653C0258# show card "B" fabric-port-status
=====
Fabric Connectivity Information
=====
Slot No   Equipped Type                Fabric Port State
-----
1         imm-sas-b-16tx              up
2         imm-sas-b-11csfp           up
3         imm-sas-b-11csfp           up
4         imm-sas-b-16tx              up
5         imm-sas-b-16tx              up
6         imm-sas-b-4sfp+           up
7         imm-sas-b-2sfp+           up
8         imm-sas-b-10sfp-1sfp+   up
9         imm-sas-b-10sfp-1sfp+   up
10        imm-sas-b-2sfp+           up
11        imm-sas-b-11csfp           up
12        imm-sas-b-10sfp-1sfp+   up
A         cpm-sf-sas-R12             up
B         cpm-sf-sas-R12             up
-----
Entries found: 14

```

|       |
|-------|
| ===== |
|-------|

Table 30: Output fields: card fabric port status

| Label             | Description                                                   |
|-------------------|---------------------------------------------------------------|
| Slot No           | Displays the slot number of the card in the chassis           |
| Equipped Type     | Displays the card type that is actually populated in the slot |
| Fabric Port State | Displays the state of the fabric port: up or down             |

## mda

### Syntax

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

### Context

show

### Platforms

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

### Description

This command displays MDA information.

### Default

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.

**Values**    1

**detail**

Displays detailed MDA information.

### Output

The following output is an example of MDA information, and [Table 31: Output fields: MDA Detailed](#) and [Table 32: Output fields: MDA](#) describe the output fields.

Sample output —7210 SAS-T

```
A:SAST>show# mda detail

=====
MDA 1/1 detail
=====
Slot  Mda   Provisioned Type           Admin   Operational
      Mda   Equipped Type (if different) State    State
-----
1      1      m12-sfp+10-tx+4-xfp       up      up

MDA Specific Data
Maximum port count          : 26
Number of ports equipped    : 26
Network ingress queue policy : default
Capabilities                 : Ethernet

Hardware Data
Platform type               : N/A
Part number                 : 3HE08117AAAA01
CLEI code                   :
Serial number               : NS1310C2059
Manufacture date            : 03252013
Manufacturing string        : (Not Specified)
Manufacturing deviations    : (Not Specified)
Manufacturing assembly number :
Administrative state        : up
Operational state          : up
Temperature                 : 41C
Temperature threshold       : 68C
Low Temperature threshold   : -20C
Software version            : N/A
Time of last boot           : 2015/02/16 08:20:58
Current alarm state         : alarm cleared
Base MAC address            : 4c:5f:d2:7c:fa:30
Firmware version            : N/A
=====

A:SAST>show#
```

Table 31: Output fields: MDA Detailed

| Label                           | Description                                                             |
|---------------------------------|-------------------------------------------------------------------------|
| Slot                            | The chassis slot number                                                 |
| Slot                            | The MDA slot number                                                     |
| Provisioned<br>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                                 |

| Label                        | Description                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------------------|
| 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                       |
| Transmit timing selected     | The transmit timing method which is presently selected and being used by this MDA                     |
| Sync Interface timing status | Indicates the status of the synchronous equipment timing subsystem                                    |
| Network Ingress Queue Policy | Specifies the network queue policy applied to the MDA to define the 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.                                                                             |
| CLEI code                    | The code used to identify the MDA.                                                                    |
| Serial number                | The MDA part number<br>Not user modifiable                                                            |
| Manufacture date             | The MDA manufacture date<br>Not user modifiable                                                       |
| Manufacturing string         | Factory-inputted manufacturing text string<br>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.                                                      |

| Label               | Description                                                                                                                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Current alarm state | Displays the alarm conditions for the specific MDA.                                                                                                 |
| Base MAC address    | The base chassis Ethernet MAC address. Special purpose MAC addresses used by the system software are constructed as offsets from this base address. |

### Sample output — 7210 SAS-Sx/S 1/10GE 48T 4SFP+ variant

```
*7210SAS>show# mda detail

=====
MDA 1/1 detail
=====
Slot  Mda  Provisioned Type              Admin   Operational
      Mda  Equipped Type (if different)  State   State
-----
1      1    s48-t4-sfpp                    up      up

MDA Specific Data
Maximum port count      : 52
Number of ports equipped : 52
Network ingress queue policy : default
Capabilities             : Ethernet
Fail On Error           : Disabled
Egress XPL error threshold : 1000
Egress XPL error window   : 60
Ingress XPL error threshold : 1000
Ingress XPL error window   : 60

Hardware Data
Platform type           : N/A
Part number             : 1160400046
CLEI code               :
Serial number           : 01160400046
Manufacture date        :
Manufacturing deviations : (Not Specified)
Manufacturing assembly number : 82-0827-01
Administrative state     : up
Operational state       : up
Temperature             : 59C
Temperature threshold    : 96C
Software version         : N/A
Time of last boot        : 2000/01/19 08:59:27
Current alarm state      : alarm cleared
Base MAC address         : a4:7b:2c:c6:69:d5
Firmware version         : N/A
=====
*A:hw_sass_duth>show#
```

### Sample output — 7210 SAS-Sx 10/100GE

```
*A:NS1633T0067>show# mda

=====
MDA Summary
=====
Slot  Mda  Provisioned Type              Admin   Operational
```

```

                Equipped Type (if different)                State      State
-----
1      1      s64-sfpp+4-cfp                                up        up
=====
*A:NS1633T0067>show#
*A:NS1633T0067>show# mda detail

=====
MDA 1/1 detail
=====
Slot  Mda  Provisioned Type                Admin    Operational
                Equipped Type (if different)                State      State
-----
1      1      s64-sfpp+4-cfp                                up        up

MDA Specific Data
Maximum port count      : 68
Number of ports equipped : 68
Network ingress queue policy : default
Capabilities             : Ethernet
Fail On Error           : Disabled
Egress XPL error threshold : 1000
Egress XPL error window  : 60

Hardware Data
Platform type           : N/A
Part number             : AABBCDD-11
CLEI code               :
Serial number           : NS1633T0067
Manufacture date        :
Manufacturing deviations : (Not Specified)
Manufacturing assembly number :
Administrative state     : up
Operational state       : up
Temperature             : 29C
Temperature threshold    : 85C
Software boot (rom) version : (Not Specified)
Software version         : (Not Specified)
Time of last boot       : 2000/01/01 00:33:20
Current alarm state      : alarm cleared
Base MAC address        : d0:99:d5:8f:5e:43
Firmware version        : N/A
=====
*A:NS1633T0067>show#

```

Table 32: 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    |

| Label     | Description               |
|-----------|---------------------------|
| Ops State | Up — Operationally up     |
|           | Down — Operationally down |

### Sample output — 7210 SAS-R6 and 7210 SAS-R12

```
A:dut-a>show# mda detail
```

#### MDA 1/1 detail

| Slot | Mda | Provisioned Type<br>Equipped Type (if different) | Admin<br>State | Operational<br>State |
|------|-----|--------------------------------------------------|----------------|----------------------|
| 1    | 1   | imm-sas-10sfp+1xfp                               | up             | up                   |

#### MDA Specific Data

```
Maximum port count      : 11
Number of ports equipped : 11
Network ingress queue policy : default
Capabilities             : Ethernet
```

#### Hardware Data

```
Platform type           : N/A
Part number              : 3HE05029AA
CLEI code               : Sim CLEI
Serial number            : mda-1
Manufacture date         : 01012003
Manufacturing string     : Sim MfgString mda-1
Manufacturing deviations : Sim MfgDeviation mda-1
Manufacturing assembly number : 01-2345-67
Administrative state      : up
Operational state        : up
Temperature              : -128C
Temperature threshold    : 74C
Software version         : N/A
Time of last boot        : 2015/01/30 07:37:12
Current alarm state      : alarm cleared
Base MAC address         : 20:89:01:01:00:01
Firmware version         : N/A
```

#### MDA 2/1 detail

| Slot | Mda | Provisioned Type<br>Equipped Type (if different) | Admin<br>State | Operational<br>State |
|------|-----|--------------------------------------------------|----------------|----------------------|
| 2    | 1   | imm-sas-10sfp+1xfp                               | up             | up                   |

#### MDA Specific Data

```
Maximum port count      : 11
Number of ports equipped : 11
Network ingress queue policy : default
Capabilities             : Ethernet
```

#### Hardware Data

```
Platform type           : N/A
Part number              : 3HE05029AA
```



```
CLEI code           : Sim CLEI
Serial number       : mda-1
Manufacture date    : 01012003
Manufacturing string : Sim MfgString mda-1
Manufacturing deviations : Sim MfgDeviation mda-1
Manufacturing assembly number : 01-2345-67
Administrative state : up
Operational state   : up
Temperature         : -128C
Temperature threshold : 74C
Software version    : N/A
Time of last boot   : 2015/01/30 07:37:12
Current alarm state : alarm cleared
Base MAC address    : 20:8a:02:01:00:01
Firmware version    : N/A
=====
A:dut-a>show#
```

## pools

### Syntax

```
pools mda-id [/port] [access-app pool-name]
pools mda-id [/port] [network-app pool-name]
```

### Context

show

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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 output is an example of pool information, and [Table 33: Output fields: pool](#) describes the output fields.

Sample output — 7210 SAS-Mxp

```
A:Dut-A# show pools 1/1/1 network-egress

=====
Pool Information
=====
Port          : 1/1/1
Application    : System
MMU Configured CBS : 28728 KB

-----
ID              FC-MAPS/   CBS (B)   Depth  A.CIR   A.PIR
                Queue      MBS (B)
-----
Sap Egress Queues:

No Match Found
Network/Access Queues:

1/1/1           be      131328   0        0        1000000
                262656   0        0        1000448
1/1/1           l2      131328   0      100000   1000000
                262656   0      100032   1000448
1/1/1           af      131328   0      100000   1000000
                262656   0      100032   1000448
1/1/1           l1      131328   0      100000   1000000
                262656   0      100032   1000448
1/1/1           h2      131328   0      200000   1000000
                262656   0      200064   1000448
1/1/1           ef      131328   0      200000   1000000
                262656   0      200064   1000448
1/1/1           h1      131328   0       50000   1000000
                262656   0       50016   1000448
1/1/1           nc      131328   0       50000   1000000
                262656   0       50016   1000448
=====
```

Sample output — 7210 SAS-Mxp, 7210 SAS-R6 and 7210 SAS-R12

```
*A:7210SAS>show# pools 1/1/1 access-egress

=====
Pool Information
=====
Port          : 1/1/1
Application    : System
MMU Configured CBS : 20382 KB

-----
ID              FC-MAPS/   CBS (B)   Depth  A.CIR   A.PIR
                Queue      MBS (B)
-----
Sap Egress Queues:
```

```

No Match Found
Network/Access Queues:

