NOKIA

7210 SERVICE ACCESS SWITCH | RELEASE 10.0.R6

7210 SAS-M, T, X, R6, R12, Mxp, Sx, S 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

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. If multiple modes of operation apply, they are explicitly noted in the topic.

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

See section 1.2 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-M, 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-T, and 7210 SAS-X
- 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-M and 7210 SAS-T platforms 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 10.0 content and may include some content that will be released in later maintenance loads. Refer to the 7210 SAS OS Software Release Notes 10.0R*x*, part number 3HE14066000*x*TQZZA, for information about features supported in each load of the Release 10.0 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.
- Refer to the *7210 SAS-M, T, X, R6, R12, Mxp, Sx, S Basic System Configuration Guide* for boot options to configure the satellite mode of operation on the router. Refer to 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. Refer to the 7210 SAS OS Software Release Notes 10.0R*x*, part number 3HE14066000*x*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-E, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C, 7210 SAS-M, 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; refer to 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-M, 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-T, and 7210 SAS-X

- 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), 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-M 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.

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

Table 1 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-E		Implicit	Implicit		
7210 SAS-K 2F1C2T		Implicit	Implicit		
7210 SAS-K 2F6C4T [2]	Port Mode [4] Configuration	Port Mode [4] Configuration	Implicit		
7210 SAS-K 3SFP+ 8C [2]	Port Mode [4] Configuration	Port Mode [4] Configuration	Implicit		
7210 SAS-M	Explicit BOF Configuration	Explicit BOF Configuration	Implicit		
7210 SAS-Mxp	Implicit [3]		Explicit BOF Configuration		Explicit BOF Configuration
7210 SAS-R6 [1]	Implicit		Implicit		
7210 SAS-R12 [1]	Implicit		Implicit		
7210 SAS-Sx/S 1/10GE	Implicit [3]		Explicit BOF Configuration	Explicit BOF Configuration	Explicit BOF Configuration
7210 SAS-Sx 10/100GE	Implicit [3]		Explicit BOF Configuration	Explicit BOF Configuration	Explicit BOF Configuration
7210 SAS-T	Explicit BOF Configuration	Explicit BOF Configuration	Implicit		

Table 1 **Supported Modes of Operation and Configuration Methods (Continued)**

7210 SAS Platform	Mode of Operation and Configuration Method				
	Network	Access-Uplink	Standalone	Standalone-VC	Satellite
7210 SAS-X [1]	Implicit		Implicit		

Notes:

1. Supports MPLS uplinks only and implicitly operates in network mode
2. 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.
3. Implicitly operates in network mode when standalone mode of operation is configured
4. See section 1.3 for information about port mode configuration

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

  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 are available for configuration on the router, regardless of the current mode of operation.

Table 2 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 [1]				
Standalone	✓	✓	✓	
Standalone-VC	✓	✓	✓	

Note:

1. Port modes are configured on the 7750 SR host and managed by the host.

Table 3 lists the port mode configuration supported by the 7210 SAS product family. Refer to the appropriate *Interface Configuration Guide* for detailed information about configuring the port modes for a specific platform.

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-E	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-M	Yes	Yes [1]	Yes [2]	Yes [3]
7210 SAS-Mxp	Yes	Yes	Yes	No
7210 SAS-R6 IMM (IMMv1) and IMM-b (IMMv2)	Yes	Yes	Yes	No
7210 SAS-R6 IMM-c 100GE (IMM-c 1CFP4 or IMM-c 1QSFP28)	Yes	Yes	No	No
7210 SAS-R12 IMM-b	Yes	Yes	Yes	No
7210 SAS-R12 IMM-c 100GE (IMM-c 1CFP4 or IMM-c 1QSFP28)	Yes	Yes	No	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 [1]	Yes [2]	Yes [3]
7210 SAS-X	Yes	Yes	Yes	No

Notes:

1. Network ports are supported only if the node is operating in network mode.
2. Hybrid ports are supported only if the node is operating in network mode.
3. Access-uplink ports are supported only if the node is operating in access-uplink mode.

1.4 7210 SAS Router Configuration Process

Table 4 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.

Table 4 **Configuration Process**

Area	Task	Chapter
Provisioning	Chassis slots and cards	Chassis Slots and Cards
	MDAs	MDAs
	Ports	Ports
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support

2 7210 SAS Interfaces

2.1 In This Chapter

This chapter provides information about configuring chassis slots, cards, and ports. Topics in this chapter include:

2.2 Configuration Overview

Note: This document uses the term *preprovisioning* in the context of preparing or preconfiguring entities such as chassis slots, Line cards (for example, SF/CPM - Switch Fabric and Control Plane Module, IMMs - Integrated Media Modules), 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), then the entity is considered to be *provisioned*.

The 7210 SAS-M and its variants (that is, 7210 SAS-M 24F, 7210 SAS-M 24F 2XFP, 7210 SAS-M 24F 2XFP ETR), is a platform with a fixed port configuration and an additional expansion slot that accepts supported MDAs.

7210 SAS software inherits the concept for CPM, IOM and MDA from 7x50 to represent the hardware logically. The software creates 2 logical cards, to represent the CPM and IOM and these are preprovisioned on bootup. The IOM card, is modeled with 2 MDAs. One of the MDA, a non-removable logical entity, represents the fixed ports available on the platform, and it is preprovisioned on bootup. The second MDA, represents the physical removable MDA that can be plugged into the available expansion slot and it must be provisioned by the user depending on the MDA they plan to use (see the following for more information about provisioning MDA for the expansion slot on 7210 SAS-M). Ports and interfaces can also be preprovisioned.

The 7210 SAS-X, 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 7x50 to represent the hardware logically. These are fixed and are not removable. The software creates 2 logical cards, to represent the CPM and IOM and these are preprovisioned on bootup. The IOM card, is modeled with a single MDA, a logical entity to represent the fixed ports on the system. This MDA is auto-provisioned on bootup and user does not need to provision them. 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.

2.2.1 Chassis Slots and Cards

The 7210 SAS-M and its variants are platforms which has a set of fixed ports and supports one expansion slot. Software preprovisions the cards on bootup. The expansion slot is represented as a MDA and supported MDAs can be plugged into the expansion slot. The list of MDAs supported on 7210 SAS-M is available in the 7210 SAS release notes.

The following display output of **show card** command lists the cards auto-provisioned on 7210 SAS-M chassis:

```
A:7210#  show card state


===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sas          iom-sas          up    up                  2
1/1    m24-1gb+2-10gb   m24-1gb+2-10gb   up    up            24
1/2    m4-ds1-ces       m4-ds1-ces       up    up            4
A      sfm-sas          sfm-sas          up    up                      Active
```

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

The following display output of **show card** command lists the cards auto-provisioned on 7210 SAS-X, 7210 SAS-T, 7210 SAS-Mxp, and 7210 SAS-Sx/S 1/10GE chassis:

The following display output of **show card** command lists the cards auto-provisioned on 7210 SAS-X chassis:

```
A:7210-SAS-X>show# card

===============================================================================
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up
A         sfm-sas             sfm-sas             up         up/active
===============================================================================
A:7210-SAS-X>show#
```

The following display output of **show card** command 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#
```

The following display output of **show card** command 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#
```

The following display output of **show card** command 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 IMMs. It does not support any physical removable MDAs. Software uses logical MDAs internally to represent the ports on the IMMs and the MDA type is auto-provisioned by software when the IMMs are provisioned. Check the latest release notes for a list of supported card types (that is, CPM and IMMs). 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 IMMs. It does not support any physical removable MDAs. Software uses logical MDAs internally to represent the ports on the IMMs and the MDA type is auto-provisioned by software when the IMMs are provisioned. Please check the latest release notes for a list of supported card types (that is, CPM and IMMs). See 7210 SAS-R12 Chassis Installation Guide for more information about installation of cards.

Note:

- IMMv1 (imm-sas-r) cannot be installed in the same 7210 SAS-R6 chassis as IMMv2 (imm-sas-r-b) cards or IMM-c (imm-sas-r-c) cards. A mix of IMMv1 and any other type of card is not supported.
- IMMv1 cards are not supported on 7210 SAS-R12. Refer to the 7210 SAS-M, T, X, R6, R12, Mxp, Sx, S Basic System Configuration Guide for more information.
- On the 7210 SAS-R6 and 7210 SAS-R12, the user must preconfigure the type of IMMs that will be populated so that appropriate resources can be allocated on system bootup. Refer to the **config**>**system**>**chassis**>**allow-imm-family** command in the 7210 SAS-M, T, X, R6, R12, Mxp, Sx, S Basic System Configuration Guide for more information.

The following **show** command samples display 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                           Admin Operational   Comments
            Equipped Type (if different)           State State
-------------------------------------------------------------------------------
1       imm-sas-10sfp+1xfp                         up    up
2       imm-sas-10sfp+1xfp                         up    provisioned
            (not equipped)
3       imm-sas-10sfp                              up    up
4       (not provisioned)                          up    unprovisioned
            imm-sas-2xfp
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
```

2.3 MDAs

The 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-X, 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.

On 7210 SAS-M, as described in the previous section, in addition to the fixed ports, a expansion slot is available. It is represented as a physical MDA and needs to be provisioned. The following section talks about provisioning of MDAs and is applicable only to those platforms where physical MDAs are supported.

A chassis slot and card type must be specified and provisioned before an MDA can be preprovisioned. An MDA is provisioned when a type designated from the allowed MDA types is inserted. A preprovisioned MDA slot can remain empty without conflicting with populated slots. After installed and enabled, the system verifies that the installed MDA type matches the configured parameters. If the parameters do not match, the MDA remains offline. An MDA is provisioned when a type designated from the allowed MDA type is inserted. A preprovisioned MDA slot can remain empty without conflicting with the populated slots.

2.3.1 Provisioning of MDAs on the 7210 SAS-M

2.3.1.1 Provisioning Guidelines for MDA used with 7210 SAS-M

- The device rejects the insertion of a CES card if the slot is provisioned for a 2* 10G MDA and vice versa.
- If a 2*10G MDA provisioned, it ensures that the BOF parameter "**no-service-ports**" is configured to specify two ethernet ports.
- Only on 7210 SAS-M 24F variant, the no-service-ports BOF parameter is not available for use.
- Change of value assigned to 'use-expansion-card-type' BOF parameter, requires a reboot so that a different MDA type can be used.

2.3.1.2 Provisioning 2 x 10G MDA and 4 x T1/E1 CES MDA on 7210 SAS-M

For 7210 SAS-M devices currently deployed or new deployments, to insert 2*10 MDA perform the following steps:

- Configure the BOF parameter "use-expansion-card-type" to m2-xfp. This provisions the system to expect a 2 x 10G MDA for use in the expansion slot.
- Configure the BOF parameter "no-service-ports", if using a 7210 SAS-M 24F 2XFP and 7210 SAS-M 24F 2XFP ETR variants.
- Reboot the device.
- The preceding steps are required for first-time use of 2 x 10G MDA or when changing the MDA type in use. It is not needed, if a MDA is being replaced with a MDA of the same type.

In 7210 SAS devices using 2 x 10G MDA, to insert CES MDA perform the following steps:

1. Configure the BOF parameter "use-expansion-card-type" to m4-ds1-ces. This will provision the system to expect a 4 x T1/E1 CES MDA for use in the expansion slot.
2. Configure the BOF parameter "no-service-ports" to default, if using a 7210 SAS-M 24F 2XFP and 7210 SAS-M 24F 2XFP ETR variants.
3. Reboot the device.
4. The preceding steps are required when changing the MDA type in use. It is not needed, if a MDA is being replaced with a MDA of the same type.

Note: Insertion and removal of the CES MDA into the chassis at any point of time is only supported if the BOF parameter configuration is set to default.

2.4 Digital Diagnostics Monitoring

Some Nokia SFP and XFP transponders have Digital Diagnostics Monitoring (DDM) capability. With DDM the transceiver module maintains information about its working status in device registers, such as:

- Temperature
- Supply voltage
- Transmit (TX) bias current

- TX output power
- Received (RX) optical power

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

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

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

DDM information is populated into the router 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.

Table 5 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	µV	Supported	Supported
TX Bias Current	mA	µA	Supported	Supported
TX Output Power	dBm (converted from mW)	mW	Supported	Supported

Table 5 Real-Time DDM Information (Continued)

Parameter	User Units	SFP/XFP Units	SFP	XFP
RX Received Optical Power4	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

Table 6 describes supported factory-programmed DDM alarms and warnings.

Table 6 DDM Alarms and Warnings

Parameter	SFP/XFP Units	SFP	XFP	Required?
Temperature - High Alarm - Low Alarm - High Warning - Low Warning	C	Yes	Yes	Yes
Supply Voltage - High Alarm - Low Alarm - High Warning - Low Warning	µV	Yes	Yes	Yes
TX Bias Current - High Alarm - Low Alarm - High Warning - Low Warning	µA	Yes	Yes	Yes
TX Output Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes

Table 6 **DDM Alarms and Warnings (Continued)**

Parameter	SFP/XFP Units	SFP	XFP	Required?
RX Optical Power - High Alarm - Low Alarm - High Warning - Low Warning	mW	Yes	Yes	Yes
AUX1 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes
AUX2 - High Alarm - Low Alarm - High Warning - Low Warning	parameter dependent (embedded in transceiver)	No	Yes	Yes

2.4.1 Nokia SFPs and XFPs

The availability of the DDM real-time information and warning or alarm status is based on the transceiver. It may or may not indicate if DDM is supported, although some Nokia SFPs support DDM. Non-DDM and DDM-supported SFPs are distinguished by a specific ICS value.

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

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

2.4.2 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!
===============================================================================
```