1/1/1          be      131328    0        0        1000000
                131328    0        0        1000448
1/1/1          l2      131328    0        100000   1000000
                131328    0        100032   1000448
1/1/1          af      131328    0        100000   1000000
                131328    0        100032   1000448
1/1/1          l1      131328    0        100000   1000000
                131328    0        100032   1000448
1/1/1          h2      131328    0        200000   1000000
                131328    0        200064   1000448
1/1/1          ef      131328    0        200000   1000000
                131328    0        200064   1000448
1/1/1          h1      131328    0        50000    1000000
                131328    0        50016    1000448
1/1/1          nc      131328    0        50000    1000000
                131328    0        50016    1000448
=====
*A: 7210SAS>show#

```

Table 33: 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 network traffic at either ingress or egress                                                                  |
| Pool Name          | Specifies the name of the pool being used                                                                                                                                                                    |
| Resv CBS           | Specifies the percentage of pool size reserved for CBS                                                                                                                                                       |
| Utilization        | Specifies the type of the slope policy                                                                                                                                                                       |
| State              | The administrative status of the port                                                                                                                                                                        |
| Start-AvgThreshold | Specifies the percentage of the buffer used after which the drop probability starts to rise above 0                                                                                                          |
| Max-Avg            | Specifies the percentage of the buffer used after which the drop probability is 100 percent. This implies that all packets beyond this point will be dropped                                                 |
| Time Avg Factor    | Specifies the time average factor the weighting between the previous shared buffer average utilization result and the new shared buffer utilization in determining the new shared buffer average utilization |
| Actual ResvCBS     | Specifies the actual percentage of pool size reserved for CBS                                                                                                                                                |

| Label              | Description                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Admin ResvCBS      | Specifies the percentage of pool size reserved for CBS                                                                                                        |
| PoolSize           | Specifies the size in percentage of buffer space. The value '-1' implies that the pool size should be computed as per fair weighting between all other pools. |
| Pool Total         | Displays the total pool size                                                                                                                                  |
| Pool Shared        | Displays the amount of the pool which is shared.                                                                                                              |
| Pool Resv          | Specifies the percentage of reserved pool size.                                                                                                               |
| Pool Total In Use  | Displays the total amount of the pool which is in use.                                                                                                        |
| Pool Shared In Use | Displays the amount of the shared pools that is in use.                                                                                                       |
| MMU Configured CBS | Displays the total amount of CBS buffers configured on the IMM across all the queues on the IMM.                                                              |

## 2.22.2.2.2 Port Show commands

port

### Syntax

**port** *port-id* [**detail**]  
**port** *port-id* **description**  
**port** *port-id* **associations**  
**port** *port-id* **ethernet** [**efm-oam** | **detail**]  
**port** *port-id* **optical**  
**port** *port-id* **acr** [**detail**]  
**port** *port-id* **dot1x** [**detail**]  
**port** *port-id* **ptp-hw-timestamp**  
**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, including platforms configured in the access-uplink operating mode

## Description

This command displays port information.

## Default

the command port displays summary information for all ports on provisioned MDAs

## Parameters

### ***port-id***

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

|               |                                                          |
|---------------|----------------------------------------------------------|
| <b>Values</b> | slot: 1                                                  |
|               | mda: 1                                                   |
|               | port: 1 to 24, 28, 52, or 68 (depending on the platform) |

### **associations**

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

### **description**

Displays port description strings.

### **dot1x**

Displays information about 802.1x status and statistics.

### **ethernet**

Displays Ethernet port information.

**efm-oam** — Displays EFM OAM information.

**detail** — Displays detailed information about the Ethernet port.

**A1** — Displays the out-of-band Ethernet port information.

### **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.

### **ptp-hw-timestamp**

Specifies that the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx 1/10GE, and 7210 SAS-Sx 10/100GE will display the current status of Precision Time Protocol (PTP) port-based hardware timestamping per port in a tabular format, similar to the **show port statistics** command.

## Output

The following outputs are example of port information. The associated tables describe the output fields.

- [Sample output — general port output fields, Table 34: Output fields: port](#)
- [Sample output — specific port output, Table 35: Output fields: specific port](#)
- [Sample output — detailed port output, Table 36: Output fields: detailed port](#)
- [Sample output — Ethernet output fields](#)
- [Sample output — Ethernet output fields, 7210 SAS-Mxp](#)

- Sample output — Ethernet output fields, 7210 SAS-Mxp with IP DSCP-based profile assignment with color-aware metering
- Sample output — access egress queue override, Table 37: Output fields: Ethernet access egress queue override
- Sample output — Ethernet statistics, Table 38: Output fields: Ethernet statistics
- Sample output — Ethernet-like medium statistics, Table 39: Output fields: Ethernet-like medium statistics
- Sample output — Port associations , Table 40: Output fields: port associations
- Sample output — A1 detailed , Table 41: Output fields: A1 detailed
- Sample output — dot1x detail
- Sample output — detail, 7210 SAS-Sx 10/100GE
- Sample output — port PTP hardware timestamp , Table 42: Output fields: port PTP hardware timestamp
- Sample output — optical , Table 43: Output fields: optical

#### Sample output — general port output fields

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

*A:ALU-211# show port 1/1/2
=====
Ethernet Interface
=====
Description      : 10/100 Ethernet TX
Interface        : 1/1/2
Link-level       : Ethernet
Admin State      : up
Oper State       : down - Standby in LAG 10
Physical Link    : Yes
Single Fiber Mode : No
IfIndex          : 35717120
Last State Change : 12/16/2008 18:28:52
Last Cleared Time : 12/16/2008 18:28:51
IP MTU           : 1000
Oper Speed       : 100 mbps
Config Speed     : 100 mbps
Oper Duplex      : full
Config Duplex    : full
MTU              : 1514
Hold time up    : 0 seconds
Hold time down  : 0 seconds
=====
*A:ALU-211#

A:SASR-12-A-Ring># show port 1/1/1
=====
```

# Ethernet Interface

```

=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : up
Oper State       : up
Physical Link     : Yes
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 12/04/2017 16:06:54
Last Cleared Time : N/A
Phys State Chng Cnt: 3
Ptp timestamp    : enabled
Configured Mode  : network

Oper Speed       : 1 Gbps
Config Speed     : 1 Gbps
Oper Duplex      : full
Config Duplex    : full
MTU              : 9212
LoopBack Mode    : None
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Encap Type       : null

```

\*A:7210SAS>show# port

## Ports on Slot 1

| Port Id | Admin State | Link State | Port State | Cfg MTU | Oper MTU | LAG/ Bndl | Port Mode | Port Encp | Port Type | SFP/XFP/ MDIMDX |
|---------|-------------|------------|------------|---------|----------|-----------|-----------|-----------|-----------|-----------------|
| 1/1/1   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/2   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      | GIGE-SX         |
| 1/1/3   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/4   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/5   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      | GIGE-T          |
| 1/1/6   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/7   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/8   | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/9   | Up          | Yes        | Up         | 1522    | 1522     | -         | accs      | qinq      | xcme      | MDI GIGE-T      |
| 1/1/10  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/11  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/12  | Up          | Yes        | Up         | 9212    | 9212     | -         | accs      | null      | xcme      | MDI GIGE-SX     |
| 1/1/13  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/14  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/15  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/16  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/17  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      | GIGE-SX         |
| 1/1/18  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      | GIGE-LX 10KM    |
| 1/1/19  | Up          | Yes        | Up         | 9212    | 9212     | -         | accs      | null      | xcme      | None(loopback)  |
| 1/1/20  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/21  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/22  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/23  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      | GIGE-LX 10KM    |
| 1/1/24  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xcme      |                 |
| 1/1/25  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xgige     |                 |
| 1/1/26  | Down        | No         | Down       | 9212    | 9212     | -         | netw      | null      | xgige     |                 |

## Ports on Slot A

| Port Id | Admin State | Link State | Port State | Cfg MTU | Oper MTU | LAG/ Bndl | Port Mode | Port Encp | Port Type | SFP/XFP/ MDIMDX |
|---------|-------------|------------|------------|---------|----------|-----------|-----------|-----------|-----------|-----------------|
| A/1     | Up          | Yes        | Up         | 1514    | 1514     | -         | netw      | null      | faste     | MDI             |

\*A:7210SAS>show#

Table 34: Output fields: port

| Label       | Description                                                                                 |
|-------------|---------------------------------------------------------------------------------------------|
| Port ID     | The port ID configured or displayed in the <i>slot/mda/port</i> format                      |
| Admin State | Up — The administrative state is up                                                         |
|             | Down — The administrative state is down                                                     |
| Phy Link    | Yes — A physical link is present                                                            |
|             | No — A physical link is not present                                                         |
| Port State  | Up — The port is physically present and has physical link present                           |
|             | Down — The port is physically present but does not have a link.                             |
|             | Ghost — A port that is not physically present                                               |
|             | None — The port is in its initial creation state or about to be deleted                     |
|             | Link Up — A port that is physically present and has physical link present                   |
|             | Link Down — A port that is physically present but does not have a link                      |
| Cfg MTU     | The configured MTU                                                                          |
| Oper MTU    | The negotiated size of the largest packet which can be sent on the port specified in octets |
| LAG ID      | The LAG or multi-link trunk (MLT) that the port is assigned to                              |
| Port Mode   | network — The port is configured for transport network use                                  |
|             | access — The port is configured for service access                                          |
| Port Encap  | Null — Ingress frames will not use tags or labels to delineate a service                    |
|             | dot1q — Ingress frames carry 802.1Q tags where each tag signifies a different service       |
|             | QinQ — Encapsulation type specified for QinQ Access SAPs                                    |
| Port Type   | The type of port or optics installed                                                        |
| SFP/MDI MDX | GIGE — Indicates the GigE SFP type                                                          |
|             | FASTE — Indicates the FastE SFP type                                                        |



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

#### Sample output — specific port output

The following table describes port output fields for a specific port.

Table 35: Output fields: specific port

| Label         | Description                                                                                                                                                                                                                                                                  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description   | A text description of the port                                                                                                                                                                                                                                               |
| Interface     | The port ID displayed in the <i>slot/mda/port</i> 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. |
| 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<br>Additionally, the <i>lag-id</i> 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 full duplex mode                                                                                                                                                                                                                                   |
| Hold time up  | The link up dampening time, in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.                                                                                                                  |

| Label               | Description                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------|
| Hold time down      | The link down dampening time, in seconds. The <b>down</b> timer controls the dampening timer for link down transitions. |
| Physical Link       | Yes — A physical link is present                                                                                        |
|                     | No — A physical link is not present                                                                                     |
| IfIndex             | Displays the interface's index number which reflects its initialization sequence                                        |
| Last State chg      | Displays the system time moment that the peer is up                                                                     |
| Configured Mode     | network — The port is configured for transport network use                                                              |
|                     | access — The port is configured for service access                                                                      |
| Dot1Q Ethertype     | Indicates the Ethertype expected when the port's encapsulation type is Dot1Q                                            |
| QinQ Ethertype      | Indicates the Ethertype expected when the port's encapsulation type is QinQ                                             |
| Net. Egr. Queue Pol | Specifies the network egress queue policy or that the default policy is used                                            |
| Access Egr. Qos     | Specifies the access egress policy or that the default policy 1 is in use                                               |
| Egr. Sched. Pol     | Specifies the port scheduler policy or that the default policy default is in use                                        |
| Encap Type          | Null — Ingress frames will not use any tags or labels to delineate a service                                            |
|                     | dot1q — Ingress frames carry 802.1Q tags where each tag signifies a different service                                   |
|                     | QinQ — Encapsulation type specified for QinQ Access SAPs                                                                |
| Active Alarms       | The number of alarms outstanding on this port                                                                           |
| Auto-negotiate      | True — The link attempts to automatically negotiate the link speed and duplex parameters.                               |
|                     | False — The duplex and speed values are used for the link                                                               |
| Alarm State         | The current alarm state of the port                                                                                     |
| Collect Stats       | Enabled — The collection of accounting and statistical data for the network Ethernet port is enabled                    |

| Label              | Description                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | When applying accounting policies the data, by default, will be collected in the appropriate records and written to the designated billing file                       |
|                    | Disabled — Collection is disabled. Statistics are still accumulated by the IOM cards, however, the CPU will not obtain the results and write them to the billing file |
| OTU                | OTU encapsulation status                                                                                                                                              |
| Configured Address | The base chassis Ethernet MAC address                                                                                                                                 |
| Hardware Address   | The interface's hardware or system assigned MAC address at its protocol 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, then octet, packet, and error statistics are displayed                                             |
| Description        | A text description of the port                                                                                                                                        |
| Interface          | The port ID displayed in the <i>slot/mda/port</i> format                                                                                                              |
| Speed              | The speed of the interface                                                                                                                                            |
| Link-level         | Ethernet — The port is configured as Ethernet                                                                                                                         |
|                    | SONET — The port is configured as SONET-SDH                                                                                                                           |

| Label           | Description                                                                                                                                                                                                                                  |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MTU             | The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets                                                                                                                            |
| Admin State     | Up — The port is administratively up                                                                                                                                                                                                         |
|                 | Down — The port is administratively down                                                                                                                                                                                                     |
| Oper State      | Up — The port is operationally up                                                                                                                                                                                                            |
|                 | Down — The port is operationally down                                                                                                                                                                                                        |
| Duplex          | Full — The link is set to full duplex mode                                                                                                                                                                                                   |
|                 | Half — The link is set to half duplex mode                                                                                                                                                                                                   |
| Hold time up    | The link up dampening time, in seconds<br>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<br>The <b>down</b> timer controls the dampening timer for link down transitions.                                                                                                                    |
| IfIndex         | Displays the interface's index number which reflects its initialization sequence                                                                                                                                                             |
| Phy Link        | Yes — A physical link is present                                                                                                                                                                                                             |
|                 | No — A physical link is not present                                                                                                                                                                                                          |
| Ptp timestamp   | The status of the Precision Time Protocol (PTP) timestamp; applicable to 7210 SAS-R6, 7210 SAS-R12, and 7210 SAS-Sx 10/100GE only.<br>enabled — PTP port-based timestamping is enabled<br>disabled — PTP port-based timestamping is disabled |
| Configured Mode | network — The port is configured for transport network use                                                                                                                                                                                   |
|                 | access — The port is configured for service access                                                                                                                                                                                           |
| Network Qos Pol | The network QoS policy ID applied to the port                                                                                                                                                                                                |
| Encap Type      | Null — Ingress frames will not use any tags or labels to delineate a service.                                                                                                                                                                |
|                 | dot1q — Ingress frames carry 802.1Q tags where each tag signifies a different service                                                                                                                                                        |
|                 | QinQ — Encapsulation type specified for QinQ Access SAPs.                                                                                                                                                                                    |
| Active Alarms   | The number of alarms outstanding on this port                                                                                                                                                                                                |

| Label               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Auto-negotiate      | True — The link attempts to automatically negotiate the link speed and duplex parameters.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                     | False — The duplex and speed values are used for the link                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Alarm State         | The current alarm state of the port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Collect Stats       | Enabled — The collection of accounting and statistical data for the network Ethernet port is enabled. When applying accounting policies the data by default will be collected in the appropriate records and written to the designated billing file.                                                                                                                                                                                                                                                                                                |
|                     | Disabled — Collection is disabled. Statistics are still accumulated by the IOM cards, however, the CPU will not obtain the results and write them to the billing file                                                                                                                                                                                                                                                                                                                                                                               |
| Down-When-Looped    | Shows whether the feature is enabled or disabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Down On Int. Error  | Indicates if down-on-internal-error is enabled or not                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CRC Mon SD Thresh   | Indicates if signal-degrade threshold is configured or not                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| CRC Mon SF Thresh   | Indicates if signal-fail threshold is configured or not                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| CRC Mon Window      | Displays the value of window size used for CRC error monitoring when the signal-degrade or signal-fail thresholds are configured                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Egress Buf (Acc)    | The access-buffer policy for the egress buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Egress Buf (Net)    | The network-buffer policy for the egress buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Ingress Buf (Acc)   | The access-buffer policy for the ingress buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Ingress Pool Size   | The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering.                                                                                                                                                                                                                                                                                                                                                                                              |
| Configured Address  | The base chassis Ethernet MAC address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Hardware Address    | The interface's hardware or system assigned MAC address at its protocol sublayer                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Errors Input/Output | <p>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.</p> <p>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</p> |

| 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      | <p>The number of packets, delivered by this sublayer to a higher (sub)layer, which were addressed to a broadcast address at this sublayer.</p> <p>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.</p> <p>For a MAC layer protocol, this includes both Group and Functional addresses.</p>                                                         |
| 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                              | <p>This field displays the number of cells discarded because of uncorrectable HEC errors</p> <p>Errors do not show up in the raw cell counts</p>                                                                                                                                                                                                                                                                                                                                                       |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Label            | Description                                                        |
|------------------|--------------------------------------------------------------------|
| 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                     |

### Sample output — detailed port output

The following table describes detailed port output fields.

Table 36: Output fields: detailed port

| Label           | Description                                                                                                                                                |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description     | A text description of the port                                                                                                                             |
| Interface       | The port ID displayed in the <i>slot/mda/port</i> format                                                                                                   |
| Speed           | The speed of the interface                                                                                                                                 |
| Link-level      | Ethernet — The port is configured as Ethernet                                                                                                              |
| MTU             | The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets                                          |
| Admin State     | Up — The port is administratively up                                                                                                                       |
|                 | Down — The port is administratively down                                                                                                                   |
| Oper State      | Up — The port is operationally up                                                                                                                          |
|                 | Down — The port is operationally down                                                                                                                      |
| Duplex          | Full — The link is set to full duplex mode                                                                                                                 |
|                 | Half — The link is set to half duplex mode                                                                                                                 |
| Hold time up    | The link up dampening time, in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols |
| Hold time down  | The link down dampening time, in seconds. The <b>down</b> timer controls the dampening timer for link down transitions                                     |
| IfIndex         | Displays the interface's index number which reflects its initialization sequence                                                                           |
| Phy Link        | Yes — A physical link is present                                                                                                                           |
|                 | No — A physical link is not present                                                                                                                        |
| Configured Mode | network — The port is configured for transport network use                                                                                                 |

| Label              | Description                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | access — The port is configured for service access                                                                                                                                                                                                   |
| Network Qos Pol    | The QoS policy ID applied to the port                                                                                                                                                                                                                |
| Table-based        | Indicates whether the table-based resource allocation is enabled or disabled                                                                                                                                                                         |
| DSCP Class Pol Id  | The policy ID for the DSCP classification policy associated with the Ethernet interface used to classify IP packets                                                                                                                                  |
| Untagged-Fc        | The default forwarding class assigned to untagged non-IP packets that do not meet any match criteria for the DSCP classification policy                                                                                                              |
| Access Egr. Qos    | Specifies the access egress policy or that the default policy 1 is in use                                                                                                                                                                            |
| Egr. Sched. Pol    | Specifies the port scheduler policy or that the default policy default is in use                                                                                                                                                                     |
| Encap Type         | Null — Ingress frames will not use any tags or labels to delineate a service                                                                                                                                                                         |
|                    | dot1q — Ingress frames carry 802.1Q tags where each tag signifies a different service                                                                                                                                                                |
| Active Alarms      | The number of alarms outstanding on this port                                                                                                                                                                                                        |
| Auto-negotiate     | True — The link attempts to automatically negotiate the link speed and duplex parameters                                                                                                                                                             |
|                    | False — The duplex and speed values are used for the link                                                                                                                                                                                            |
| Alarm State        | The current alarm state of the port                                                                                                                                                                                                                  |
| Collect Stats      | Enabled — The collection of accounting and statistical data for the network Ethernet port is enabled. When applying accounting policies the data by default will be collected in the appropriate records and written to the designated billing file. |
|                    | Disabled — Collection is disabled. Statistics are still accumulated by the IOM cards, however, the CPU will not obtain the results and write them to the billing file.                                                                               |
| Down-When-Looped   | Shows whether the feature is enabled or disabled                                                                                                                                                                                                     |
| Down On Int. Error | Indicates if down-on-internal-error is enabled or not                                                                                                                                                                                                |
| CRC Mon SD Thresh  | Indicates if signal-degrade threshold is configured or not                                                                                                                                                                                           |
| CRC Mon SF Thresh  | Indicates if signal-fail threshold is configured or not                                                                                                                                                                                              |



| Label                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CRC Mon Window                 | Displays the value of window size used for CRC error monitoring when the signal-degrade or signal-fail thresholds are configured                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Egress Rate                    | The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Egress Buf (Acc)               | The access-buffer policy for the egress buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Egress Buf (Net)               | The network-buffer policy for the egress buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Egress Pool Size               | The amount of egress buffer space, expressed as a percentage of the available buffer space that will be allocated to the port for egress buffering                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Ingress Buf (Acc)              | The access-buffer policy for the ingress buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Ingress Pool Size              | The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Configured Address             | The base chassis Ethernet MAC address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Hardware Address               | The interface's hardware or system assigned MAC address at its protocol sublayer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Errors Input/Output            | <p>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.</p> <p>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.</p> |
| 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                                                                                                                                                                                                                                      |

| Label                               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.                                                                                                                                                                                                                                                                                                                                                         |
| Broadcast Packets Input/Output      | <p>The number of packets, delivered by this sublayer to a higher (sub)layer, which were addressed to a broadcast address at this sublayer.</p> <p>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.</p> <p>For a MAC layer protocol, this includes both Group and Functional addresses.</p>                              |
| Discards Input/Output               | The number of inbound packets chosen to be discarded to possibly free up buffer space                                                                                                                                                                                                                                                                                                                                                                                       |
| Unknown Proto Discards Input/Output | For packet-oriented interfaces, the number of packets received through the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. |
| LLF Admin State                     | Displays the Link Loss Forwarding administrative state                                                                                                                                                                                                                                                                                                                                                                                                                      |
| LLF Oper State                      | Displays the Link Loss Forwarding operational state                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Rx S1 Byte                          | Displays the received S1 byte and its decoded QL value                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Tx DUS/DNU                          | Displays whether the QL value is forcibly set to QL-DUS/QL-DNU                                                                                                                                                                                                                                                                                                                                                                                                              |
| Qinq etype                          | Displays the Ethertype used for qinq packet encapsulation                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Reason down                         | Indicates the reason for an operation state Down                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Acc Egr Sch Mode                    | Displays the port egress scheduler mode                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                  |

```
*A:7210# show port 1/1/1
=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
```

```

Interface       : 1/1/1
Link-level      : Ethernet
Admin State     : up
Oper State      : up
Physical Link    : Yes
Single Fiber Mode : No
IfIndex         : 35684352
Last State Change : 06/27/2001 11:15:22
Last Cleared Time : 06/27/2001 11:14:44

Oper Speed      : 1 Gbps
Config Speed    : 1 Gbps
Oper Duplex     : full
Config Duplex   : full
MTU             : 1578
                : Internal
Hold time up    : 0 seconds
Hold time down  : 0 seconds

Configured Mode : network
Dot1Q Ethertype : 0x8100
Net. Egr. Queue Pol : default
Egr. Sched. Pol  : default
Auto-negotiate   : limited
Accounting Policy : None

Encap Type      : 802.1q
QinQ Ethertype  : 0x8100
Acc Egr Sch Mode : Fc-Based
Access Egr. Qos * : n/a
Network Qos Pol  : n/a
MDI/MDX         : MDI
Collect-stats    : Disabled

Down-when-looped : Disabled
Loop Detected     : False
Down On Int. Error : Disabled

Keep-alive       : 10
Retry            : 120

CRC Mon SD Thresh : Enabled
CRC Mon SF Thresh : Enabled
CRC Mon Window    : 10 seconds
Configured Address : 00:11:00:22:bc:13
Hardware Address   : 00:11:00:22:bc:13
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type : SFP
Model Number     : 3HE00027AAAA02 ALA IPUIAELDAB2
TX Laser Wavelength: 850 nm
Connector Code    : LC
Manufacture date  : 2008/09/29
Serial Number     : PEC5184
Part Number       : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;

=====
Traffic Statistics
=====
                Input                Output
-----
Octets          1556859              1766709
Packets         18523                5849
Errors           0                    0
=====
* indicates that the corresponding row element may have been truncated.
=====
Port Statistics
=====
                Input                Output
-----
Unicast Packets    3324                5847
Multicast Packets  15199                0
Broadcast Packets   0                    2
Discards           0                    0
Unknown Proto Discards 0                    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
=====

```

\*7210#

\*A:7210>config>port# /show port 1/1/1

=====

Ethernet Interface

=====

```

Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1          Oper Speed       : 100 mbps
Link-level       : Ethernet       Config Speed      : 1 Gbps
Admin State      : up             Oper Duplex       : full
Oper State       : up             Config Duplex     : full
Physical Link    : Yes            MTU               : 9212
Single Fiber Mode : No            : None
IfIndex          : 35684352        Hold time up      : 0 seconds
Last State Change : 05/31/2010 11:54:16 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        Access Egr. Qos *: 1
Egr. Sched. Pol   : default          Network Qos Pol  : n/a
Auto-negotiate    : true             MDI/MDX          : MDI
Accounting Policy : None              Collect-stats     : Disabled
Egress Rate       : Default           Max Burst         : Default
LACP Tunnel       : Enabled

```

```

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
Down On Int. Error : Disabled

```

```

CRC Mon SD Thresh : Enabled           CRC Mon Window    : 10 seconds
CRC Mon SF Thresh : Enabled
Configured Address : 00:25:ba:01:b7:f2
Hardware Address   : 00:25:ba:01:b7:f2
Cfg Alarm          :
Alarm Status       :

```

Transceiver Data

```

Transceiver Type   : SFP
Model Number       : 3HE00062AAAA01 ALA IPU1AEHDAA
TX Laser Wavelength : 0 nm           Diag Capable      : no
Connector Code     : Unknown          Vendor OUI        : 00:90:65
Manufacture date    : 2008/09/11      Media             : Ethernet
Serial Number       : PEB2WPD
Part Number         : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
Link Length support : 100m for copper

```

```

=====
Traffic Statistics
=====
-----
                                Input              Output
-----
Octets                        72974              20243
Packets                       482               10
Errors                         0                0
=====
* indicates that the corresponding row element may have been truncated.
=====
Port Statistics
=====
-----
                                Input              Output
-----
Unicast Packets                9                6
Multicast Packets             469               2
Broadcast Packets              4                2
Discards                       0                0
Unknown Proto Discards         0
=====
Ethernet-like Medium Statistics
=====
-----
Alignment Errors :          0  Sngl Collisions :          0
FCS Errors       :          0  Mult Collisions :          0
SQE Test Errors  :          0  Late Collisions :          0
CSE              :          0  Excess Collisns :          0
Too long Frames  :          0  Int MAC Tx Errs :          0
Symbol Errors    :          0  Int MAC Rx Errs :          0
=====
*7210>config>port#

```

```

*7210>config>port# /show port 1/1/1 detail
=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : up
Oper State       : up
Physical Link     : Yes
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 05/31/2010 11:54:16
Last Cleared Time : N/A
Oper Speed       : 100 mbps
Config Speed     : 1 Gbps
Oper Duplex      : full
Config Duplex    : full
MTU              : 9212
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : access
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Net. Egr. Queue Pol: default
Egr. Sched. Pol  : default
Auto-negotiate   : true
Accounting Policy : None
Egress Rate      : Default
LACP Tunnel      : Enabled
Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100

Access Egr. Qos *: 1
Network Qos Pol  : n/a
MDI/MDX          : MDI
Collect-stats    : Disabled
Max Burst        : Default

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
Down On Int. Error : Disabled

CRC Mon SD Thresh : Enabled           CRC Mon Window  : 10 seconds
CRC Mon SF Thresh : Enabled
Configured Address : 00:25:ba:01:b7:f2
Hardware Address   : 00:25:ba:01:b7:f2
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00062AAAA01 ALA IPUIAEHDAA
TX Laser Wavelength: 0 nm             Diag Capable    : no
Connector Code     : Unknown           Vendor OUI      : 00:90:65
Manufacture date   : 2008/09/11        Media          : Ethernet
Serial Number      : PEB2WPD
Part Number        : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
Link Length support: 100m for copper
=====
Traffic Statistics
=====
                        Input          Output
-----
Octets                72974          20243
Packets               482            10
Errors                 0              0
=====
Ethernet Statistics
=====
Broadcast Pckts : 6 Drop Events : 0
Multicast Pckts : 471 CRC/Align Errors : 0
Undersize Pckts : 0 Fragments : 0
Oversize Pckts : 0 Jabbers : 0
Collisions      : 0

Octets : 93217
Packets : 492
Packets of 64 Octets : 0
Packets of 65 to 127 Octets : 2
Packets of 128 to 255 Octets : 567
Packets of 256 to 511 Octets : 2
Packets of 512 to 1023 Octets : 16
Packets of 1024 to 1518 Octets : 7
Packets of 1519 or more Octets : 0
=====
* indicates that the corresponding row element may have been truncated.
=====
Port Statistics
=====
                        Input          Output
-----
Unicast Packets      9            6
Multicast Packets    469           2
Broadcast Packets     4            2
Discards              0            0
Unknown Proto Discards 0
=====