2.5 Ports

2.5.1 Port Types

Table 7 describes supported port types on the 7210 SAS platforms.

Table 7 **Supported Ethernet Ports and TDM Port Types**

	Copper Ports (10/100/1000 Base-T)	Ethernet SFP Ports	10 Gigabit XFP/ SFP+ Ports	100 Gigabit CFP4/QSFP28 Ports	TDM Ports (DS1/E1)
7210 SAS-M	No	Yes	Yes (with 2 x 10G/XFP MDA)	No	Yes (only in network mode and with CES MDA)

Table 7 Supported Ethernet Ports and TDM Port Types (Continued)

	Copper Ports (10/100/1000 Base-T)	Ethernet SFP Ports	10 Gigabit XFP/ SFP+ Ports	100 Gigabit CFP4/QSFP28 Ports	TDM Ports (DS1/E1)
7210 SAS-M 24F 2XFP	No	Yes	Yes (XFP)	No	Yes (only in network mode and with CES MDA)
7210 SAS-M 24F 2XFP ETR	No	Yes	Yes (XFP)	No	Yes (only in network mode and with CES MDA)
7210 SAS-X	No	Yes	Yes (XFP)	No	No
7210 SAS-T	Yes	Yes	Yes (XFP)	No	No
7210 SAS-R6	IMMv2 with copper ports	Yes	IMMv1 (XFP) IMMv2 (SFP+)	No	No
7210 SAS-R12	IMMv2 with copper ports	Yes	IMMv2 (SFP+)	No	No
7210 SAS-Mxp	Yes	Yes	Yes (SFP+)	No	No
7210 SAS-Sx/S 1/ 10GE	Yes	Yes	Yes (SFP+)	No	No
7210 SAS-Sx 10/ 100GE	No	No	Yes (SFP+)	Yes	No

The following guidelines apply.

- 10/100/1000 Base-T copper SFPs can be used in any of the SFP ports.
- Copper SFPs with speeds of 10 Mbps and half-duplex mode are supported only on 7210 SAS-M and 7210 SAS-T platforms. They are not supported on the 7210 SAS-Sx/S 1/10GE, 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12 platforms.
- Combo ports support speeds of 10 Mbps with full-duplex mode on both the 7210 SAS-Mxp and 7210 SAS-Sx/S 1/10GE, when the copper port is used.
- 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 Mbps with full-duplex mode. They do not support 10 Mbps speed with half-duplex mode.
- Fixed copper ports on the 7210 SAS-T support 10 Mbps speed with full-duplex and half duplex modes.

- For the 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE, the user can configure the connection type of the port. By default, the combo port type must be set to auto. In auto mode, the software detects the type of port automatically based on the link availability of the media inserted into the port.
- For TDM ports, only CES services (CESoPSN-based and SAToP-based) are provided for the T1/E1 ports.
- The SFP+ ports on the 7210 SAS-S 1/10GE and 7210 SAS-Sx 1/10GE (copper variants), and on the 7210 SAS-Sx 10/100GE, allow the use of 1 GE fiber-optic SFPs in SFP+ ports. The SFP+ ports must be set to 1000 Mb/s with the **config>port>ethernet>speed** command.

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

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 since a single SAP is allowed, and can be achieved by configuring the port in the access mode, or a single network IP interface is allowed, which can be achieved by configuring the port in network mode. Hybrid mode can be enabled on a LAG port when the port is part of a single chassis LAG configuration. When the port is part of a multi-chassis LAG configuration, it can only be configured to access mode as MC-LAG is not supported on a network port and consequently is not supported on a hybrid port.

Table 8 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**
7210 SAS-M	Yes	Yes [1]	Yes [2]	Yes [3]
7210 SAS-X	Yes	Yes	Yes	No
7210 SAS-T	Yes	Yes [1]	Yes [2]	Yes [3]
7210 SAS-R6 IMM (IMMv1) and IMM-b (IMMv2)	Yes	Yes	Yes	No
7210 SAS-R6 IMM-c 100GE (IMM-c 1CFP4 or IMM-c 1QSFP28)	Yes	Yes	No	No
7210 SAS-R12 IMM-b	Yes	Yes	Yes	No

Table 8 **7210 SAS Platforms Supporting Port Modes (Continued)**

Port Mode Platforms	Access	Network	Hybrid	Access-uplink
7210 SAS-R12 IMM-c 100GE (IMM-c 1CFP4 or IMM-c 1QSFP28)	Yes	Yes	No	No
7210 SAS-Mxp	Yes	Yes	Yes	No
7210 SAS-Sx/S 1/10GE	Yes	Yes	Yes	No
7210 SAS-Sx 10/100GE	Yes	Yes	Yes	No

Notes:

1. Network ports can be configured only if the BOF is configured to operate the node in network mode (also known as, MPLS mode).
2. Hybrid ports are supported only when the node is operating in network mode.
3. 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).

2.5.1.2 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.

2.5.1.3 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.
- 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).

2.5.2 Support for Power over Ethernet (PoE) on 7210 SAS-T ETR Variant and 7210 SAS-Mxp ETR Variant

The 7210 SAS-T ETR unit and 7210 SAS-Mxp ETR unit supports Power over Ethernet (PoE) as per 802.3af and 802.3at standards. It allows these devices to be used to supply power to connected PoE devices, such as telephones, CCTV cameras, and other PoE standard compliant devices.

Note:

- On 7210 SAS-T ETR, up to four fixed copper ports are available to connect PoE/PoE+ devices. It can supply a maximum of up to 60W of power.
- On 7210 SAS-Mxp ETR unit, up to 2 ports are available to connect PoE/PoE+ devices. It can supply a maximum of up to 60W of power.
- On both 7210 SAS-T ETR and 7210 SAS-Mxp ETR, the maximum amount of power available is to be shared among all the PoE/PoE+ devices connected to the node. That is, it is possible to have a mix of PoE devices (using 15W of power) and PoE+ devices (using 30W of power) as long as the total power drawn is within the system limits.

The following functionalities are available:

- Supports both 802.3af (PoE) and 802.3at (PoE+) on any of the ports. The ports can be used to connect either PoE devices or PoE+ devices or a combination of both simultaneously, as long as the power drawn is within the device system limits.
- Only Alternative A is supported on the supported 7210 SAS devices.

- Supports classification of both Type 1 and Type 2 PD using physical layer classification mechanism (using 1-event physical layer classification mechanism for Type 1 PD and 2-event physical layer classification mechanism for Type 2 PD).
- Supports allocation of power based on the identified class (called as class-based power allocation method) using physical layer classification mechanism. The 802.3af and 802.3at standards define the power that can be allocated or requested by a particular class. There are four classes defined - Class 1, Class 2, Class 3 and Class 4 by standards. These are used to allow PoE devices to request power based on their needs. If enough power is not available to supply power based on the identified class, then power is denied to the connected PoE device. Each device has limit on the maximum amount of power it can provide. If the total of power requested by the devices connected to PoE enabled ports exceed this threshold, then the device denies power to the device. When power is denied to the PD, the port is operationally up, though power is not supplied to the port. If the power is applied successfully or power is denied to the port, the system logs an event.
- Only DC power is supplied to connected PoE devices (PDs). It works with PoE devices that use injectors where a AC/DC wall device is used to power a remote PoE device.
- The software monitors the PoE port and detect faults and events and raises traps, along with displaying the same in the status of the port.
  Events and faults detected and notified to the user are:
  - 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 are generated for events such as overload, short-circuit, and other events. Software clears the fault when the fault no longer exists.
- If a port enabled for PoE is shutdown, then the power supplied to the port is disabled. It restores when the **no shutdown** command is executed, if the request does not exceed the power budget.

2.5.3 Support for PoE/PoE+ for 7210 SAS-Sx 1/10GE Fiber Variants

Note: PoE on the 7210 SAS-Sx 1/10GE is only supported in standalone mode.

On the 24-port and 48-port fiber variants of the 7210 SAS-Sx 1/10GE, there are two PoE/PoE+ capable ports, namely, 1/1/1 and 1/1/2, the combo ports. To use PoE/PoE+, these ports must be configured to use the copper interface. The two PoE/PoE+ ports cannot draw more than 60W of power. The ports can be used for either PoE or PoE+ devices or a combination of PoE/PoE+ devices.

2.5.4 Support for PoE/PoE+ for 7210 SAS-Sx 1/10GE Copper PoE Variant

Note: PoE on the 7210 SAS-Sx 1/10GE is only supported in standalone mode.

The 7210 SAS-Sx 1/10GE has two PoE variants:

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

Both variants support PoE/PoE+ on all the fixed copper ports. For both variants, the ports can draw a maximum of 720 W of power. On the 24-port variant, each port can have up to 15 W of power for PoE or up to 25 W of power for PoE+. On the 48-port variant, each port can have up to 15 W of power for PoE or up to 25 W of power for PoE+, or a combination of PoE and PoE+ ports as long as the total draw across all ports does not exceed 720 W.

2.5.5 Support for PoE/PoE+ for 7210 SAS-S 1/10GE Copper PoE Variant

Note: PoE on the 7210 SAS-S 1/10GE is only supported in standalone mode.

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

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

Both variants support PoE/PoE+ on all the fixed copper ports. For both variants, the ports can draw a maximum of 720 W of power. On the 24-port variant, each port can have up to 15 W of power for PoE or up to 25 W of power for PoE+. On the 48-port variant, each port can have up to 15 W of power for PoE or up to 25 W of power for PoE+, or a combination of PoE and PoE+ ports as long as the total draw across all ports does not exceed 720 W.