```

```
=====
Ethernet-like Medium Statistics
=====
Alignment Errors :          0  Sngl Collisions :          0
FCS Errors       :          0  Mult Collisions :          0
SQE Test Errors  :          0  Late Collisions :          0
CSE              :          0  Excess Collisns :          0
Too long Frames  :          0  Int MAC Tx Errs :          0
Symbol Errors    :          0  Int MAC Rx Errs :          0
=====
```

#### Queue Statistics

```
=====
-----
Packets      Octets
-----
Egress Queue 1 (be)
Fwd Stats    :      112      20243
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:7210>config>port#

\*A:7210>config>port# /show port 1/1/1 detail

#### Ethernet Interface

```
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : up
Oper State       : up
Physical Link     : Yes
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 05/31/2010 11:54:16
Last Cleared Time  : N/A
Oper Speed       : 100 mbps
Config Speed     : 1 Gbps
Oper Duplex      : full
Config Duplex    : full
MTU              : 9212
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : access
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100

Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100
=====
```

```

Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol : default
Egr. Sched. Pol    : default
Auto-negotiate     : true
Accounting Policy   : None
Egress Rate        : Default
LACP Tunnel        : Enabled

Access Egr. Qos *: 1
Network Qos Pol   : n/a
MDI/MDX           : MDI
Collect-stats     : Disabled
Max Burst         : Default

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

Keep-alive        : 10
Retry             : 120

Sync. Status Msg.  : Disabled
Down On Int. Error : Disabled

Rx Quality Level   : N/A

CRC Mon SD Thresh  : Enabled
CRC Mon SF Thresh  : Enabled
Configured Address : 00:25:ba:01:b7:f2
Hardware Address   : 00:25:ba:01:b7:f2
Cfg Alarm          :
Alarm Status       :

CRC Mon Window     : 10 seconds

Transceiver Data

Transceiver Type    : SFP
Model Number        : 3HE00062AAAA01 ALA IPUIAEHDAA
TX Laser Wavelength: 0 nm
Connector Code      : Unknown
Manufacture date    : 2008/09/11
Serial Number       : PEB2WPD
Part Number         : FCMJ-8521-3-A5
Optical Compliance  : GIGE-T
Link Length support : 100m for copper

=====
Traffic Statistics
=====
                        Input          Output
-----
Octets                  72974          20243
Packets                 482            10
Errors                   0              0
=====

Ethernet Statistics
=====
Broadcast Pckts : 6 Drop Events : 0
Multicast Pckts : 471 CRC/Align Errors : 0
Undersize Pckts : 0 Fragments : 0
Oversize Pckts  : 0 Jabbers : 0
Collisions      : 0

Octets : 93217
Packets : 492
Packets of 64 Octets : 0
Packets of 65 to 127 Octets : 2
Packets of 128 to 255 Octets : 567
Packets of 256 to 511 Octets : 2
Packets of 512 to 1023 Octets : 16
Packets of 1024 to 1518 Octets : 7
Packets of 1519 or more Octets : 0
=====
* indicates that the corresponding row element may have been truncated.

```



```

=====
Port Statistics
=====
                                     Input          Output
-----
Unicast Packets                    9             6
Multicast Packets                  469            2
Broadcast Packets                   4             2
Discards                           0             0
Unknown Proto Discards              0
=====

Ethernet-like Medium Statistics
=====
Alignment Errors : 0 Sngl Collisions : 0
FCS Errors       : 0 Mult Collisions : 0
SQE Test Errors  : 0 Late Collisions : 0
CSE              : 0 Excess Collisns : 0
Too long Frames  : 0 Int MAC Tx Errs  : 0
Symbol Errors    : 0 Int MAC Rx Errs  : 0
=====

Queue Statistics
=====
                                     Packets      Octets
-----
Egress Queue 1 (be)
Fwd Stats      : 112          20243
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
=====

*7210#

```

```

*7210# show port 1/1/1
=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1          Oper Speed      : 1 Gbps
Link-level       : Ethernet        Config Speed     : 1 Gbps

```

```

Admin State      : up
Oper State       : up
Physical Link    : Yes
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 06/27/2001 11:15:22
Last Cleared Time : 06/27/2001 11:14:44

Oper Duplex      : full
Config Duplex    : full
MTU              : 1578
                  : Internal
Hold time up     : 0 seconds
Hold time down   : 0 seconds

Configured Mode  : network
Dot1Q Ethertype  : 0x8100
Net. Egr. Queue Pol : default
Egr. Sched. Pol  : default
Auto-negotiate   : limited
Accounting Policy : None

Encap Type       : 802.1q
QinQ Ethertype   : 0x8100
Access Egr. Qos * : n/a
Network Qos Pol  : n/a
MDI/MDX          : MDI
Collect-stats    : Disabled

Down-when-looped : Disabled
Loop Detected     : False
Down On Int. Error : Disabled

Keep-alive       : 10
Retry            : 120

CRC Mon SD Thresh : Enabled
CRC Mon SF Thresh : Enabled
Configured Address : 00:11:00:22:bc:13
Hardware Address   : 00:11:00:22:bc:13
Cfg Alarm          :
Alarm Status       :

CRC Mon Window    : 10 seconds

Transceiver Data

Transceiver Type  : SFP
Model Number      : 3HE00027AAAA02 ALA IPU1AELDAB2
TX Laser Wavelength: 850 nm
Connector Code    : LC
Manufacture date  : 2008/09/29
Serial Number     : PEC5184
Part Number       : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;

=====
Traffic Statistics
=====

```

|         | Input   | Output  |
|---------|---------|---------|
| Octets  | 1556859 | 1766709 |
| Packets | 18523   | 5849    |
| Errors  | 0       | 0       |

```

=====
* indicates that the corresponding row element may have been truncated.
=====

Port Statistics
=====

```

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 3324  | 5847   |
| Multicast Packets      | 15199 | 0      |
| Broadcast Packets      | 0     | 2      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     |        |

```

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

```

|                    |   |                   |   |
|--------------------|---|-------------------|---|
| Alignment Errors : | 0 | Sngl Collisions : | 0 |
| FCS Errors :       | 0 | Mult Collisions : | 0 |
| SQE Test Errors :  | 0 | Late Collisions : | 0 |
| CSE :              | 0 | Excess Collisns : | 0 |

```
Too long Frames : 0 Int MAC Tx Errs : 0
Symbol Errors : 0 Int MAC Rx Errs : 0
=====
*7210#
```

### Sample output — Ethernet output fields

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

=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : down
Oper State       : down
Physical Link     : No
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 03/03/2011 04:34:26
Last Cleared Time : N/A

Oper Speed       : N/A
Config Speed     : 1 Gbps
Oper Duplex      : N/A
Config Duplex    : full
MTU              : 9212
Internal         : Internal
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : network
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Net. Egr. Queue Pol : default
Egr. Sched. Pol  : default
Auto-negotiate   : true
Accounting Policy : None
Egress Rate      : Default
LACP Tunnel      : Disabled

Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100

Network Qos Pol  : 1
Access Egr. Qos *: n/a
MDI/MDX          : unknown
Collect-stats    : Disabled
Max Burst        : Default

Split Horizon Group: (Not Specified)
Down-when-looped  : Disabled
Loop Detected     : False
Use Broadcast Addr : False

Keep-alive        : 10
Retry             : 120

Sync. Status Msg. : Disabled
Code-Type         : SDH
Tx DUS/DNU        : Disabled
Down On Int. Error : Disabled

Rx Quality Level  : N/A
Tx Quality Level  : N/A

CRC Mon SD Thresh : Enabled
CRC Mon SF Thresh : Enabled
Configured Address : 00:25:ba:02:bd:62
Hardware Address   : 00:25:ba:02:bd:62
Cfg Alarm          :
Alarm Status       :

CRC Mon Window    : 10 seconds

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00062AAAA01 ALA IPUIAEHDAA
TX Laser Wavelength: 0 nm
Connector Code     : Unknown
Manufacture date   : 2010/01/06
Serial Number      : PH22J35
Part Number        : FCMJ-8521-3-A5
Optical Compliance : GIGE-T

Diag Capable       : no
Vendor OUI         : 00:90:65
Media              : Ethernet
```

Link Length support: 100m for copper

#### 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 |

#### Meter Statistics

|         |        |
|---------|--------|
| Packets | Octets |
|---------|--------|

```

Ingress Meter 1 (Unicast)
For. InProf      :      0      0
For. OutProf     :      0      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:7210-SAS>

```

```

*7210>show# port 1/1/6 detail

=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/6
Link-level       : Ethernet
Admin State      : down
Oper State       : down
Physical Link    : No
Single Fiber Mode : No
IfIndex          : 35848192
Last State Change : 04/06/2001 07:30:45
Last Cleared Time : N/A
Oper Speed       : N/A
Config Speed     : 1 Gbps
Oper Duplex      : N/A
Config Duplex    : full
MTU              : 9212
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : network
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100

```

```

Net. Egr. Queue Pol: default      Network Qos Pol : 1
Egr. Sched. Pol   : default      Access Egr. Qos *: n/a
Auto-negotiate    : true         MDI/MDX         : unknown
Accounting Policy : None         Collect-stats    : Disabled
Egress Rate       : Default      Max Burst       : Default
LACP Tunnel       : 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
Down On Int. Error: Disabled

CRC Mon SD Thresh : Enabled      CRC Mon Window  : 10 seconds
CRC Mon SF Thresh : Enabled
Configured Address: 00:25:ba:03:92:77
Hardware Address  : 00:25:ba:03:92:77
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   : 2010/05/28  Media           : Ethernet
Serial Number      : PHN661L
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)            | +26.2  | +95.0      | +90.0     | -20.0    | -25.0     |
| Supply Voltage (V)         | 3.25   | 3.90       | 3.70      | 2.90     | 2.70      |
| Tx Bias Current (mA)       | 1.0    | 17.0       | 14.0      | 2.0      | 1.0       |
| Tx Output Power (dBm)      | -23.77 | -2.00      | -2.00     | -11.02   | -11.74    |
| Rx Optical Power (avg dBm) | -35.23 | 1.00       | -1.00     | -18.01   | -20.00    |

```

=====

Traffic Statistics
=====

```

|         | Input | Output |
|---------|-------|--------|
| Octets  | 128   | 640    |
| Packets | 2     | 10     |
| 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          :          768
Packets         :          12
Packets of 64 Octets :          12
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                2             10
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
=====

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
=====

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:MTU-T1>show#

```

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

```

=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/2
Link-level       : Ethernet
Admin State      : down
Oper State       : down
Reason Down      : noServicePort
Physical Link    : No
Single Fiber Mode : No
IfIndex          : 35717120
Last State Change : 12/20/2010 20:51:55
Last Cleared Time : N/A

Oper Speed       : N/A
Config Speed     : 1 Gbps
Oper Duplex      : N/A
Config Duplex    : full

MTU              : 9212
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : network
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Net. Egr. Queue Pol : default
Egr. Sched. Pol  : default
Auto-negotiate   : true
Accounting Policy : None
Egress Rate      : Default
LACP Tunnel      : Disabled

Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100

Network Qos Pol  : 1
Access Egr. Qos *: n/a
MDI/MDX          : unknown
Collect-stats    : Disabled
Max Burst        : Default

Split Horizon Group: (Not Specified)
Down-when-Looped  : Disabled
Loop Detected     : False
Use Broadcast Addr : False

Keep-alive        : 10
Retry             : 120

Sync. Status Msg. : Disabled
Down On Int. Error : Disabled

Rx Quality Level  : N/A

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

```



Configured Address : 00:25:ba:00:5e:34  
Hardware Address : 00:25:ba:00:5e:34  
Cfg Alarm :  
Alarm Status :

#### Transceiver Data

Transceiver Type : SFP  
Model Number : 3HE00867CAAA01 ALA IPUIBD9DAA  
TX Laser Wavelength: 1310 nm Diag Capable : yes  
Connector Code : LC Vendor OUI : 00:00:5f  
Manufacture date : 2010/03/10 Media : Ethernet  
Serial Number : 9ZT500000163  
Part Number : SCP6G14-A8-AWE  
Optical Compliance : GIGE-LX  
Link Length support: 40km for SMF

#### Transceiver Digital Diagnostic Monitoring (DDM), Externally Calibrated

|                            | Value  | High Alarm | High Warn | Low Warn | Low Alarm |
|----------------------------|--------|------------|-----------|----------|-----------|
| Temperature (C)            | +32.3  | +98.0      | +88.0     | -43.0    | -45.0     |
| Supply Voltage (V)         | 3.29   | 4.12       | 3.60      | 3.00     | 2.80      |
| Tx Bias Current (mA)       | 0.0    | 70.0       | 60.0      | 0.1      | 0.0       |
| Tx Output Power (dBm)      | -40.00 | 3.00       | 1.00      | -5.50    | -7.50     |
| Rx Optical Power (avg dBm) | -40.00 | 0.00       | -1.00     | -21.49   | -22.44    |

#### 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
=====

=====
Meter Statistics
=====

-----
Packets                                Octets
-----
Ingress Meter  1 (Unicast)
For. InProf      :                0
For. OutProf     :                0
Ingress Meter  9 (Multipoint)
For. InProf      :                0
For. OutProf     :                0
-----

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

-----
Packets                                Octets
-----
Egress Queue  1 (be)
Fwd Stats      :                0
Drop Stats     :                0
Egress Queue  2 (l2)
Fwd Stats      :                0
Drop Stats     :                0
Egress Queue  3 (af)
Fwd Stats      :                0
Drop Stats     :                0
Egress Queue  4 (l1)
Fwd Stats      :                0
Drop Stats     :                0
Egress Queue  5 (h2)
Fwd Stats      :                0
Drop Stats     :                0
Egress Queue  6 (ef)
Fwd Stats      :                0
Drop Stats     :                0
Egress Queue  7 (h1)
Fwd Stats      :                0
Drop Stats     :                0

```

```

Egress Queue 8 (nc)
Fwd Stats      :      0      0
Drop Stats     :      0      0
=====

*A:dut-g>config>port>ethernet>access>egr>queue-override# show port 1/1/1 detail
=====
Ethernet Interface
=====
Description      : 10-Gig Ethernet
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : up
Oper State       : down
Physical Link     : No
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 01/01/2000 00:10:14
Last Cleared Time : N/A
Phys State Chng Cnt: 0
Ptp timestamp    : enabled
Configured Mode   : access
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate  : 100
Net. Egr. Queue Pol: default
Table-based      : disabled
DSCP Class Pol Id : n/a
Acc Egr Policy ID : 1
Auto-negotiate    : N/A
Accounting Policy : None
Acct Plcy Eth Phys : None
Egress Rate       : Default
LACP Tunnel       : Disabled
Split Horizon Group: (Not Specified)
Down-when-looped  : Disabled
Loop Detected     : False
Use Broadcast Addr : False
Sync. Status Msg. : Disabled
Tx DUS/DNU       : Disabled
SSM Code Type     : sdh
Down On Int. Error : Disabled
CRC Mon SD Thresh : Disabled
CRC Mon SF Thresh : Disabled
EFM OAM           : Disabled
Configured Address :
Hardware Address  :
Cfg Alarm         : remote local
Transceiver Data  :
Transceiver Status : not-equipped
=====
* indicates that the corresponding row element may have been truncated.
=====
Traffic Statistics
=====
                                Input      Output
-----
Octets                      0          0
Packets                     0          0
Errors                      0          0
=====
Interface

```

```

=====
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
=====

-----
Egress Queue Override details
-----
Queue Id : 1
queue-mgmt : default
queue-mode : strict
weight : 7
rate cir : 3000 (kbps)
rate pir : 90000 (kbps)
adaptation-rule cir: min
adaptation-rule pir: max

Queue Id : 5
queue-mgmt : 200
queue-mode : weighted
weight : 1
rate cir : 5.00% (percent)
rate pir : 10.00% (percent)
adaptation-rule cir: min
adaptation-rule pir: closest

Queue Id : 8

=====
Port Statistics
=====
Input Output
-----
Unicast Packets 0 0
Multicast Packets 0 0
Broadcast Packets 0 0
Discards 0 0
Unknown Proto Discards 0 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:dut-g>config>port>ethernet>access>egr>queue-override#
```

### Sample output — Ethernet output fields, 7210 SAS-Mxp

```
*A:SAS-M2>show# port 1/1/1 ethernet

=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : up
Oper State       : up
Physical Link     : Yes
Config Conn Type : SFP
Single Fiber Mode : No
IfIndex          : 35684352
Last State Change : 09/03/2015 06:28:58
Last Cleared Time  : N/A
Phys State Chng Cnt: 1

Oper Speed       : 1 Gbps
Config Speed     : 1 Gbps
Oper Duplex      : full
Config Duplex    : full
MTU              : 9212
Oper Conn Type   : SFP
LoopBack Mode    : None
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : network
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100
Net. Egr. Queue Pol: default
Egr. Remark      : False

Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100
Network Qos Pol  : 1
Egr. Remark Plcy : N/A

Acc Egr Policy ID : N/A
```

```

Auto-negotiate      : true          MDI/MDX           : MDX
Accounting Policy   : None          Collect-stats      : Disabled
Acct Plcy Eth Phys  : None          Collect Eth Phys   : Disabled
Egress Rate         : Default       Max Burst          : Default
LACP Tunnel         : Disabled       DEI Classificati* : Disabled

Split Horizon Group: (Not Specified)
Down-when-looped    : Disabled      Keep-alive         : 10
Loop Detected       : False         Retry              : 120
Use Broadcast Addr   : False

Sync. Status Msg.   : Enabled        Rx Quality Level   : failed
Tx DUS/DNU          : Disabled       Tx Quality Level   : 0x2(prc)
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  : c4:08:4a:7a:ad:e3
Hardware Address     : c4:08:4a:7a:ad:e3

Transceiver Data

Transceiver Type    : SFP
Model Number        : 3HE00062CBAA01 ALA IPUIBDYDAA
TX Laser Wavelength: 0 nm           Diag Capable       : no
Connector Code      : Unknown        Vendor OUI          : 00:90:65
Manufacture date     : 2013/08/02     Media               : Ethernet
Serial Number        : PQ547A3
Part Number          : FCLF8521P2BTL-A5
Optical Compliance   : GIGE-T
Link Length support  : 100m for copper

=====
Traffic Statistics
=====
                        Input          Output
-----
Octets                 586            57661376
Packets                7             450481
Errors                 0              0
=====
* indicates that the corresponding row element may have been truncated.

=====
Port Statistics
=====
                        Input          Output
-----
Unicast Packets        0              0
Multicast Packets      7             450479
Broadcast Packets      0              3
Discards               0              0
Unknown Proto Discards 0              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:SAS-M2>show
```

### Sample output — Ethernet output fields, 7210 SAS-Mxp with IP DSCP-based profile assignment with color-aware metering

```
*A:Dut-A# show port 5/1/1
=====
Ethernet Interface
=====
Description      : 10/100/Gig Ethernet SFP
Interface        : 5/1/1
Link-level       : Ethernet
Admin State      : up
Oper State       : down
Physical Link     : No
Single Fiber Mode : No
IfIndex          : 169902080
Last State Change : 11/07/2017 05:02:44
Last Cleared Time  : N/A
Phys State Chng Cnt: 0
Ptp timestamp    : enabled
Configured Mode   : access
Dot1Q Ethertype  : 0x8100
PBB Ethertype     : 0x88e7
Ing. Pool % Rate  : 100
Net. Egr. Queue Pol: default
Table-based      : enabled
DSCP Class Pol Id : 1
Acc Egr Policy ID : 1
Auto-negotiate    : true
Accounting Policy : None
Acct Plcy Eth Phys : None
Egress Rate       : Default
LACP Tunnel       : Disabled
Split Horizon Group: (Not Specified)
Down-when-looped  : Disabled
Loop Detected     : False
Use Broadcast Addr : False
Sync. Status Msg. : Disabled
Tx DUS/DNU        : Disabled
SSM Code Type     : sdh
Down On Int. Error : Disabled
CRC Mon SD Thresh : Disabled
CRC Mon SF Thresh : Disabled
EFM OAM           : Disabled
Configured Address : c4:08:4a:31:b6:f3
Hardware Address   : c4:08:4a:31:b6:f3
Transceiver Data
Transceiver Status : operational
Transceiver Type    : SFP
Model Number        : 3HE00027AAAA02 ALA IPUIAELDAB
TX Laser Wavelength: 850 nm
Connector Code      : LC
Manufacture date    : 2010/05/28
Serial Number       : PHN1DWU
Part Number         : FTRJ8519P2BNL-A6
Optical Compliance  : GIGE-SX
Link Length support: 550m for OM2 50u MMF; 300m for OM1 62.5u MMF

Oper Speed      : N/A
Config Speed    : 1 Gbps
Oper Duplex     : N/A
Config Duplex   : full
MTU             : 1518
LoopBack Mode   : None
Hold time up    : 0 seconds
Hold time down  : 0 seconds
DDM Events      : Enabled

Encap Type      : 802.1q
QinQ Ethertype  : 0x8100
Egr. Pool % Rate : 100
Network Qos Pol : n/a
Untagged-Fc     : be
MDI/MDX         : unknown
Collect-stats    : Disabled
Collect Eth Phys : Disabled
Max Burst       : Default
DEI Classificati*: Enabled
Keep-alive      : 10
Retry           : 120
Rx Quality Level : N/A
Tx Quality Level : N/A
CRC Mon Window  : 10 seconds
EFM OAM Link Mon : Disabled
Diag Capable    : yes
Vendor OUI      : 00:90:65
Media           : Ethernet
```

```

=====
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
=====
                                Value High Alarm  High Warn    Low Warn    Low Alarm
-----
Temperature (C)                 +24.6      +95.0      +90.0      -20.0      -25.0
Supply Voltage (V)              3.26       3.90       3.70       2.90       2.70
Tx Bias Current (mA)            6.1        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)      -36.99      1.00      -1.00      -18.01!    -20.00!
=====
* indicates that the corresponding row element may have been truncated.
=====
Traffic Statistics
=====
                                Input              Output
-----
Octets                          0              0
Packets                         0              0
Errors                          0              0
=====
Port Statistics
=====
                                Input              Output
-----
Unicast Packets                 0              0
Multicast Packets               0              0
Broadcast Packets               0              0
Discards                       0              0
Unknown Proto Discards          0
=====
Ethernet-like Medium Statistics
=====
Alignment Errors :              0  Sngl Collisions :              0
FCS Errors       :              0  Mult Collisions :              0
SQE Test Errors  :              0  Late Collisions :              0
CSE              :              0  Excess Collisns :              0
Too long Frames  :              0  Int MAC Tx Errs :              0
Symbol Errors    :              0  Int MAC Rx Errs :              0
=====
*A:Dut-A#

```

### Sample output — access egress queue override

The following table describes Ethernet access egress queue override output fields.

Table 37: Output fields: Ethernet access egress queue override

| Label      | Description                                                                                                                                                   |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Queue ID   | The queue ID of the queue having queue overrides                                                                                                              |
| queue-mgmt | The name of the queue management policy that overrides the queue management policy configured in the access egress QoS policy assigned to the port            |
| queue-mode | The queue mode that overrides the queue mode configured in the access egress QoS policy assigned to the port. The values are <b>strict</b> or <b>weighted</b> |



| Label               | Description                                                                                                                                                                                                                                                                                                                                          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| weight              | The <i>weight</i> value that overrides the value configured in the access egress QoS policy assigned to the port                                                                                                                                                                                                                                     |
| rate cir            | The <i>rate-cir</i> value that overrides the value configured in the access egress QoS policy assigned to the port<br><br>The displayed CIR value is specified in kilobits per second (kbps) when the <b>rate</b> command is used or as a percentage of egress port line rate (that is, the port limit) when the <b>percent-rate</b> command is used |
| rate pir            | The <i>rate-pir</i> value that overrides the value configured in the access egress QoS policy assigned to the port<br><br>The displayed PIR value is specified in kilobits per second (kbps) when the <b>rate</b> command is used or as a percentage of egress port line rate (that is, the port limit) when the <b>percent-rate</b> command is used |
| adaptation-rule cir | The adaptation rule CIR setting ( <b>min</b> , <b>max</b> , or <b>closest</b> ) that overrides the setting configured in the access egress QoS policy assigned to the port                                                                                                                                                                           |
| adaptation-rule pir | The adaptation rule PIR setting ( <b>min</b> , <b>max</b> , or <b>closest</b> ) that overrides the setting configured in the access egress QoS policy assigned to the port                                                                                                                                                                           |

```

-----
Egress Queue Override details
-----
Queue Id : 1
queue-mgmt      : default
queue-mode      : strict
weight          : 7
rate cir        : 3000 (kbps)
rate pir        : 90000 (kbps)
adaptation-rule cir: min
adaptation-rule pir: max

Queue Id : 5
queue-mgmt      : 200
queue-mode      : weighted
weight          : 1
rate cir        : 5.00% (percent)
rate pir        : 10.00% (percent)
adaptation-rule cir: min
adaptation-rule pir: closest