2.6 Link Layer Discovery Protocol (LLDP)

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

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

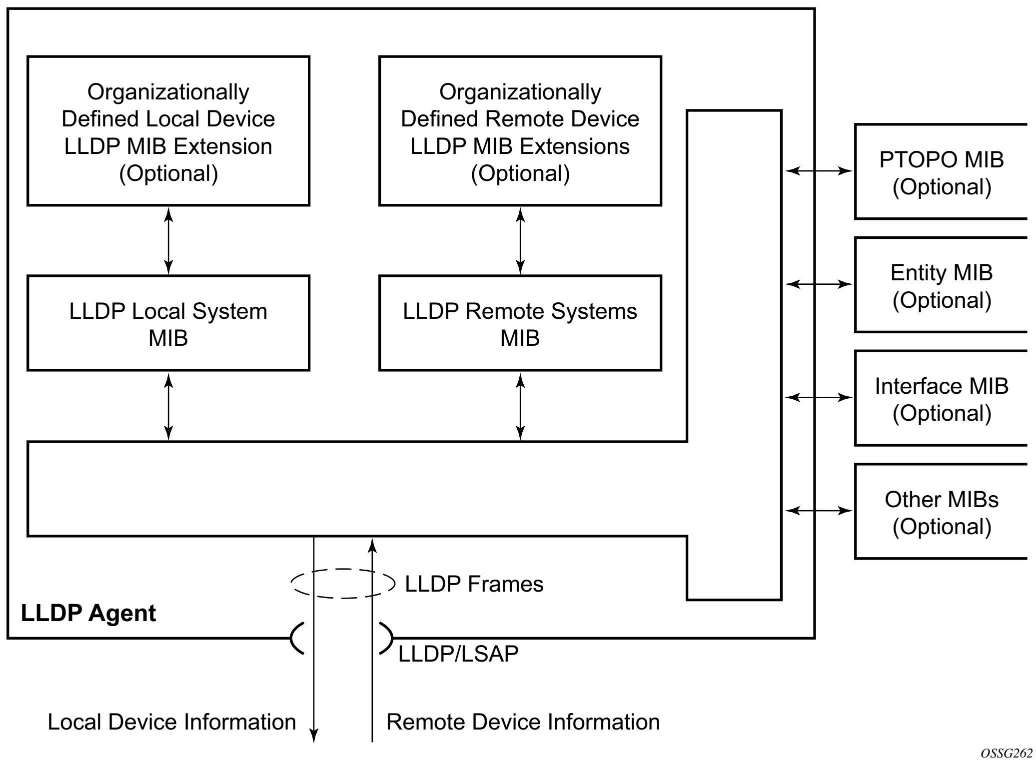
The following list is the information included in the protocol defined by the IEEE 802.1ab standard.

- 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.

Figure 1 shows the internal architecture for a network node.

Figure 1 **LLDP Internal Architecture for a Network Node**

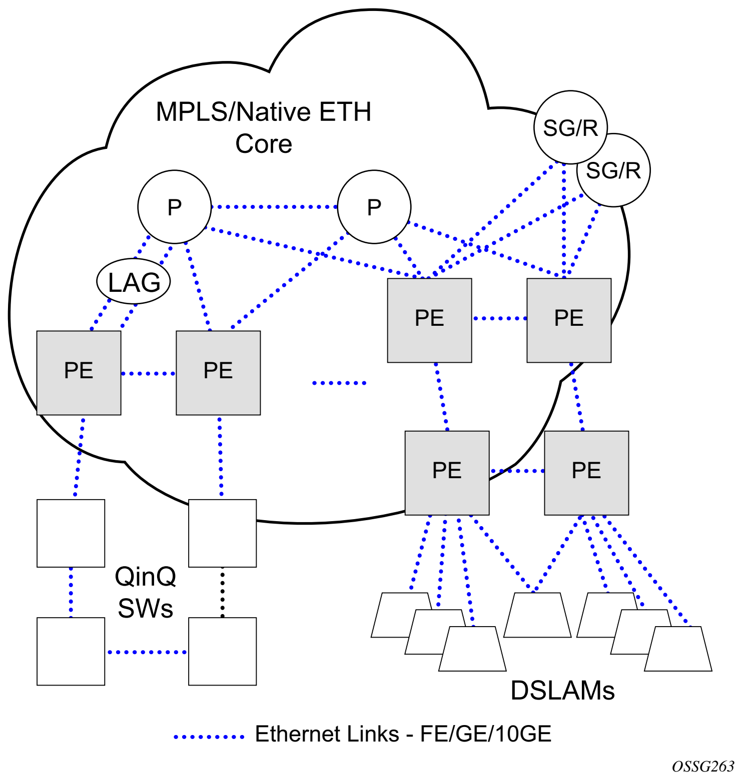


To detect and address network problems and inconsistencies in the configuration, the network operators can discover the topology information using LLDP. The Standard-based tools address the complex network scenarios where multiple devices from different vendors are interconnected using Ethernet interfaces.

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

Figure 2 **Generic Customer Use Case For LLDP**



2.6.1 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-idsub-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.

2.6.2 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.

Table 9 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

Table 9 **Behavior for LLDP with Different Values (Continued)**

Nearest-bridge-mac Admin Status	Tunneling Enabled	Tunneling Disabled
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.

2.7 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.

2.7.1 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.

2.7.2 Port Loopback with MAC Swap

Note: Port loopback with mac-swap is not supported on100GE 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.

2.8 LAG

Based on the IEEE 802.3ax standard (formerly 802.3ad), Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two network devices, depending on the number of links installed. LAG also provides redundancy in the event that one or more links participating in the LAG fail. All physical links in a 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.

2.8.1 LAG Features

2.8.1.1 Hardware Capabilities

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

2.8.1.2 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.

2.8.1.2.1 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.

2.8.1.2.2 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.

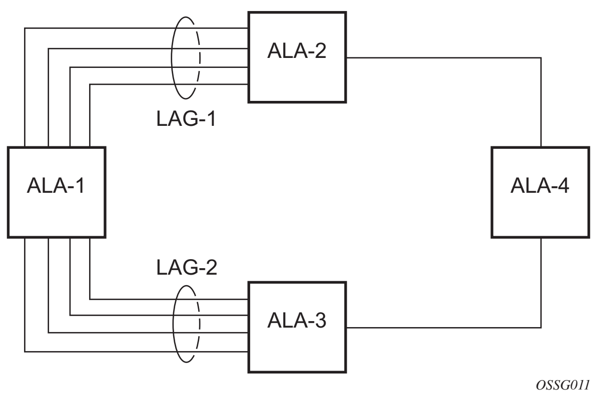
2.8.2 Configuring LAGs

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 and/or from the LAG are added or removed, the hashing algorithm is adjusted for the new port count.
- The **show** commands display physical port statistics on a port-by-port basis or the entire LAG can be displayed.
- LAG is supported on Ethernet ports.
- Ports of a particular LAG can be of different types but they must be the same speed and duplex. To guarantee the same port speed is used for all ports in a LAG, auto-negotiation must be disabled or in limited mode to ensure only a specific speed is advertised.

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

Figure 3 **LAG Configuration**



2.8.3 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.

2.8.4 LAG and QoS Policies on 7210 SAS-M, 7210 SAS-T, 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE

In the 7210 SAS-M, 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-M, 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.

2.8.5 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 uses 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 uses 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.

2.8.6 LAG and QoS Policies on 7210 SAS-X

In 7210 SAS-X, 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-X, 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 uses the entire SLA. The disadvantage is that the overall SLA can be exceeded if the flows span multiple ports.

In 7210 SAS-X, 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 uses the entire SLA. The disadvantage is that the overall SLA can be exceeded if the flows span multiple ports.

2.8.7 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 IMMs, 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 IMMs, 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 IMMs. 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 uses 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 IMMs. 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 uses 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.

2.8.8 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.

2.8.9 LACP

Generally, link aggregation is used for two purposes: provide an increase in bandwidth and/or provide redundancy. Both aspects are addressed by aggregating several Ethernet links in a single LAG.

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

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

2.8.9.1 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 power-off option for standby-signaling in the CLI command at the LAG level at the port member level. As a consequence, the transmit laser will be switched off for all LAG members in standby mode. On switch over (active-links failed) the laser will be switched on all LAG members will become active.

Note that 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 inherit 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 on the other end.

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

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

2.8.9.2 LAG Sub-groups

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

The 7210 SAS-M, 7210 SAS-X, 7210 SAS-T, 7210 SAS-R6, 7210 SAS-R6, and 7210 SAS-Mxp implementation of LACP supports the following:

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

  - If multiple groups satisfy the selection criteria, the sub-group being currently active remains active. Initially, the sub-group containing the highest priority eligible link is selected.
  - Only links pertaining to a single sub-group are active at any time.
  - An eligible member refers to a LAG member link which can potentially become active. This means it is operationally up, and if the slave-to-partner flag is set, the remote system did not disable its use (by signaling stand-by).
- The selection algorithm works in a reverting mode. This means that every time the configuration or status of any link in a LAG changes, the selection algorithm is rerun. In case of a tie between two groups (one of them being currently active) the active group remains active (no reverting).

2.8.10 LAG and ECMP Hashing

Note: Refer to the 7210 SAS-M, T, X, R6, R12, Mxp, Sx, S 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 Link Aggregation (LAG). A 7210 SAS can deploy both at the same time, meaning, using ECMP of two or more Link Aggregation Groups (LAG) and/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 and/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.

2.8.10.1 LAG Hashing for the 7210 SAS-M (Network Mode)

Table 10 describes the packet fields used for hashing for services configured in network mode on the 7210 SAS-M.

Table 10 **LAG Hashing Mechanism for Services Configured in Network Mode on 7210 SAS-M Devices**

Traffic direction (For example SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SAP to SAP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): BDA, BSA, VLAN. PBB traffic (Unlearned): Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC (Outer MACs of the ethernet packet that encapsulates MPLS packet), VLAN. MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN. Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic (Learned and Unlearned): BDA, BSA, ISID, Ingress Port-Id. MPLS traffic (Learned and Unlearned): MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.
Epipe Service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN. MPLS traffic: Source and Destination MAC (Outer MACs of the ethernet packet that encapsulates MPLS packet), VLAN. Non-IP traffic: Source and Destination MAC, EtherType, VLAN.	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.

Table 10 **LAG Hashing Mechanism for Services Configured in Network Mode on 7210 SAS-M Devices (Continued)**

Traffic direction (For example SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SAP to SDP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): BDA, BSA, VLAN PBB traffic (Unlearned): Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC,VLAN MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic (Learned and Unlearned): BDA, BSA, ISID, Ingress Port-Id. MPLS traffic (Learned and Unlearned): MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.
Epipe Service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN MPLS traffic: Source and Destination MAC,VLAN Non-IP traffic: Source and Destination MAC, EtherType, VLAN	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.

Table 10 **LAG Hashing Mechanism for Services Configured in Network Mode on 7210 SAS-M Devices (Continued)**

Traffic direction (For example SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SDP to SAP	Learned traffic : Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header) Unlearned traffic: Hash-2 and parameter under hash-2 used.	All traffic (Learned and Unlearned) : Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
Epipe Service: SDP to SAP	All traffic : Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header)	All traffic : Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
VPLS Service: SDP to SDP	IP traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header) IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), ISID PBB traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), EtherType Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id PBB traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), ISID, Ingress Port-Id Non-IP traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), EtherType, Ingress Port-Id
MPLS – LSR	All traffic: Source and Destination MAC (Outer MACs of the ethernet packet that encapsulates MPLS packet)	All traffic: MPLS label stack (Two labels deep), Ingress Port-Id.