Queue Id : 8

=====
*A:dut-g>config>port>ethernet>access>egr>queue-override#

```

### Sample output — Ethernet statistics

The following table describes Ethernet statistics output fields.

Table 38: Output fields: Ethernet statistics

| Label            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Broadcast Pckts  | <p>The number of packets, delivered by this sublayer to a higher (sub)layer, which were addressed to a broadcast address at this sublayer.</p> <p>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.</p> <p>For a MAC layer protocol, this includes both Group and Functional addresses.</p>                                                                |
| Multicast Pckts  | <p>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.</p> |
| Undersize Pckts  | <p>The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed</p>                                                                                                                                                                                                                                                                                                                                              |
| Oversize Pckts   | <p>The total number of packets received that were longer than can be accepted by the physical layer of that port (9900 octets excluding framing bits, but including FCS octets for GE ports) and were otherwise well formed</p>                                                                                                                                                                                                                                                                               |
| Collisions       | <p>The best estimate of the total number of collisions on this Ethernet segment</p>                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Drop Events      | <p>The total number of events in which packets were dropped by the probe because of lack of resources</p> <p>This number is not necessarily the number of packets dropped; it is just the number of times this condition has been detected.</p>                                                                                                                                                                                                                                                               |
| CRC Align Errors | <p>The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)</p>                                                                                                                                                                                  |
| Fragments        | <p>The total number of packets received that were less than 64 octets (excluding framing bits but including FCS octets) and had either a bad Frame Check Sequence (FCS) with an integral</p>                                                                                                                                                                                                                                                                                                                  |

| Label             | Description                                                                                                                                                                                                                                                                                  |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)                                                                                                                                                                                             |
| Jabbers           | The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error) |
| Ingress Pool Size | The amount of ingress buffer space, expressed as a percentage of the available buffer space that will be allocated to the port for ingress buffering.                                                                                                                                        |
| Octets            | The total number of octets received                                                                                                                                                                                                                                                          |
| Packets           | The total number of packets received                                                                                                                                                                                                                                                         |
| Packets to        | The number of packets received that were equal to or less than the displayed octet limit                                                                                                                                                                                                     |

```

=====
Ethernet Statistics
=====
Broadcast Pckts :                2 Drop Events      :                0
Multicast Pckts :             15863 CRC/Align Errors :                0
Undersize Pckts :                0 Fragments       :                0
Oversize Pckts :                0 Jabbers          :                0
Collisions      :                0

Octets          :             3468749
Packets         :             25439
Packets of 64 Octets :             25370
Packets of 65 to 127 Octets :             4987
Packets of 128 to 255 Octets :             10937
Packets of 256 to 511 Octets :                0
Packets of 512 to 1023 Octets :                0
Packets of 1024 to 1518 Octets :                0
Packets of 1519 or more Octets :                0
=====

```

#### Sample output — Ethernet-like medium statistics

The following table describe Ethernet-like Medium Statistics fields.

Table 39: Output fields: Ethernet-like medium statistics

| Label            | Description                                                                                                                                                                                                                                                                                              |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alignment Errors | The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets |

| Label             | Description                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCS Errors        | The number of frames received that are an integral number of octets but do not pass the FCS check                                                                                                                                                                                                                                                                          |
| SQE Errors        | The number of times that the SQE TEST ERROR is received                                                                                                                                                                                                                                                                                                                    |
| CSE               | The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame                                                                                                                                                                                                                                                        |
| Too long Frames   | The number of frames received that exceed the maximum permitted frame size                                                                                                                                                                                                                                                                                                 |
| Symbol Errors     | For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present                                                                                                                                                                                                                                              |
| Sngl Collisions   | The number of frames that are involved in a single collision, and are subsequently transmitted successfully                                                                                                                                                                                                                                                                |
| Mult Collisions   | The number of frames that are involved in more than one collision and are subsequently transmitted successfully                                                                                                                                                                                                                                                            |
| Late Collisions   | The number of times that a collision is detected later than one slot time into the transmission of a packet                                                                                                                                                                                                                                                                |
| Excess Collisions | The number of frames for which a transmission fails because of excessive collisions                                                                                                                                                                                                                                                                                        |
| Int MAC Tx Errs   | The number of frames for which a transmission fails because of an internal MAC sublayer transmit error                                                                                                                                                                                                                                                                     |
| Int MAC Rx Errs   | The number of frames for which a reception fails because of an internal MAC sublayer receive error                                                                                                                                                                                                                                                                         |
| Multicast Pckts   | The number of packets, delivered by this sublayer to a higher (sub)layer, which were not addressed to a unicast 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 unicast or broadcast address at this sublayer, including those that were discarded or not sent. |
| Undersize Pckts   | The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed                                                                                                                                                                                                                    |
| Oversize Pckts    | The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed                                                                                                                                                                                                                   |
| Collisions        | The best estimate of the total number of collisions on this Ethernet segment.                                                                                                                                                                                                                                                                                              |
| Drop Events       | The total number of times that packets were detected as being dropped because of a lack of resources (not necessarily the total number of packets dropped).                                                                                                                                                                                                                |
| CRC Align Errors  | The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).                                                                            |

| Label                               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fragments                           | The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).                                                                                                                                                                            |
| Jabbers                             | The total number of packets received that were longer than 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)                                                                                                                                                                            |
| Octets                              | Total number of octets received                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Packets                             | The number of packets received, broken down by size Port Statistics                                                                                                                                                                                                                                                                                                                                                                                                    |
| Unicast packets input/output        | The number of packets, delivered by this 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 not addressed to a unicast 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 unicast or broadcast address at this sublayer, including those that were discarded or not sent.                                                                                             |
| Broadcast packets input/output      | 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 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.                                                                                             |
| Discards input/output               | The number of inbound packets chosen to be discarded to possibly free up buffer space                                                                                                                                                                                                                                                                                                                                                                                  |
| Unknown proto discards input/output | For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. |
| Unknown proto                       | Discards do not show up in the packet counts                                                                                                                                                                                                                                                                                                                                                                                                                           |

\*7210#

=====

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
=====
*7210#

```

**Sample output — Port associations**

The following table describes port associations output fields.

Table 40: Output fields: port associations

| Label       | Description                                                             |
|-------------|-------------------------------------------------------------------------|
| Svc ID      | The service identifier                                                  |
| Name        | The name of the IP interface                                            |
| Encap Value | The dot1q or qinq encapsulation value on the port for this IP interface |

```

*7210>config# show port 1/1/23 associations
=====
Interface Table
=====
Router/ServiceId      Name      Encap Val
-----
Router: Base          one       0
-----
Interfaces
=====
*7210>config#

```

**Sample output — A1 detailed**

The following table describes A1 detailed output fields.

Table 41: Output fields: A1 detailed

| Label        | Description                                       |
|--------------|---------------------------------------------------|
| Description  | A text description of the port                    |
| Interface    | The port ID displayed in the slot/mda/port format |
| Oper Speed   | The operating speed of the interface              |
| Link-level   | Ethernet — The port is configured as Ethernet     |
| Config Speed | The configured speed of the interface             |
| Admin State  | Up — The port is administratively up              |
|              | Down — The port is administratively down          |
| Oper Duplex  | The operating duplex mode of the interface        |

| Label               | Description                                                                                                                                               |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oper State          | Up — The port is operationally up                                                                                                                         |
|                     | Down — The port is operationally down                                                                                                                     |
| Config Duplex       | Full — The link is configured to full duplex mode                                                                                                         |
|                     | Half — The link is configured to half duplex mode                                                                                                         |
| Physical Link       | Yes — A physical link is present                                                                                                                          |
|                     | No — A physical link is not present                                                                                                                       |
| MTU                 | The size of the largest packet that can be sent/received on the Ethernet physical interface, specified in octets                                          |
| IfIndex             | The interface 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                                                    |
| 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                                                                               |

| Label               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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  | <p>Octets input/output – The total number of octets received and transmitted on the port 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.</p> <p>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.</p> <p>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.</p> |
| Ethernet Statistics | Broadcast Pkts — 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 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

```
A:7210>show# port A/1
```

```
=====
Ethernet Interface
=====
```

```

Description      : 10/100 Ethernet TX
Interface        : A/1
Link-level       : Ethernet
Admin State      : up
Oper State       : up
Physical Link    : Yes
Single Fiber Mode : No
IfIndex          : 67141632
Last State Change : 07/12/2010 14:26:43
Last Cleared Time : N/A

Oper Speed       : 10 mbps
Config Speed     : 100 mbps
Oper Duplex      : half
Config Duplex    : full
MTU              : 1514

Hold time up     : 0 seconds
Hold time down   : 0 seconds

```



```

Configured Mode      : network
Dot1Q Ethertype     : 0x8100
PBB Ethertype       : 0x88e7
Ing. Pool % Rate    : 100
Ing. Pool Policy    : n/a
Egr. Pool Policy    : n/a
Net. Egr. Queue Pol :
Egr. Sched. Pol     : default
Auto-negotiate      : true
Accounting Policy   : None
Egress Rate         : Default
LACP Tunnel         : Disabled

Encap Type          : null
QinQ Ethertype     : 0x8100
Egr. Pool % Rate   : 100

Access Egr. Qos *  : n/a
Network Qos Pol    : n/a
MDI/MDX            : MDI
Collect-stats      : Disabled
Max Burst           : Default

Split Horizon Group: (Not Specified)
Down-when-looped   : N/A
Loop Detected      : N/A
Use Broadcast Addr : N/A

Keep-alive          : N/A
Retry               : N/A

Sync. Status Msg.   : Disabled
Down On Int. Error  : Disabled

Rx Quality Level    : N/A

CRC Mon SD Thresh   : Enabled
CRC Mon SF Thresh   : Enabled
CRC Mon Window      : 10 seconds
Configured Address  : 00:0a:0b:0a:0d:01
Hardware Address    : 00:0a:0b:0a:0d:01
Cfg Alarm           :
Alarm Status        :

=====
Traffic Statistics
=====

```

|         | Input  | Output |
|---------|--------|--------|
| Octets  | 185674 | 0      |
| Packets | 2256   | 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      | 2256  | 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:7210>show#

```

### Sample output — 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 — detail, 7210 SAS-Sx 10/100GE

```
*A:NS1633T0067>show# port 1/1/1 detail
```

#### Ethernet Interface

```
=====
Description      : 1-Gig/10-Gig Ethernet
Interface        : 1/1/1
Link-level       : Ethernet
Admin State      : down
Oper State       : down
Physical Link    : No
Config Conn Type : N/A
Single Fiber Mode : No
Single Fiber Mode :
IfIndex          : 35684352
Last State Change : 01/01/2000 00:29:06
Last Cleared Time : N/A
Phys State Chng Cnt: 0

Oper Speed       : 0 mbps
Config Speed     : 10 Gbps
Oper Duplex      : full
Config Duplex    : N/A
MTU              : 9212
Oper Conn Type   : N/A
LoopBack Mode    : None
Decommissioned   : No
Hold time up     : 0 seconds
Hold time down   : 0 seconds
DDM Events       : Enabled

Configured Mode  : network
Dot1Q Ethertype  : 0x8100
PBB Ethertype    : 0x88e7
Ing. Pool % Rate : 100
Net. Egr. Queue Pol: default
Egr. Sched. Pol  : default
Auto-negotiate   : N/A
Accounting Policy : None
Acct Plcy Eth Phys : None
Egress Rate      : Default
LACP Tunnel      : Disabled

Encap Type       : null
QinQ Ethertype   : 0x8100
Egr. Pool % Rate : 100
Network Qos Pol  : 1
Access Egr. Qos *: n/a
MDI/MDX          : N/A
Collect-stats    : Disabled
Collect Eth Phys : Disabled
Max Burst        : Default
DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled
Loop Detected      : False
Use Broadcast Addr : False

Keep-alive        : 10
Retry             : 120

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

Down On Int. Error : Disabled

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

EFM OAM           : Disabled
EFM OAM Link Mon  : Disabled

Configured Address : d0:99:d5:8f:5e:43
Hardware Address   : d0:99:d5:8f:5e:43
Cfg Alarm          : remote local
Alarm Status       : local

Transceiver Data

Transceiver Status : unsupported
Transceiver Type    : SFP
Model Number       : 3HE00062CBAA01 ALA IPUIBDYDAA
```

```

TX Laser Wavelength: 0 nm                      Diag Capable      : no
Connector Code      : Unknown                    Vendor OUI         : 00:90:65
Manufacture date    : 2011/11/21                Media             : Ethernet
Serial Number       : PLN0YCV
Part Number         : FCLF8521P2BTL-A5
Optical Compliance  : GIGE-T
Link Length support : 100m for copper
=====
* indicates that the corresponding row element may have been truncated.
=====

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

Ethernet Statistics
=====

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

Octets : 0
Packets : 0
Packets of 64 Octets : 0
Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 0
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 0
Packets of 1024 to 1518 Octets : 0
Packets of 1519 or more Octets : 0
=====

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

Ethernet-like Medium Statistics
=====

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

```

| Per Port Threshold Statistics |         |        |
|-------------------------------|---------|--------|
|                               | Packets | Octets |
| High Fifo Dropped             | 0       | 0      |
| Low Fifo Dropped              | 0       | 0      |
| Meter Statistics              |         |        |
|                               | Packets | Octets |
| Ingress Meter 1 (Unicast)     |         |        |
| For. InProf :                 | 0       | 0      |
| For. OutProf :                | 0       | 0      |
| Queue Statistics              |         |        |
|                               | Packets | Octets |
| Egress Queue 1 (be)           |         |        |
| Fwd Stats :                   | 0       | 0      |
| Drop Stats :                  | 0       | 0      |
| Fwd Stats (uc) :              | 0       | 0      |
| Drop Stats (uc) :             | 0       | 0      |
| Fwd Stats (mc) :              | 0       | 0      |
| Drop Stats (mc) :             | 0       | 0      |
| Egress Queue 2 (l2)           |         |        |
| Fwd Stats :                   | 0       | 0      |
| Drop Stats :                  | 0       | 0      |
| Fwd Stats (uc) :              | 0       | 0      |
| Drop Stats (uc) :             | 0       | 0      |
| Fwd Stats (mc) :              | 0       | 0      |
| Drop Stats (mc) :             | 0       | 0      |
| Egress Queue 3 (af)           |         |        |
| Fwd Stats :                   | 0       | 0      |
| Drop Stats :                  | 0       | 0      |
| Fwd Stats (uc) :              | 0       | 0      |
| Drop Stats (uc) :             | 0       | 0      |
| Fwd Stats (mc) :              | 0       | 0      |
| Drop Stats (mc) :             | 0       | 0      |
| Egress Queue 4 (l1)           |         |        |
| Fwd Stats :                   | 0       | 0      |
| Drop Stats :                  | 0       | 0      |
| Fwd Stats (uc) :              | 0       | 0      |
| Drop Stats (uc) :             | 0       | 0      |
| Fwd Stats (mc) :              | 0       | 0      |
| Drop Stats (mc) :             | 0       | 0      |
| Egress Queue 5 (h2)           |         |        |
| Fwd Stats :                   | 0       | 0      |
| Drop Stats :                  | 0       | 0      |
| Fwd Stats (uc) :              | 0       | 0      |
| Drop Stats (uc) :             | 0       | 0      |
| Fwd Stats (mc) :              | 0       | 0      |
| Drop Stats (mc) :             | 0       | 0      |

```
Egress Queue 6 (ef)
Fwd Stats      :      0      0
Drop Stats     :      0      0
Fwd Stats (uc) :      0      0
Drop Stats (uc) :      0      0
Fwd Stats (mc) :      0      0
Drop Stats (mc) :      0      0
Egress Queue 7 (h1)
Fwd Stats      :      0      0
Drop Stats     :      0      0
Fwd Stats (uc) :      0      0
Drop Stats (uc) :      0      0
Fwd Stats (mc) :      0      0
Drop Stats (mc) :      0      0
Egress Queue 8 (nc)
Fwd Stats      :      0      0
Drop Stats     :      0      0
Fwd Stats (uc) :      0      0
Drop Stats (uc) :      0      0
Fwd Stats (mc) :      0      0
Drop Stats (mc) :      0      0
=====
*A:NS1633T0067>show#
```

**Sample output — port PTP hardware timestamp**  
The following table describes PTP hardware timestamp output fields.

Table 42: Output fields: port PTP hardware timestamp

| Label                         | Description                                                                |
|-------------------------------|----------------------------------------------------------------------------|
| Port Ptp Hw Timestamp Details |                                                                            |
| Port ID                       | The port ID                                                                |
| Ptp Hw Timestamp state        | The current state of the PTP HW Timestamp on the port: enabled or disabled |

```
A:SASR-12-A-Ring># show port 1/1/1 ptp-hw-timestamp
=====
Port Ptp Hw Timestamp Details
=====
Port Id      Ptp Hw Timestamp state
-----
1/1/1        enabled
=====
A:SASR-12-A-Ring>#
```

**Sample output — optical**  
The following output is an example of optical information, and [Table 43: Output fields: optical](#) describes the optical 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                                                                                                   |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Transceiver Data</b>                                                       |                                                                                                               |
| Transceiver Status                                                            | The status of the transceiver                                                                                 |
| Transceiver Type                                                              | The type of the transceiver                                                                                   |
| Model Number                                                                  | The model number of the transceiver.                                                                          |
| TX Laser Wavelength                                                           | Indicates the transceiver laser wavelength                                                                    |
| Connector Code                                                                | The vendor Organizationally Unique 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                                 |
| 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             |
| Optical Compliance                                                            | Specifies the optical compliance code of the transceiver                                                      |
| Link Length support                                                           | Specifies the link length support for the transceiver                                                         |
| <b>Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated</b> |                                                                                                               |
| Temperature (C)                                                               | The temperature of the transceiver                                                                            |
| Supply Voltage (V)                                                            | The supply voltage of the transceiver                                                                         |
| Tx Bias Current (mA)                                                          | The transmitted bias current of the transceiver                                                               |

| Label                      | Description                                     |
|----------------------------|-------------------------------------------------|
| Tx Output Power (dBm)      | The transmitted output power of the transceiver |
| Rx Optical Power (avg dBm) | The received optical power of the transceiver   |

## Ildp

### Syntax

**Ildp** [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**] [**Ildp-med**]

### Context

show>port>ethernet

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### 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 detailed information.

#### **Ildp-med**

Displays LLDP-MED information. This keyword is supported only on the 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC).

### Output

The following output is an example of LLDP information, and [Table 44: Output fields: port Ethernet LLDP](#) describes the output fields.



## Sample output

```
*A:7210>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:7210>show#

*A:7210>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:7210>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) 2000-2010 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)
                    : 2000-2010 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 44: 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                                                                                                                                                                                                                                |
| <b>Management Address Transmit Configuration</b> |                                                                                                                                                                                                                                                                                                                   |
| Index 1 (system)<br>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<br><br>Enabled — the management address TLV is included in LLDPDUs sent by the port<br><br>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                                                                                                                                                                                   |

| Label                     | Description                                                                                                                                                                                                    |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                                                                                                                         |
| 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 <b>application-type</b> 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<br><br>True — The VLAN tag is present<br>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                                                                                                   |

## poe

### Syntax

**poe [detail]**

Context

show>port>ethernet

Platforms

7210 SAS-T ETR (network and access-uplink), 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE (standalone), and 7210 SAS-Sx 10/100GE variants

Description

This command displays the PoE support status.

Parameters

detail

Displays detailed information.

Output

The following output is an example of detailed PoE support status information, and [Table 45: Output fields: PoE detailed](#) describes the output fields.

Sample output

```
A:7210SAST>show>system# poe detail
=====
PoE Information
=====
PSE Maximum Power Budget      : 60 watts
PSE Power Committed           : 0 watts
PSE Power Available            : 60 watts

=====
PoE Port Information
=====
Port-Id      PoE Admin/  PoE Oper/  Class
              State      State
-----
1/1/19      Disabled    NotApplicable  None (0 W)
1/1/20      Disabled    NotApplicable  None (0 W)
1/1/21      Disabled    NotApplicable  None (0 W)
1/1/22      Disabled    NotApplicable  None (0 W)

=====

*A:SAST>show>system#
=====
PoE Information
=====
PSE Maximum Power Budget      : 60 watts
PSE Power Consumed            : 0 watts
PSE Power Available            : 60 watts

=====
PoE Port Information
=====
Port-Id      PoE Admin/  PoE Oper/  Class
              State      State
-----
1/1/19      Enabled     Off         None (0 W)
1/1/20      Enabled     Off         None (0 W)
1/1/21      Enabled     Off         None (0 W)
```

```
1/1/22      Enabled      Off      None (0 W)
=====
A:7210SAST>show>system#
```

Table 45: Output fields: PoE detailed

| Label                    | Description                                                                                                                                                          |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PSE Maximum Power Budget | The maximum PSE power budget available for the system                                                                                                                |
| PSE Power Committed      | Sum of the power supplied to all ports as determined by class                                                                                                        |
| PSE Power Available      | Maximum Power Budget – Power Consumed                                                                                                                                |
| Port-ID                  | Displays the port ID                                                                                                                                                 |
| PoE Admin/state          | Indicates whether PoE/PoE+ is enabled on the port                                                                                                                    |
| PoE Oper/state           | Indicates whether power is supplied to the port or not                                                                                                               |
| Class                    | Displays the Class of the PoE device connected to the port. Class of the device is classified by software as per standard, based on the power consumed by the device |

## internal-loopback-ports

### Syntax

**internal-loopback-ports [detail]**

### Context

show>system

### Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

### Description

This command displays information about internal loopback ports.

### Parameters

#### Detail

Displays application information.

## Output

The following outputs are examples of internal loopback port information, and [Table 46: Output fields: internal loopback ports](#) describes the output fields.

### Sample output — 7210 SAS-T

```
A:SAST-1# show system internal-loopback-ports detail

=====
Internal Loopback Port Status
=====
Port          Loopback      Application    Service
Id            Type                               Enabled
-----
1/1/27        Virtual       Not-In-Use     No
1/1/28        Virtual       Not-In-Use     No

=====
Mac-swap Application Status
=====
Enabled       : No
Test Service Id : None
Test Sap Id   : None
=====
```

### Sample output — 7210 SAS-R6 and 7210 SAS-R12

```
*A:7210SAS>show>system# internal-loopback-ports

=====
Internal Loopback Port Status
=====
Port          Loopback      Application    Service    Speed Type
Id            Type                               Enabled    1G/10G
-----
2/1/7         Physical      Dot1q-Mirror   No         1G
3/1/1         Physical      P2mpbud        No         10G
1/1/12        Virtual       Not-In-Use     No         1G
1/1/13        Virtual       Not-In-Use     No         10G
2/1/11        Virtual       Not-In-Use     No         1G
2/1/12        Virtual       Not-In-Use     No         10G
3/1/3         Virtual       Not-In-Use     No         1G
3/1/4         Virtual       Not-In-Use     No         1G

=====
*A:7210SAS-C>show>system##
```

### Sample output — 7210 SAS-Sx 10/100GE

```
*A:7210SAS>show>system# internal-loopback-ports

=====
Internal Loopback Port Status
=====
Port          Loopback      Application    Service    Speed Type
Id            Type                               Enabled    1G/10G/40G/
                                           100G
-----
1/1/69        Virtual       Not-In-Use     No         10G
1/1/70        Virtual       Not-In-Use     No         10G
1/1/71        Virtual       Not-In-Use     No         40G
```

```
=====
*A:7210SAS>show>system#
```

Table 46: Output fields: internal loopback ports

| Label             | Description                                                                                  |
|-------------------|----------------------------------------------------------------------------------------------|
| 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      |
| 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, including platforms configured in the access-uplink operating mode

### 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-level LLDP information.

### Sample output

```
*A:7210>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            : SAS
System Description     : TiMOS-B-9.0.B1-12 both/mpc Nokia 7210 SAS 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           |

2.22.2.2.3 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, including platforms configured in the access-uplink operating mode

Description

This command displays Link Aggregation Group (LAG) information.

Default

a summary listing of all LAGs is displayed

Parameters

lag-id

Displays only information about the specified LAG ID.

- Values

1 to 25 (7210 SAS-T, 7210 SAS-Mxp)  
1 to 63 (7210 SAS-R6 and 7210 SAS-R12)  
1 to 125 (7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE)
- Default

Display information for all LAG IDs.

**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—LAG, Table 47: Output fields: LAG](#)
- [Sample output — LAG detail, Table 48: Output fields: LAG detailed](#)
- [Sample output — LAG statistics, Table 49: Output fields: LAG statistics detailed](#)
- [Sample output — LAG associations, Table 50: Output fields: LAG associations](#)
- [Sample output — detailed statistics, Table 51: Output fields: LAG statistics detailed](#)
- [Sample output — description](#)
- [Sample output — subgroups and forcing](#)

**Sample output—LAG**

A:ALA-48# show lag

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

A:ALA-48#

Table 47: Output fields: LAG

| Label  | Description                             |
|--------|-----------------------------------------|
| LAG ID | The LAG ID that the port is assigned to |

| Label          | Description                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------|
| 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 — LAG detail

```
*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
Ptrtr System Id   : 4c:5f:d2:c1:5d:3a Ptrtr System Priority : 32768
Ptrtr 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    yes    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 48: Output fields: LAG detailed

| 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 statistics 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                                                                                                                 |
| Load Balancing      | Load-balancing function configured for this LAG                                                                                      |
| 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                                                                                       |
| Prtr System ID      | System ID used by partner in LACP messages                                                                                           |
| Prtr Oper Key       | Key used by partner in LACP messages                                                                                                 |

| Label                | Description                                                                            |
|----------------------|----------------------------------------------------------------------------------------|
| 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<br>Down — The LAG is operationally down               |
| Port Threshold       | Configured port threshold                                                              |
| Thres. Exceeded Cnt  | The number of times that the drop count was reached                                    |
| Threshold Action     | Action to take when the number of available links is equal or below the port threshold |
| Encap Type           | The encapsulation method used to distinguish customer traffic on a LAG                 |
| Lag-IFIndex          | A box-wide unique number assigned to this interface                                    |
| Port ID              | The specific slot/MDA/port ID                                                          |
| (LACP) Mode          | LACP active or passive mode                                                            |
| LACP xmit standby    | LACP transmits on standby links enabled / disabled                                     |
| Slave-to-partner     | Configured enabled/disabled                                                            |
| Port-id              | Displays the member port ID                                                            |
| Adm                  | Displays the member port administrative state                                          |
| Active/stdby         | Indicates that the member port is selected as the active or standby link               |
| Opr                  | Indicates that the member port operational state                                       |
| Primary              | Indicates that the member port is the primary port of the LAG                          |
| Sub-group            | Displays the member subgroup where the member port belongs to                          |
| Priority             | Displays the member port priority                                                      |

### Sample output — 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 49: Output fields: LAG statistics detailed

| 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 <i>slot/mda/port</i> 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.<br><br>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 — 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 50: Output fields: LAG associations

| Label      | Description                                          |
|------------|------------------------------------------------------|
| Service ID | Displays the service associated with the LAG         |
| Name       | Displays the name of the IP interface                |
| Encap Val  | Displays the values of the port for the IP interface |