Table 10 LAG Hashing Mechanism for Services Configured in Network Mode on 7210 SAS-M Devices (Continued)

Traffic direction (For example SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
PBB VPLS service: PBB BCB Traffic (that is, B-sap to B-sap)	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. L2/non-IP traffic (Learned): BDA, BSA L2/non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. L2/non-IP traffic (Learned and Unlearned): BDA, BSA, ISID, Ingress Port-Id
PBB VPLS service: Originating PBB BEB traffic (that is, I-SAP to B-SAP)	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. L2/non-IP traffic (Learned): CSA, CDA, EtherType, VLAN L2/non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id L2/non-IP traffic (Learned and Unlearned): CSA, CDA, EtherType, VLAN, Ingress Port-Id.
PBB Epipe service: Originating PBB BEB traffic (that is, PBB Epipe I-SAP to B-SAP)	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id L2/non-IP traffic: CSA, CDA, EtherType, VLAN, Ingress Port-Id	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id L2/non-IP traffic: CSA, CDA, EtherType, VLAN, Ingress Port-Id
PBB Epipe service: Terminating PBB BEB traffic (PBB Epipe SAP to B-SAP)	IP traffic: CSA, CDA L2/non-IP traffic: CSA, CDA, EtherType	IP traffic: CSA, CDA L2/non-IP traffic: CSA, CDA, EtherType

Table 10 LAG Hashing Mechanism for Services Configured in Network Mode on 7210 SAS-M Devices (Continued)

Traffic direction (For example SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPRN service: SAP to SAP SDP to SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
VPRN service: SAP to SDP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IES SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IPv4 network port interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.
Network port IPv4 interface: IPv4 network interface to IPv4 network interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.
Network port IPv6 interface: IPv6 network interface to IPv6 network interface	Source and Destination IP(v6), Source and Destination L4 ports	Source and Destination IP(v6), Source and Destination L4 ports, Ingress Port-Id.

The following notes apply.

- In the LSR case, incoming labels are used for hashing.
- “Learned” corresponds to Destination MAC.

- Source/Destination MAC refer to Customer Source/Destination MACs unless otherwise specified
- Applicable to non-IP, IP, PBB and MPLS traffic encapsulated in the MPLS packet received on the SDP Binding/SDP.

2.8.10.2 LAG Hashing for the 7210 SAS-X

Table 11 describes the packet fields used for hashing for services configured on the 7210 SAS-X.

Table 11 **LAG Hashing Mechanism for Services Configured on 7210 SAS-X Devices**

Services and Traffic Direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types
VPLS service: SAP to SAP SAP to SDP	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, VLAN, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (learned and unlearned): Source and Destination MAC, EtherType, Ingress Port-Id.
Epipe service: SAP to SAP SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports, VLAN, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, Ingress Port-Id.
VPLS and Epipe service: SDP to SAP	All traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
VPLS service: SDP to SDP	All traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.

Table 11 **LAG Hashing Mechanism for Services Configured on 7210 SAS-X Devices**

Services and Traffic Direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types
MPLS – LSR	All traffic: MPLS label stack (Two labels deep), Ingress Port-Id.
PBB VPLS service: PBB BCB Traffic (that is, B-SAP to B-SAP)	IP traffic (learned and unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. L2/non-IP traffic (learned and unlearned): BDA, BSA, ISID, Ingress Port-Id.
PBB VPLS service: Originating PBB BEB traffic (that is, I-SAP to B-SAP)	IP traffic (learned and unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, VLAN. L2/non-IP traffic (learned and unlearned): CSA, CDA, EtherType, Ingress Port-Id.
PBB VPLS service: Terminating PBB BEB traffic (that is, B-SAP to I-SAP)	IP traffic (learned and unlearned): CSA, CDA, Ingress Port-Id. L2/non-IP traffic (learned and unlearned): CSA, CDA, EtherType, Ingress Port-Id.
PBB Epipe service: Originating PBB BEB traffic (that is, PBB Epipe I-SAP to B-SAP)	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, VLAN. L2/non-IP traffic: CSA, CDA, EtherType, Ingress Port-Id.
PBB Epipe service: Terminating PBB BEB traffic (PBB Epipe SAP to B-SAP)	IP traffic: CSA, CDA, Ingress Port-Id. L2/non-IP traffic: CSA, CDA, EtherType, Ingress Port-Id.
VPRN service: SAP to SAP SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, VLAN.
VPRN service: SDP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress port-Id.

Table 11 **LAG Hashing Mechanism for Services Configured on 7210 SAS-X Devices**

Services and Traffic Direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types
IES service and IPv4 Network port interface: IES SAP to IES SAP IPv4 network port interface to IPv4 network port interface IES SAP to IPv4 network port interface	IPv4 unicast traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, VLAN.
Network port IPv6 interface: IPv6 network interface to IPv6 network interface	IPv6 unicast traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id, VLAN.
IES (Multicast IP traffic) IP interface (Network or SAP) to IP interface (SAP)	IPv4 Multicast traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.
Network Port IP interface (Multicast IP traffic) IP interface (Network or SAP) to IP interface (Network)	IPv4 Multicast traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.

The following notes apply.

- In the LSR case, incoming labels are used for hashing.
- “Learned” corresponds to Destination MAC.
- Source/Destination MAC always refers to Customer Source/Destination MACs unless otherwise specified.

2.8.10.3 LAG Hashing for the 7210 SAS-M (Access-uplink Mode)

Table 12 describes the packet fields used for hashing for services configured on the 7210 SAS-M in access-uplink mode.

Table 12 LAG Hashing Mechanism for Services Configured in Access-uplink Mode on 7210 SAS-M

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

The following notes apply.

- 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.

2.8.10.4 LAG Hashing for the 7210 SAS-T (Access-uplink Mode)

Table 13 describes the packet fields used for hashing for services configured on the 7210 SAS-T in access-uplink mode.

Table 13 LAG Hashing Mechanism for Services Configured on 7210 SAS-T Access-uplink Mode

Services and Traffic Direction	Packet fields used for Hashing for different traffic types
VPLS service: SAP to SAP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports. IP traffic (Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic (Learned): BDA, BSA, VLAN PBB traffic (Unlearned): BDA, BSA, ISID, Ingress Port-Id MPLS traffic (Learned): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet) MPLS traffic (Unlearned-IP): MPLS label stack (Two labels deep), Source and Destination IP, Ingress Port-Id, VLAN MPLS traffic (Unlearned-L2): MPLS label stack (Two labels deep), Ingress Port-Id Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearned): Source and Destination MAC, EtherType, Ingress Port-Id, VLAN

Table 13 **LAG Hashing Mechanism for Services Configured on 7210 SAS-T Access-uplink Mode (Continued)**

Services and Traffic Direction	Packet fields used for Hashing for different traffic types
Epipe service: SAP to SAP	IIP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id MPLS traffic (IP): MPLS label stack (Two labels deep), Source and Destination IP, Ingress Port-Id MPLS traffic (L2): MPLS label stack (Two labels deep), Ingress Port-Id Non-IP traffic: Source and Destination MAC, EtherType, Ingress Port-Id, VLAN
IES service (IPv4): IES SAP to IES SAP	IPv4 unicast traffic: Source and Destination IP, Source and Destination L4 ports.

The following notes apply.

- 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.

2.8.10.5 LAG Hashing for the 7210 SAS-T (Network Mode)

Table 14 describes the packet fields used for hashing for services configured on the 7210 SAS-T in network mode.

Table 14 **LAG Hashing Fields Used for 7210 SAS-T Network Mode**

Services and Traffic direction (For example -SAP to SDP)	Packet fields used for Hashing for different traffic types With hash-1	Packet fields used for Hashing for different traffic types With hash-2
VPLS Service: SAP to SAP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports. IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): BDA, BSA, VLAN. PBB traffic (Unlearned): Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), VLAN. MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN. Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic (Learned and Unlearned): BDA, BSA, ISID, Ingress Port-Id. MPLS traffic (Learned and Unlearned): Source and Destination IP, MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.

Table 14 **LAG Hashing Fields Used for 7210 SAS-T Network Mode (Continued)**

Services and Traffic direction (For example -SAP to SDP)	**Packet fields used for Hashing for different traffic types With hash-1**	**Packet fields used for Hashing for different traffic types With hash-2**
Epipe service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN. MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), VLAN. Non-IP traffic: Source and Destination MAC, EtherType, VLAN.	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. MPLS traffic: Source and Destination IP, MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.
VPLS service: SAP to SDP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports. IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): BDA, BSA, VLAN PBB traffic (Unlearned):Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC, VLAN MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic (Learned and Unlearned): BDA, BSA, ISID, Ingress Port-Id. MPLS traffic (Learned and Unlearned): Source and Destination IP, MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.

Table 14 **LAG Hashing Fields Used for 7210 SAS-T Network Mode (Continued)**

Services and Traffic direction (For example -SAP to SDP)	Packet fields used for Hashing for different traffic types With hash-1	Packet fields used for Hashing for different traffic types With hash-2
Epipe service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN MPLS traffic: Source and Destination MAC, VLAN Non-IP traffic: Source and Destination MAC, EtherType, VLAN	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. MPLS traffic: Source and Destination IP, MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.
VPLS service: SDP to SAP	IP traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Source and Destination L4 ports, VLAN PBB traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header). Non-IP traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), EtherType. All traffic (Unlearned): Hash-2 and parameter under hash-2 used.	All traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.

Table 14 LAG Hashing Fields Used for 7210 SAS-T Network Mode (Continued)

Services and Traffic direction (For example -SAP to SDP)	Packet fields used for Hashing for different traffic types With hash-1	Packet fields used for Hashing for different traffic types With hash-2
Epipe service: SDP to SAP	IP traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Source and Destination L4 ports, VLAN PBB traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header). Non-IP traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), EtherType.	All traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
VPLS service: SDP to SDP	All traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header) All traffic (Unlearned): Hash-2 and parameter under hash-2 used.	All traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
MPLS – LSR	All traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet)	All traffic: MPLS label stack (Two labels deep), Source and Destination IP (only when IP header immediately follows MPLS header without any Source and Destination MAC in between inside the MPLS encapsulation), Ingress Port-Id.

Table 14 **LAG Hashing Fields Used for 7210 SAS-T Network Mode (Continued)**

Services and Traffic direction (For example -SAP to SDP)	Packet fields used for Hashing for different traffic types With hash-1	Packet fields used for Hashing for different traffic types With hash-2
PBB VPLS service: PBB BCB Traffic (that is, B-sap to B-sap)	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. L2/non-IP traffic (Learned): BDA, BSA L2/non-IP traffic (Unlearned):Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. L2/non-IP traffic (Learned and Unlearned): BDA, BSA, ISID, Ingress Port-Id
PBB VPLS service: Originating PBB BEB traffic (that is, I-SAP to B-SAP)	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. L2/non-IP traffic (Learned): CSA, CDA, EtherType, VLAN L2/non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id L2/non-IP traffic (Learned and Unlearned): CSA, CDA, EtherType, VLAN, Ingress Port-Id.
PBB VPLS service: Terminating PBB BEB traffic (that is, B-SAP to I-SAP)	IP traffic (Learned): CSA, CDA IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. L2/non-IP traffic (Learned): CSA, CDA, EtherType L2/non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): CSA, CDA, Ingress Port-Id L2/non-IP traffic (Learned and Unlearned): CSA, CDA, EtherType, Ingress Port-Id. .