### Sample output — LAG details

```
*A:dut-c# show lag 2 detail
=====
LAG Details
-----
Details
-----
Lag-id           : 2                Mode           : network
Adm              : up                Opr            : up
Thres. Exceeded Cnt : 85            Port Threshold  : 0
Thres. Last Cleared : 05/17/2009 07:56:24 Threshold Action : down
Dynamic Cost      : false           Encap Type      : null
Configured Address : 00:ab:00:5a:01:1d   Lag-IfIndex     : 1342177282
Hardware Address   : 00:ab:00:5a:01:1d
LACP              : enabled          Mode           : active
LACP Transmit Intvl : fast          LACP xmit stdby : enabled
Selection Criteria : highest-count    Slave-to-partner : disabled
Number of sub-groups: 1            Forced         : -
System Id         : 00:ab:00:5a:01:01 System Priority  : 32768
Admin Key         : 32769           Oper Key       : 32769
Prtr System Id    : 00:9a:9a:ba:ba:60 Prtr System Priority : 32768
Prtr Oper Key     : 32769

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

-----
Port-id      Role   Exp  Def  Dist  Col  Syn  Aggr  Timeout  Activity
-----
1/1/5        actor  No   No   Yes  Yes  Yes  Yes  Yes     Yes
1/1/5        partner No   No   Yes  Yes  Yes  Yes  Yes  Yes     Yes
1/1/6        actor  No   No   Yes  Yes  Yes  Yes  Yes     Yes
1/1/6        partner No   No   Yes  Yes  Yes  Yes  Yes  Yes     Yes
=====
*A:dut-c#
```

### Sample output — description

```
*A:7210SAS>show# lag description
=====
Lag Port States
LACP Status: e - Enabled, d - Disabled
=====
Lag-id Port-id  Adm  Act/Stdby Opr  Description
-----
```



```

1(e)      6/1/1      up      active      up      N/A
15(e)      3/1/2      up      active      up      10-Gig Ethernet
           4/1/1      up      active      up      N/A
           4/1/1      up      active      up      10/100/Gig Ethernet SFP
25(d)      3/1/1      up      active      up      10/100/Gig Ethernet SFP
           5/1/4      down    active      down    10/100/Gig Ethernet SFP
           5/1/4      up      active      up      10/100/Gig Ethernet SFP

```

```

=====
*A:7210SAS>show#

```

### Sample output — subgroups and forcing

Initial output without subgroups:

| Port-id | Adm | Act/Stdby | Oper | Primary | Sub-grp | Forced Prio | Fld-Port |
|---------|-----|-----------|------|---------|---------|-------------|----------|
| 1/1/3   | up  | active    | up   | yes     | 1       | 32768       | yes      |
| 1/1/5   | up  | active    | up   | 1       | -       | 32768       | no       |
| 2/1/3   | up  | active    | up   | 1       | -       | 32768       | no       |
| 2/1/4   | up  | active    | up   | 1       | -       | 32768       | no       |

Once subgroups are configured:

| Port-id | Adm | Act/Stdby | Oper | Primary | Sub-grp | Forced Prio | Fld-Port |
|---------|-----|-----------|------|---------|---------|-------------|----------|
| 1/1/3   | up  | standby   | down | yes     | 2       | 32768       | no       |
| 1/1/5   | up  | standby   | down | 2       | -       | 32768       | no       |
| 2/1/3   | up  | active    | up   | 1       | -       | 32768       | no       |
| 2/1/4   | up  | active    | up   | 1       | -       | 32768       | yes      |

After forcing:

| Port-id | Adm | Act/Stdby | Oper | Primary | Sub-grp | Forced Prio | Fld-Port |
|---------|-----|-----------|------|---------|---------|-------------|----------|
| 1/1/3   | up  | active    | up   | yes     | 2       | 32768       | no       |
| 1/1/5   | up  | active    | up   | 2       | -       | 32768       | yes      |
| 2/1/3   | up  | standby   | down | 1       | -       | 32768       | no       |
| 2/1/4   | up  | standby   | down | 1       | -       | 32768       | no       |

### Sample output — detailed statistics

Table 51: Output fields: LAG statistics detailed

| Label       | Description                                                             |
|-------------|-------------------------------------------------------------------------|
| LACP Status | Displays the service associated with the LAG                            |
| Lag-id      | Displays the LAG or multi-link trunk (MLT) that the port is assigned to |

| Label      | Description                                                                                                                                                                                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port-id    | Displays the port ID configured or displayed in the <i>slot/mda/port</i> format                                                                                                                                                                                      |
| Adm        | Displays the administrative state of the port/KAG. Displays up to indicate LAG/port is administratively up (no shutdown) state and displays Down to indicate LAG/port is administratively Down (shutdown) state                                                      |
| Act/Stdbby | Indicates whether the member port of the LAG is an active link or standby link                                                                                                                                                                                       |
| Opr        | Displays the operational state of the LAG/port                                                                                                                                                                                                                       |
| Primary    | Indicates whether the port is a primary member port of the LAG                                                                                                                                                                                                       |
| Sub-group  | Displays the subgroup the port belongs to                                                                                                                                                                                                                            |
| Forced     | Indicates whether the ports of the subgroup were forced to be the active/standby member ports by the user                                                                                                                                                            |
| Priority   | Displays the user-configured priority for the port                                                                                                                                                                                                                   |
| Fld-port   | Indicates the active member port of the LAG that is used for flooding BUM traffic. On 7210 SAS-R6 and 7210 SAS-R12, in a VPLS service, while egressing on a LAG SAP, a single active member port of the LAG is used to flood the BUM traffic received in the service |

## redundancy

### Syntax

**redundancy**

### Context

show

### Platforms

Supported on all 7210 SAS platforms as described in this document

### 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

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

### Description

This command displays multi-chassis redundancy information.

### Parameters

**all**

Displays all multi-chassis information.

**mc-lag**

Displays multi-chassis LAG information.

**peer** *ip-address*

Displays the address of the multi-chassis peer.

**lag** *lag-id*

Displays the specified LAG ID on this system that forms an multi-chassis LAG configuration with the indicated peer.

**statistics**

Displays statistics for the multi-chassis peer.

**sync**

Displays synchronization information.

**detail**

Displays detailed information.

### Output

The following output is an example of multi-chassis redundancy information, and [Table 52: Output fields: 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 52: Output fields: 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                   |
| 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

Supported on all 7210 SAS platforms as described in this document

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 53: 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 53: 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                |

| Label                             | Description                                                                                                                                              |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 7705 SAR 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                                                                         |
| <b>Multi-Chassis Statistics</b>   |                                                                                                                                                          |
| 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                                                                                   |
| 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                                                            |

| Label                  | Description                                                                               |
|------------------------|-------------------------------------------------------------------------------------------|
| 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 |

#### 2.22.2.2.4 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, including platforms configured in the access-uplink operating mode

#### Description

This command enables port traffic monitoring. The specified ports 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** *port-id*

Specifies up to 5 port IDs in slot/mda/port format.



### interval *seconds*

Specifies the interval for each display in seconds.

**Values** 3 to 60

**Default** 10

### repeat *repeat*

Specifies how many times the command is repeated.

**Values** 1 to 999

**Default** 10

### absolute

Displays the raw statistics are displayed, without processing. 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

The following output is an example of port traffic monitoring information.

### 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  |
|                                     | 0 | 0    | 0 | 0 | N/A  |
| 1/1/20                              | I | 0    | 0 | 0 | N/A  |
|                                     | 0 | 0    | 0 | 0 | N/A  |
| 3/1/12                              | I | 0    | 0 | 0 | N/A  |
|                                     | 0 | 3696 | 6 | 0 | N/A  |
| 3/1/13                              | I | 0    | 0 | 0 | N/A  |
|                                     | 0 | 0    | 0 | 0 | N/A  |
| 4/1/11                              | I | 0    | 0 | 0 | N/A  |
|                                     | 0 | 0    | 0 | 0 | N/A  |
| -----                               |   |      |   |   |      |
| At time t = 10 sec (Mode: Rate)     |   |      |   |   |      |
| -----                               |   |      |   |   |      |
| 1/1/12                              | I | 0    | 0 | 0 | 0.00 |
|                                     | 0 | 0    | 0 | 0 | 0.00 |
| 1/1/20                              | I | 0    | 0 | 0 | 0.00 |
|                                     | 0 | 0    | 0 | 0 | 0.00 |
| 3/1/12                              | I | 0    | 0 | 0 | 0.00 |
|                                     | 0 | 0    | 0 | 0 | 0.00 |
| 3/1/13                              | I | 0    | 0 | 0 | 0.00 |
|                                     | 0 | 0    | 0 | 0 | 0.00 |
| 4/1/11                              | I | 0    | 0 | 0 | 0.00 |
|                                     | 0 | 0    | 0 | 0 | 0.00 |

2.22.2.3 Clear commands

lag

**Syntax**  
lag lag-id statistics

**Context**  
clear

**Platforms**  
Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

**Description**  
This command clears statistics for the specified LAG ID.

**Parameters**

- lag-id*

Specifies the LAG ID to clear statistics.

Values

1 to 25 (7210 SAS-T, 7210 SAS-Mxp)  
1 to 63 (7210 SAS-R6 and 7210 SAS-R12)  
1 to 125 (7210 SAS-Sx 1/10GE, 7210 SAS-Sx 10/100GE)
- statistics*

Specifies to clear statistics for the specified LAG ID.

mda

**Syntax**

**mda** *mda-id*

**Context**

clear

**Platforms**

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

**Description**

This command reinitializes the specified MDA in a particular slot.

**Parameters**

- mda-id*

Specifies the slot and MDA/CMA to clear

Values

mda-id: slot: 1

port

**Syntax**

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

**Context**

clear

## Platforms

Supported on all 7210 SAS platforms as described in this document, including platforms configured in the access-uplink operating mode

## 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.

### *slot*

Specifies the slot number.

**Values** 1

### *mda*

Specifies the MDA number.

**Values** 1, 2

**Default** All MDAs.

## 2.22.2.4 Debug commands

lag

## Syntax

lag [lag-id lag-id [port port-id]] [all]

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

no lag [lag-id lag-id]

## Context

debug

## Platforms

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

## Description

This command enables debugging for LAG.

## Parameters

### **lag-id** *lag-id*

Specifies the link aggregation group ID.

### **port-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.

### **mc**

Specifies to display multi-chassis parameters.

### **mc-pkt**

Specifies to display the MC-LAG control packets with valid authentication were received on this system.

## 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 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 Certificate Management

RFC 5280, Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile 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 7468, Textual Encodings of PKIX, PKCS, and CMS Structures 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



**Note:**

Only PKIX and PKCS is supported.

## 3.3 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, Sx/S-1/10GE, and Sx/S-1/10GE-VC



**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, Sx/S-1/10GE, and Sx/S-1/10GE-VC



**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

## 3.4 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-1/10GE 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

## 3.5 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.

## 3.6 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-rrp-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 2132, DHCP Options and BOOTP Vendor Extensions 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 public key based user authentication. 7210 SAS-D support 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 5246, The Transport Layer Security (TLS) Protocol Version 1.2 – TLS client, RSA public key 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



**Note:**

Only TLS client.

RFC 5425, Transport Layer Security (TLS) Transport Mapping for Syslog – RFC 3164 with TLS 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



**Note:**

Only TLS client.

RFC 5656, Elliptic Curve Algorithm Integration in the Secure Shell Transport Layer – ECDSA 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 7301, Transport Layer Security (TLS) Application Layer Protocol Negotiation Extension 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



**Note:**

Only TLS client.

RFC 8446, The Transport Layer Security (TLS) Protocol Version 1.3 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



**Note:**

Only TLS client.

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

## 3.7 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 Rendezvous 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 is 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.

## 3.8 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.

## 3.9 IP — Version 6

RFC 2464, Transmission of IPv6 Packets over Ethernet 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



**Note:**

D, Dxp, K5, 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, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12



**Note:**

D, Dxp, K5, and T(A) for Management only.

RFC 4007, IPv6 Scoped Address 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



**Note:**

D, Dxp, K5, and T(A) for Management only.

RFC 4193, Unique Local IPv6 Unicast 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



**Note:**

D, Dxp, K5, and T(A) for Management only.

RFC 4291, Internet Protocol Version 6 (IPv6) Addressing 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





**Note:**

D, Dxp, K5, 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, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12



**Note:**

D, Dxp, K5, and T(A) for Management only.

RFC 4861, Neighbor Discovery for IP version 6 (IPv6) 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:**

D, Dxp, K5, and T(A) for Management only.

RFC 4862, IPv6 Stateless Address Autoconfiguration (Router Only) 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:**

D, Dxp, K5, and T(A) for Management only.

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, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12



**Note:**

D, Dxp, K5, 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

## 3.10 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.



## 3.11 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 routing 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

## 3.12 Management

draft-ietf-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

### 3.13 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

### 3.14 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

## 3.15 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-ldp-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.

## 3.16 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



### 3.17 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

### 3.18 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

### 3.19 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



## 3.20 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

## 3.21 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

## 3.22 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.

## 3.23 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, 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

## 3.24 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 supported with TLDP signalling for PW. No BGP signalling is supported for PW establishment.

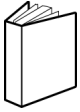
RFC 4762, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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



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