Table 14 LAG Hashing Fields Used for 7210 SAS-T Network Mode (Continued)

Services and Traffic direction (For example -SAP to SDP)	Packet fields used for Hashing for different traffic types With hash-1	Packet fields used for Hashing for different traffic types With hash-2
PBB Epipe service: Originating PBB BEB traffic (that is, PBB Epipe I-SAP to B-SAP)	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id L2/non-IP traffic: CSA, CDA, EtherType, VLAN, Ingress Port-Id	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id L2/non-IP traffic: CSA, CDA, EtherType, VLAN, Ingress Port-Id
PBB Epipe service: Terminating PBB BEB traffic (PBB Epipe SAP to B-SAP)	IP traffic: CSA, CDA L2/non-IP traffic: CSA, CDA, EtherType	IP traffic: CSA, CDA L2/non-IP traffic: CSA, CDA, EtherType
VPRN service: SAP to SAP SDP to SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
VPRN service: SAP to SDP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IES SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IPv4 network port interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.

Table 14 **LAG Hashing Fields Used for 7210 SAS-T Network Mode (Continued)**

Services and Traffic direction (For example -SAP to SDP)	Packet fields used for Hashing for different traffic types With hash-1	Packet fields used for Hashing for different traffic types With hash-2
Network port IPv4 interface: IPv4 network interface to IPv4 network interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.
Network port IPv6 interface: IPv6 network interface to IPv6 network interface	Source and Destination IP(v6), Source and Destination L4 ports	Source and Destination IP(v6), Source and Destination L4 ports, Ingress Port-Id.

The following notes apply.

- In the LSR case, incoming labels are used for hashing.
- “Learned” corresponds to Destination MAC.
- Source/Destination MAC refers to Customer Source/Destination MACs unless otherwise specified.

2.8.10.6 LAG Hashing for the 7210 SAS-R6 and 7210 SAS-R12

Table 15 describes the packet fields used for hashing for services configured on the 7210 SAS-R6 and 7210 SAS-R12.

Table 15 LAG Hashing Mechanism for Services Configured on 7210 SAS-R6 and 7210 SAS-R12 Devices

Services and Traffic direction (For example- SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS service: SAP to SAP	All Unlearned Traffic : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports PBB traffic (Learned): BDA, BSA, VLAN MPLS traffic (Learned): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), VLAN Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN	All Unlearned Traffic : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic (Learned): BDA, BSA, ISID, Ingress Port-Id MPLS traffic (Learned): MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id
EPIPE Service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), VLAN Non-IP traffic: Source and Destination MAC, EtherType, VLAN	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic: BDA, BSA, ISID, Ingress Port-Id MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id

Table 15 **LAG Hashing Mechanism for Services Configured on 7210 SAS-R6 and 7210 SAS-R12 Devices (Continued)**

Services and Traffic direction (For example- SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SAP to SDP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned) : BDA, BSA, VLAN PBB traffic (Unlearned) : Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC, VLAN MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic (Learned and Unlearned) : BDA, BSA, ISID, Ingress Port-Id MPLS traffic (Learned and Unlearned): MPLS label stack (Two labels deep), Source and Destination IP (when IP header follows MPLS header), Ingress Port-Id. Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.
Epipe Service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN MPLS traffic: Source and Destination MAC, VLAN Non-IP traffic: Source and Destination MAC, EtherType, VLAN	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic: BDA, BSA, ISID, Ingress Port-Id MPLS traffic: MPLS label stack (Two labels deep), Source and Destination IP (when IP header follows MPLS header), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.

Table 15 **LAG Hashing Mechanism for Services Configured on 7210 SAS-R6 and 7210 SAS-R12 Devices (Continued)**

Services and Traffic direction (For example- SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SDP to SAP	All traffic (Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. IP traffic (Learned): Source and Destination MAC, MPLS Label Stack (Two labels deep), Source and Destination L4 ports, VLAN All other traffic(Learned): Source and Destination MAC(Outer MACs inside the payload, just after the MPLS header), EtherType.	All traffic (Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. All traffic (Learned): Source and Destination MAC(Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id
Epipe Service: SDP to SAP	IP traffic: Source and Destination MAC, MPLS Label Stack (Two labels deep), Source and Destination L4 ports, VLAN All other traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), EtherType.	All traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id
VPLS service: SDP to SDP	All traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header) All traffic (Unlearned): Hash-2 and parameter under hash-2 used.	All traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id
MPLS – LSR	All traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet)	All traffic: MPLS label stack (Three labels deep), Ingress Port-Id, Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id

Table 15 LAG Hashing Mechanism for Services Configured on 7210 SAS-R6 and 7210 SAS-R12 Devices (Continued)

Services and Traffic direction (For example- SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service (Multicast Traffic with IGMP Snooping Enabled) SAP to SAP SDP to SAP	Based on LAG SAP parameters : service-id, lag_index, encap_value, service_vlan, mgid, sap_index, number of active ports.	Based on LAG SAP parameters : service-id, lag_index, encap_value, service_vlan, mgid, sap_index, number of active ports.
Notes: • VPLS service, Multicast traffic with IGMP snooping enabled for SAP to SDP flow and SDP to SDP flow is as described previously. • 'mgid' is the Multicast Group ID and is a software allocated number. A unique number is allocated per Layer-2 multicast MAC address. • 7210 supports Layer-2 multicast in a VPLS service. A group of 32 multicast IP addresses maps to a single Layer-2 multicast MAC address. The 'mgid' parameter remains the same for all the IP multicast address that map to the same Layer-2 multicast MAC address		
VPRN service: SAP to SAP SDP to SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
VPRN service: SAP to SDP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IES SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IPv4 network port interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.

Table 15 **LAG Hashing Mechanism for Services Configured on 7210 SAS-R6 and 7210 SAS-R12 Devices (Continued)**

Services and Traffic direction (For example-SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
Network port IPv4 interface: IPv4 network interface to IPv4 network interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.
Network port IPv6 interface: IPv6 network interface to IPv6 network interface	Source and Destination IP(v6), Source and Destination L4 ports	Source and Destination IP(v6), Source and Destination L4 ports, Ingress Port-Id.

The following notes apply.

- ‘service_id’ refers to the service id of the egressing VPLS/EPIPE/IES/VPRN service.
- ‘lag_index’ refers to the Lag-IfIndex of the egressing lag.
- 'encap_value' and 'service_vlan' are based on the inner/outer VLAN values of the egressing LAG SAP.
- '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 (also known as Port Based Egress Scheduling mode), unless otherwise specified previously.
- “Learned” corresponds to Destination MAC.
- Source/Destination MAC refers to Customer Source/Destination MACs unless otherwise specified.
- In case of a LAG with 2 ports at the egress, different Ingress port-Ids may result in the same hash-index, resulting in traffic always getting hashed to only one of the ports. With more than 2 ports in the lag, load- balancing is expected to take place.
- Hash function is implemented in software. Does not use hash-1 or hash-2.

2.8.10.7 LAG Hashing for the 7210 SAS-Mxp

Table 16 describes the packet fields used for hashing for services configured on the 7210 SAS-Mxp.

Table 16 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Mxp Devices**

Services and Traffic direction (For example-SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS and Epipe Services: SAP to SAP	**Sap Based Egress Scheduling :** All traffic (Learned and Unlearned): Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. **Port Based Egress Scheduling:** All traffic(VPLS Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. All other Traffic(VPLS Learned and Epipe): IP traffic: Source and Destination IP, Source and Destination L4 ports. MPLS and Non-IP traffic: Source and Destination MAC, EtherType, VLAN.	**Sap Based Egress Scheduling :** All traffic (Learned and Unlearned): Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. **Port Based Egress Scheduling:** All traffic(VPLS Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. All other Traffic(VPLS Learned and Epipe): IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id

Table 16 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Mxp Devices**

Services and Traffic direction (For example- SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SAP to SDP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC, VLAN MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. MPLS traffic (Learned and Unlearned): MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.
Epipe Service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports MPLS traffic: Source and Destination MAC, VLAN Non-IP traffic: Source and Destination MAC, EtherType, VLAN	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. MPLS traffic: MPLS label stack (Two labels deep), Ingress Port-Id. Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id.

Table 16 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Mxp Devices**

Services and Traffic direction (For example- SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS and Epipe Services: SDP to SAP	**Sap Based Egress Scheduling:** All traffic (including VPLS Learned and Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. **Port Based Egress Scheduling**: All traffic (VPLS Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. All other Traffic(VPLS Learned and Epipe): Source and Destination MAC(Outer MACs inside the payload, just after the MPLS header)	**Sap Based Egress Scheduling:** All traffic (including VPLS Learned and Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. **Port Based Egress Scheduling:** All traffic (VPLS Unlearned) : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index, number of active ports. All other Traffic(VPLS Learned and Epipe): Source and Destination MAC(Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id
VPLS Service: SDP to SDP	All traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header All traffic(Unlearned): Hash-2 and parameter under hash-2 used.	All traffic (Learned and Unlearned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
MPLS – LSR	All traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet)	All traffic: MPLS label stack (Three labels deep), Ingress Port-Id, Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id
VPLS Service (Multicast Traffic with IGMP Snooping Enabled) SAP to SAP SDP to SAP	Based on LAG SAP parameters : service-id, lag_index, encap_value, service_vlan, mgid, sap_index, number of active ports.	Based on LAG SAP parameters : service-id, lag_index, encap_value, service_vlan, mgid, sap_index, number of active ports.

Table 16 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Mxp Devices**

Services and Traffic direction (For example-SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
NOTES: • VPLS service, Multicast traffic with IGMP snooping enabled for SAP to SDP flow and SDP to SDP flow is as described previously. • 'mgid' is the Multicast Group ID and is a software allocated number. A unique number is allocated per Layer-2 multicast MAC address. • 7210 supports Layer-2 multicast in a VPLS service. A group of 32 multicast IP addresses maps to a single Layer-2 multicast MAC address. The 'mgid' parameter remains the same for all the IP multicast address that map to the same Layer-2 multicast MAC address		
VPRN service: SAP to SAP SDP to SAP	**Sap Based Egress Scheduling :** All traffic: Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index and number of active ports. **Port Based Egress Scheduling:** All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports.	**Sap Based Egress Scheduling :** All traffic: Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index and number of active ports. **Port Based Egress Scheduling:** All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports, ingress port-Id
VPRN service: SAP to SDP	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports.	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IES SAP	**Sap Based Egress Scheduling:** All traffic : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index and number of active ports. **Port Based Egress Scheduling:** All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports.	**Sap Based Egress Scheduling:** All traffic : Based on LAG SAP parameters: service-id, lag_index, encap_value, service_vlan, sap_index and number of active ports. **Port Based Egress Scheduling:** All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports, ingress port-Id
IES service (IPv4): IES SAP to IPv4 network port interface	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports.	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports, Ingress port-Id

Table 16 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Mxp Devices**

Services and Traffic direction (For example-SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
Network port IPv4 interface: IPv4 network interface to IPv4 network interface	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports.	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports, Ingress port-Id
Network port IPv6 interface: IPv6 network interface to IPv6 network interface	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports.	All traffic: Based on traffic parameters: Source-IP, Destination-IP, Source and destination L4 ports, Ingress port-Id

The following notes apply.

- In the LSR case, incoming labels are used for hashing.
- “Learned” corresponds to Destination MAC.
- Source/Destination MAC refers to Customer Source/Destination MACs unless otherwise specified.
- ‘service_id’ refers to the service id of the egressing VPLS/EPIPE/IES/VPRN service.
- ‘lag_index’ refers to the Lag-IfIndex of the egressing lag.
- 'encap_value' and 'service_vlan' are based on the inner/outer VLAN values of the egressing LAG SAP.
- '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 (also known as Port Based Egress Scheduling mode), unless otherwise specified previously.
- Hash function is implemented in software. Does not use hash-1 or hash-2.

2.8.10.8 LAG Hashing for the 7210 SAS-Sx/S 1/10GE and 7210 7210 SAS-Sx 10/100GE

Table 17 describes the packet fields used for hashing for services configured on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE.

Table 17 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE Devices**

Services and Traffic direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SAP to SAP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): BDA, BSA, VLAN, EtherType PBB traffic (Unlearned): Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), VLAN, EtherType MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, VLAN, EtherType Non-IP traffic (Unlearned):): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic (Learned and Unlearned): BDA, BSA, ISID, EtherType, Ingress Port-Id MPLS traffic (Learned and Unlearned): MPLS label stack (Three labels deep), Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id Non-IP traffic (Learned and Unlearned): Source and Destination MAC, VLAN, EtherType, Ingress Port-Id
Epipe Service: SAP to SAP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, VLAN, EtherType MPLS traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet), VLAN, EtherType Non-IP traffic: Source and Destination MAC, VLAN, EtherType	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic: BDA, BSA, ISID, EtherType, Ingress Port-Id MPLS traffic: MPLS label stack (Three labels deep), Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id Non-IP traffic: Source and Destination MAC, VLAN, EtherType, Ingress Port-Id

Table 17 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE Devices (Continued)**

Services and Traffic direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS Service: SAP to SDP	IP traffic (Learned): Source and Destination IP, Source and Destination L4 ports IP traffic (Unlearned): Hash-2 and parameter under hash-2 used. PBB traffic (Learned): BDA, BSA, EtherType PBB traffic (Unlearned): Hash-2 and parameter under hash-2 used. MPLS traffic (Learned): Source and Destination MAC, VLAN MPLS traffic (Unlearned): Hash-2 and parameter under hash-2 used. Non-IP traffic (Learned): Source and Destination MAC, EtherType, VLAN Non-IP traffic (Unlearned): Hash-2 and parameter under hash-2 used.	IP traffic (Learned and Unlearned): Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic (Learned and Unlearned): BDA, BSA, ISID, EtherType, Ingress Port-Id MPLS traffic (Learned and Unlearned): MPLS label stack (Three labels deep), Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id Non-IP traffic (Learned and Unlearned): Source and Destination MAC, EtherType, VLAN, Ingress Port-Id
Epipe service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports PBB traffic: BDA, BSA, EtherType MPLS traffic: Source and Destination MAC, VLAN Non-IP traffic: Source and Destination MAC, EtherType, VLAN	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id PBB traffic: BDA, BSA, ISID, EtherType, Ingress Port-Id MPLS traffic: MPLS label stack (Three labels deep), Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id Non-IP traffic: Source and Destination MAC, EtherType, VLAN, Ingress Port-Id

Table 17 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE Devices (Continued)**

Services and Traffic direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS service: SDP to SAP	IP traffic (Learned): Source and Destination MAC, MPLS Label Stack (Two labels deep), Source and Destination L4 ports, VLAN PBB traffic (Learned): BDA, BSA, EtherType Non-IP traffic(Learned) : Source and Destination MAC, EtherType All traffic(Unlearned): Hash-2 and parameter under hash-2 used.	All traffic (Learned and Unlearned): Src & dst MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
Epipe service: SDP to SAP	IP traffic: Source and Destination MAC, MPLS Label Stack (Two labels deep), Source and Destination L4 ports, VLAN PBB traffic: BDA, BSA, EtherType Non-IP traffic: src & dst MAC, EtherType	All traffic: Src & dst MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id.
VPLS service: SDP to SDP	All Traffic (Learned): Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header) All Traffic (Unlearned): Hash-2 and parameter under hash-2 used.	All Traffic: Source and Destination MAC (Outer MACs inside the payload, just after the MPLS header), Ingress Port-Id
MPLS – LSR	All traffic: Source and Destination MAC (Outer MACs of the Ethernet packet that encapsulates MPLS packet)	All traffic: MPLS label stack (Three labels deep), Source and Destination IP (being used when IP header follows MPLS header), Ingress Port-Id

Table 17 LAG Hashing Mechanism for Services Configured on 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE Devices (Continued)

Services and Traffic direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
VPLS IGMP Snooping VPLS (Multicast traffic with IGMP snooping enabled) SAP to SAP SAP to SDP	IP Multicast traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port id L2 Multicast traffic: Source and Destination MAC, EtherType, VLAN	IP Multicast traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port id L2 Multicast traffic: Source and Destination MAC, EtherType, VLAN
VPLS IGMP Snooping VPLS (Multicast traffic with IGMP snooping enabled) SDP to SAP SDP to SDP	Source and Destination MAC, Ingress Port Id	Source and Destination MAC, Ingress Port Id
VPRN service: SAP to SAP SDP to SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
VPRN service: SAP to SDP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IES SAP	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress port-Id
IES service (IPv4): IES SAP to IPv4 network port interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.
Network port IPv4 interface: IPv4 network interface to IPv4 network interface	Source and Destination IP, Source and Destination L4 ports	Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id.

Table 17 **LAG Hashing Mechanism for Services Configured on 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE Devices (Continued)**

Services and Traffic direction (For example: SAP to SDP)	Packet fields used for Hashing for different traffic types with hash-1	Packet fields used for Hashing for different traffic types with hash-2
Network port IPv6 interface: IPv6 network interface to IPv6 network interface	Source and Destination IP(v6), Source and Destination L4 ports	Source and Destination IP(v6), Source and Destination L4 ports, Ingress Port-Id.

The following notes apply.

- “Learned” corresponds to Destination MAC.
- Source/Destination MAC refers to Customer Source/Destination MACs unless otherwise specified.

2.8.10.9 PW Hash-label Generation for 7210 SAS-R6 and 7210 SAS-R12

Table 18 describes the packet fields used for different services and different traffic types, to generate the hash-label.

Table 18 **PW Hash-label – Packet Fields Used for PW Hash-label Generation for 7210 SAS-R6 and 7210 SAS-R12**

Services and Traffic Direction (For Example: SAP to SDP)	Packet fields Used for Hash-label
VPLS and Epipe service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports. MPLS and PBB traffic: Fixed label value. Any Other traffic: Source and Destination MAC, EtherType, VLAN

Table 18 **PW Hash-label – Packet Fields Used for PW Hash-label Generation for 7210 SAS-R6 and 7210 SAS-R12 (Continued)**

Services and Traffic Direction (For Example: SAP to SDP)	Packet fields Used for Hash-label
VPLS service: SDP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports. MPLS and PBB traffic: Fixed label value. Any Other traffic: Source and Destination MAC(Outer MACs), EtherType, VLAN.

Note:

- Source and destination MAC address 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 lesser number of VLAN tags. If there are more VLAN tags, then the system identifies it as “Any Other traffic”.
- For IP traffic, with two or more VLAN tags, Source and Destination MAC, VLAN is used to generate the hash label.
- Any other traffic with three or more VLAN tags, uses Source and Destination MAC, VLAN to generate the hash label.
- The value of 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 might not have Ethertype (For example: xSTP traffic does not ethertype). Ethertype is used, only if available in the packet outermost ethernet header for packets with two or lesser number of VLAN tags.

2.8.10.10 PW Hash-label – Packet Fields Used for PW Hash-label Generation for 7210 SAS-Mxp

Table 19 describes the packet fields used for different services and different traffic types, to generate the hash-label.

Table 19 **PW Hash-label – Packet Fields Used for PW Hash-label Generation for 7210 SAS-Mxp**

Services and Traffic Direction (For Example: SAP to SDP)	Packet Fields Used for Hash-label
VPLS and Epipe service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. MPLS traffic: MPLS label stack (Three labels deep), Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id. PBB traffic: BDA, BSA, ISID, Ingress Port-Id. All Other traffic: Source and Destination MAC, EtherType (if applicable), VLAN, Ingress Port-Id.
VPLS service: SDP to SDP	All traffic: Source and Destination MAC (Outer MACs), Ingress Port-Id.

Note:

- Source and destination MAC address are from the outermost Ethernet header.
- MPLS and PBB traffic encapsulation is identified by the system, only if the outermost ethernet has two or lesser number of VLAN tags.
- Any traffic with three or more VLAN tags uses Source and Destination MAC, VLAN to generate the hash label.
- The value of 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” might have Ethertype or might not have Ethertype (for example: xSTP traffic does not ethertype). Ethertype is used, only if available in the packet outermost ethernet header for packets with two or lesser number of VLAN tags.

2.8.10.11 PW Hash-label – Packet Fields Used for PW Hash-label Generation for 7210 SAS-Sx/S 1/10GE

Table 20 describes the packet fields used for different services and different traffic types, to generate the hash-label:.

Table 20 **PW Hash-label – Packet Fields Used for PW Hash-label Generation for 7210 SAS-Sx/S 1/10GE**

Services and Traffic Direction (For Example: SAP to SDP)	Packet Fields Used for Hash-label
VPLS and Epipe service: SAP to SDP	IP traffic: Source and Destination IP, Source and Destination L4 ports, Ingress Port-Id. MPLS traffic: MPLS label stack (Three labels deep), Source and Destination IP (if MPLS labels are <= 3, when IP header follows MPLS header), Ingress Port-Id. PBB traffic: Ingress Port-Id. All Other traffic: Source and Destination MAC, Ethertype (if applicable), VLAN, Ingress Port-Id.
VPLS service: SDP to SDP	All traffic: Source and Destination MAC (Outer MACs), Ingress Port-Id.

Note:

- Source and destination MAC address are from the outermost Ethernet header.
- MPLS and PBB traffic encapsulation is identified by the system, only if the outermost Ethernet has two or lesser number of VLAN tags.
- Any traffic with three or more VLAN tags uses Source and Destination MAC, VLAN to generate the hash label.
- The value of 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” might have Ethertype or might not have Ethertype (for example: xSTP traffic does not have Ethertype). Ethertype is used, only if available in the packet outermost Ethernet header for packets with two or lesser number of VLAN tags.

2.8.11 Bidirectional Forwarding Detection Over LAG Links

On the 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12, the router supports the application of 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; the 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.

When configuring the local and remote IP address 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. The *local-ip* and *remote-ip* values do not have to match for hybrid mode or Q-tag.

2.8.11.1 Configuration Guidelines and Restrictions for BFD Over LAG Links

- The local address that is used for BFD sessions over LAG links cannot be an IP interface address that is associated with RVPLS 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.

2.9 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 providing redundant connection between different end points. The whole scenario is then built by combination of different mechanisms (for example, MC-LAG and redundant pseudowire to provide e2e redundant p2p connection or dual homing of DSLAMs in Layer 2/3 TPSDA).

Note: The 7210 SAS platforms configured in access-uplink mode cannot peer with an MC-LAG-enabled node since it does not implement MC-LAG protocol; a 7210 SAS-M or 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.

2.9.1 Overview

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

To ensure SLAs and deterministic forwarding characteristics between the access and the redundant-pair node, the multi-chassis LAG function provides an active/ standby operation toward/from the access node. LACP is used to manage the available LAG links into active and standby states such that only links from 1 aggregation node are active at a time to/from the access node.

Characteristics related to MC are:

- Selection of the common system ID, system-priority and administrative-key are used in LACP messages so partner systems consider all links as the part of the same LAG.
- Extension of selection algorithm to allow selection of active sub-group.
  - The sub-group definition in LAG context is still local to the single box, meaning that even if sub-groups configured on two different systems have the same sub-group-id they are still considered as two separate subgroups within specific LAG.
  - Multiple sub-groups per PE in a MC-LAG is supported.
  - In case there is a tie in the selection algorithm, for example, two sub-groups with identical aggregate weight (or number of active links) the group which is local to the system with lower system LACP priority and LAG system ID is taken.
- Providing inter-chassis communication channel allows inter-chassis communication to support LACP on both system. This communication channel enables the following:
  - Supports connections at the IP level which do not require a direct link between two nodes. The IP address configured at the neighbor system is one of the addresses of the system (interface or loop-back IP address).
  - The communication protocol provides heartbeat mechanism to enhance robustness of the MC-LAG operation and detecting node failures.
  - Support for operator actions on any node that force an operational change.
  - The LAG group-ids do not have to match between neighbor systems. At the same time, there can be multiple LAG groups between the same pair of neighbors.

- Verification that the physical characteristics, such as speed and auto-negotiation is configured and initiates operator notifications (traps) if errors exist. Consistency of MC-LAG configuration (system-id, administrative-key and system-priority) is provided. Similarly, load-balancing mode of operation must be consistently configured on both nodes.
- Traffic over the signaling link is encrypted using a user configurable message digest key.

- MC-LAG function provides active/stand-by status to other software applications to built a reliable solutions.

Figure 4 and Figure 5 show different combinations of MC-LAG attachments supported. The supported configurations can be sub-divided into following sub-groups:

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

Figure 4 shows dual homing to remote PE pairs.

Figure 4 **MC-LAG L2 Dual Homing to Remote PE Pairs**

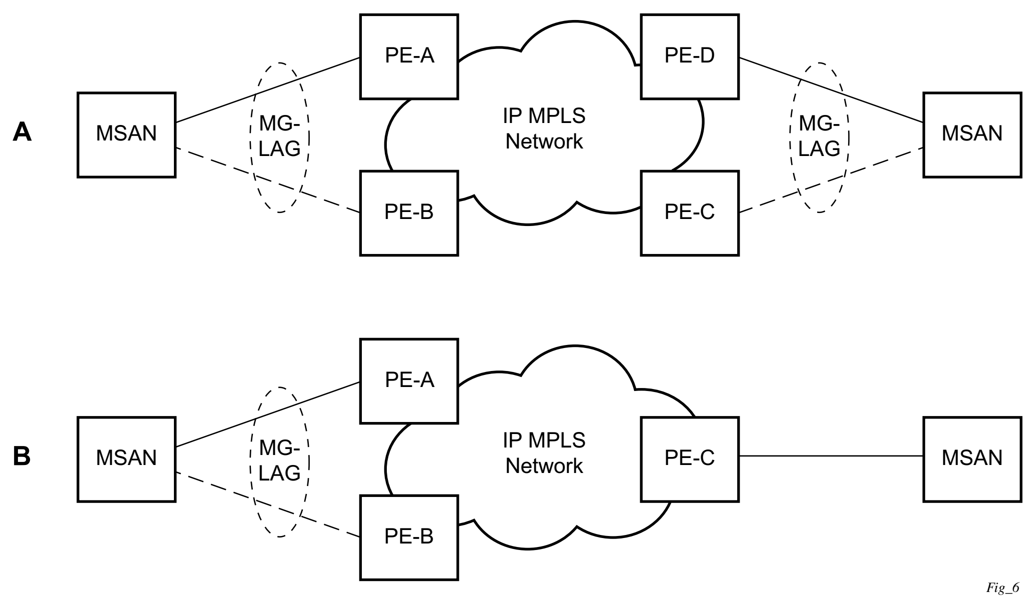
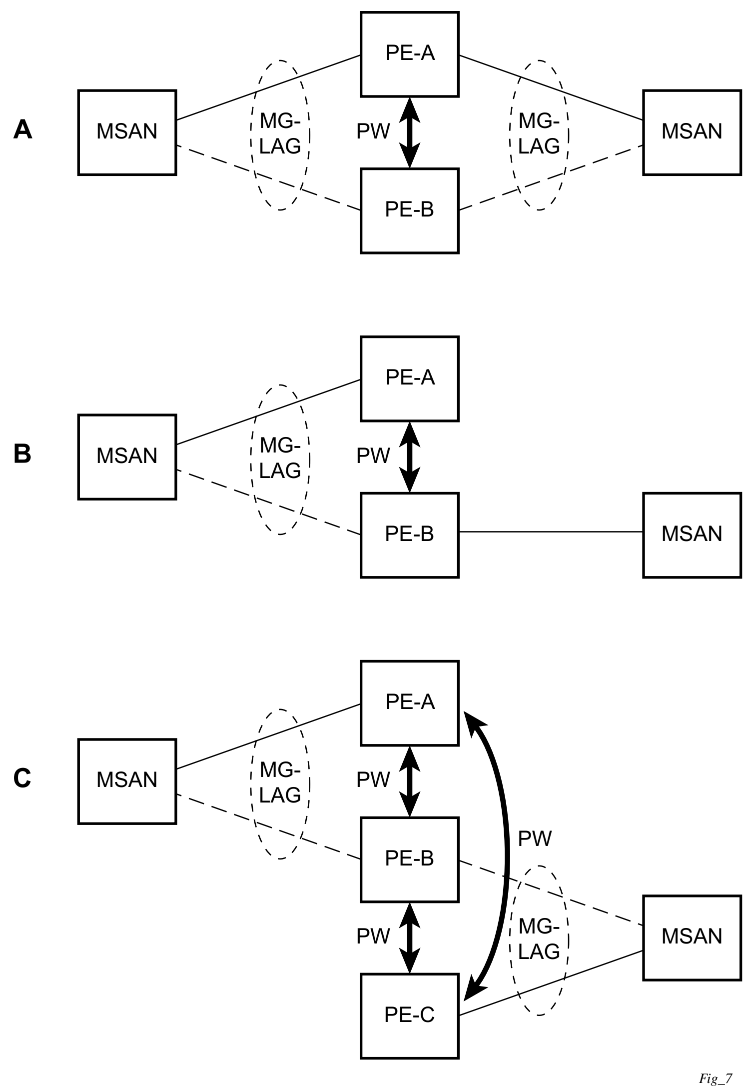


Figure 5 shows dual homing to local PE pairs.

Figure 5 **MC-LAG L2 Dual Homing to Local PE-Pairs**



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

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

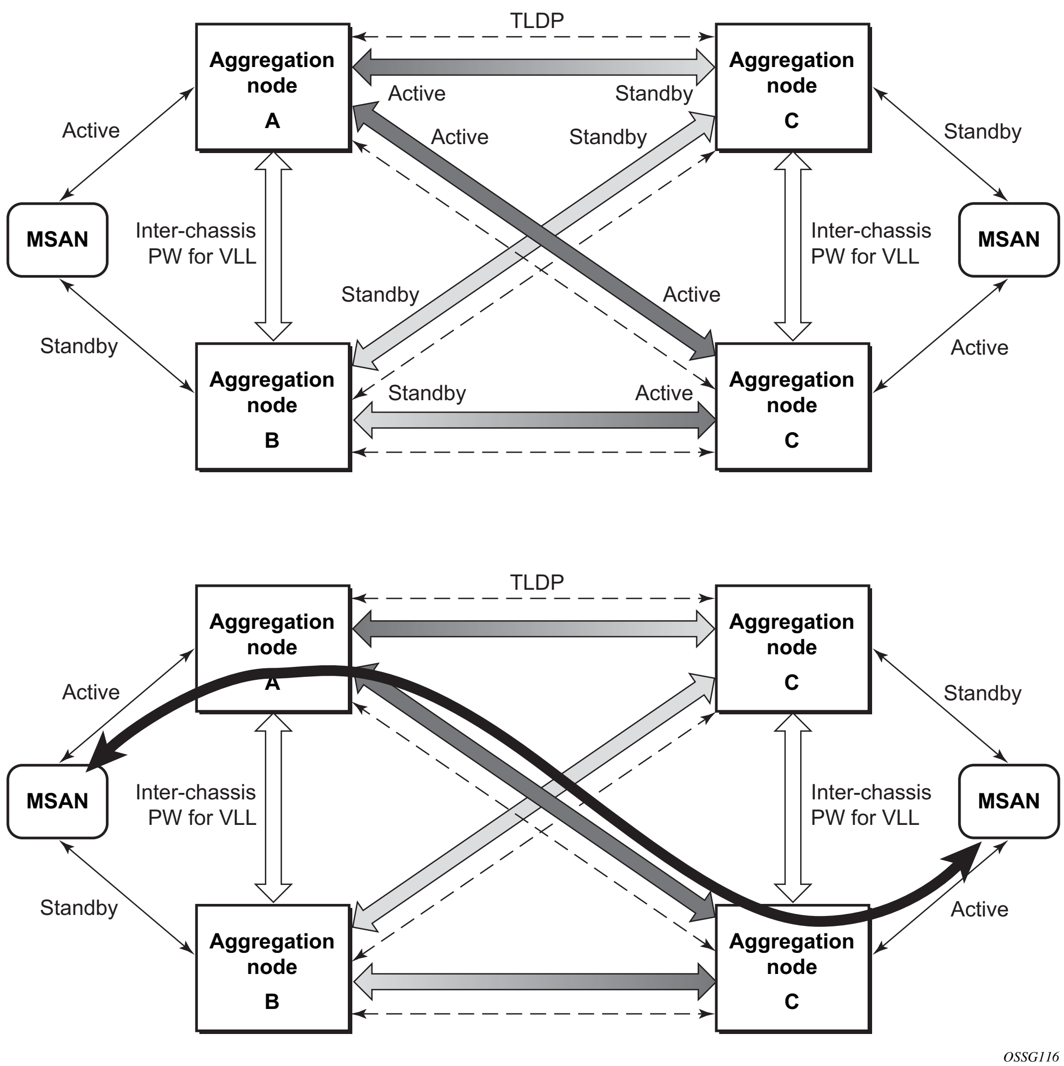
2.9.2 Point-to-Point (p2p) Redundant Connection Across Layer 2/3 VPN Network

Figure 6 shows the connection between two multi-service access nodes (MSANs) across network based on Layer 2/3 VPN pseudo-wires. The connection between MSAN and a pair of PE routers is realized by MC-LAG. From MSAN perspective, redundant pair of PE routers acts as a single partner in LACP negotiation. At any point in time, only one of the routers has an active links in a specific LAG. The status of LAG links is reflected in status signaling of pseudo-wires set between all participating PEs. The combination of active and stand-by states across LAG links as well and pseudo-wires give only 1 unique path between pair of MSANs.

Note that the configuration in Figure 6 shows one particular configuration of VLL connections based on MC-LAG, particularly the VLL connection where two ends (SAPs) are on two different redundant-pairs. In addition to this, other configurations are possible, such as:

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

Figure 6 **P2P Redundant Connection Through a Layer 2 VPN Network**

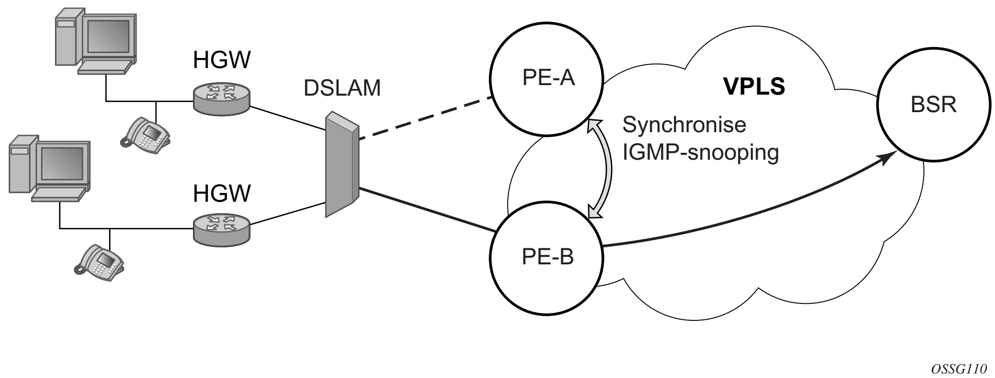


2.9.3 DSLAM Dual Homing in Layer 2 Network

Figure 7 shows a network configuration where DSLAM is dual homed to pair of redundant PEs by using MC-LAG. Inside the aggregation network redundant-pair of PEs is connecting to VPLS service which provides reliable connection to single or pair of Broadband Service Routers (BSRs).

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 7 **DSLAM Dual-Homing Using MC-LAG**



2.9.3.1 Configuration Guidelines

- MC-LAG peer nodes must be of the same platform type. For example, a 7210 SAS-M can be an MC-LAG peer with another 7210 SAS-M, but cannot be a peer of a 7210 SAS-X.
- MC-LAG is only supported in network mode on 7210 SAS-M, 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-M, then both need to be configured in network mode.
- 7210 SAS-M and 7210 SAS-T access-uplink mode supports active/standby LAG, which allows it to be used as client in an MC-LAG solution.

2.9.4 Configuring Multi-Chassis Redundancy

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

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

```
config>redundancy
```

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

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

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#
```

2.10 G.8032 Protected Ethernet Rings

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

Refer to “G.8032 Ethernet Ring Protection Switching” in the 7210 SAS-M, T, Mxp, Sx, S Services Guide and the 7210 SAS-X, R6, R12 Services Guide.

2.10.1 802.1x Network Access Control

The 7210 SAS supports network access control of client devices (PCs, STBs, etc.) on an Ethernet network using the IEEE. 802.1x standard. 802.1x is known as Extensible Authentication Protocol (EAP) over a LAN network or EAPOL.

2.10.1.1 802.1x 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.

2.10.1.2 802.1x Basics

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

- The supplicant — This is the end-user device that requests access to the network.
- The authenticator — Controls access to the network. Both the supplicant and the authenticator are referred to as Port Authentication Entities (PAEs).
- The authentication server — Performs the actual processing of the user information.

The authentication exchange is carried out between the supplicant and the authentication server, the authenticator acts only as a bridge. The communication between the supplicant and the authenticator is done through the Extended Authentication Protocol (EAP) over LANs (EAPOL). On the back end, the communication between the authenticator and the authentication server is done with the RADIUS protocol. The authenticator is therefore a RADIUS client, and the authentication server a RADIUS server.

Figure 8 shows the 802.1x architecture.

Figure 8 **802.1x Architecture**

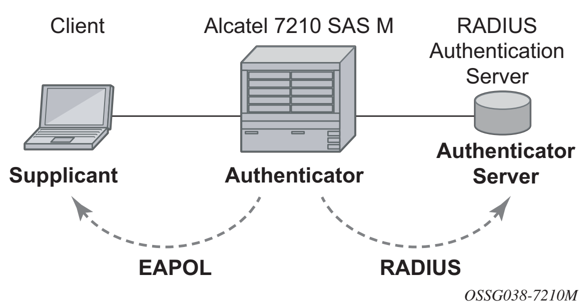
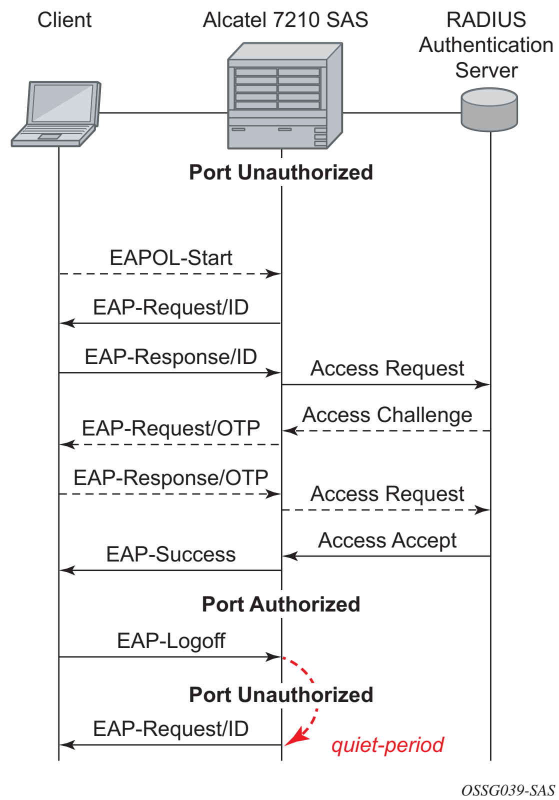


Figure 9 shows the messages involved in the authentication procedure.

Figure 9 **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 doesn't receive the EAP-Request/ID frame during bootup. The client responds on the EAP-Request/ID with a EAP-Response/ID frame, containing its identity (typically username + password).

After receiving the EAP-Response/ID frame, the router will encapsulate the identity information into a RADIUS AccessRequest packet, and send it off to the configured RADIUS server.

The RADIUS server checks the supplied credentials, and if approved will return an Access Accept message to the router. The router notifies the client with an EAP-Success PDU and puts the port in authorized state.

2.10.1.3 802.1x 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:

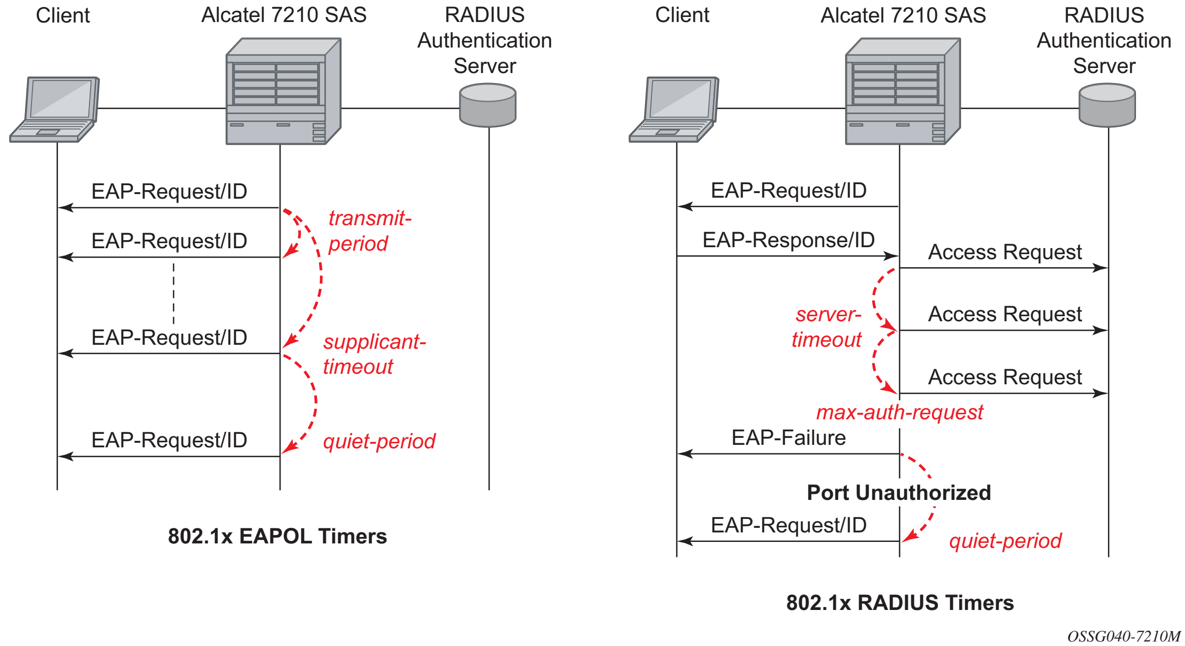
- `transit-period` — Indicates how many seconds the Authenticator will listen for an EAP-Response/ID frame. If the timer expires, a new EAP-Request/ID frame will be sent and the timer restarted. The default value is 60. The range is 1-3600 seconds.
- `supplicant-timeout` — This timer is started at the beginning of a new authentication procedure (transmission of first EAP-Request/ID frame). If the timer expires before an EAP-Response/ID frame is received, the 802.1x authentication session is considered as having failed. The default value is 30. The range is 1 — 300.
- `quiet-period` — Indicates number of seconds between authentication sessions It is started after logoff, after sending an EAP-Failure message or after expiry of the supplicant-timeout timer. The default value is 60. The range is 1 — 3600.

RADIUS timer and scaler:

- `max-auth-req` — Indicates the maximum number of times that the router will send an authentication request to the RADIUS server before the procedure is considered as having failed. The default value is value 2. The range is 1 — 10.
- `server-timeout` — Indicates how many seconds the authenticator will wait for a RADIUS response message. If the timer expires, the access request message is sent again, up to *max-auth-req* times. The default value is 60. The range is 1 — 3600 seconds.

Figure 10 shows sample EAPOL and RADIUS timers on the 7210 SAS.

Figure 10 **802.1x EAPOL Timers (left) and RADIUS Timers (right)**



The router can also be configured to periodically trigger the authentication procedure automatically. This is controlled by the enable re-authentication and reauth-period parameters. Reauth-period indicates the period in seconds (since the last time that the authorization state was confirmed) before a new authentication procedure is started. The range of reauth-period is 1 — 9000 seconds (the default is 3600 seconds, one hour). Note that the port stays in an authorized state during the re-authentication procedure.

2.10.1.4 802.1x Configuration and Limitations

Configuration of 802.1x network access control on the router consists of two parts:

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

801.x authentication:

- Provides access to the port for any device, even if only a single client has been authenticated.

- Can only be used to gain access to a predefined Service Access Point (SAP). It is not possible to dynamically select a service (such as a VPLS service) depending on the 802.1x authentication information.

2.10.1.5 802.1x Tunneling for Epipe Service

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

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

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

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

2.11 802.3ah OAM

802.3ah Clause 57 (EFM OAM) defines the Operations, Administration, and Maintenance (OAM) sub-layer, which provides mechanisms useful for monitoring link operation such as remote fault indication and remote loopback control. In general, OAM provides network operators the ability to monitor the health of the network and quickly determine the location of failing links or fault conditions. EFM OAM described in this clause provides data link layer mechanisms that complement applications that may reside in higher layers.

OAM information is conveyed in slow protocol frames called OAM protocol data units (OAMPDUs). OAMPDUs contain the appropriate control and status information used to monitor, test and troubleshoot OAM-enabled links. OAMPDUs traverse a single link, being passed between peer OAM entities, and as such, are not forwarded by MAC clients (like bridges or switches).

The following EFM OAM functions are supported:

- EFM OAM capability discovery.
- Active and passive modes.

- Remote failure indication — Handling of critical link events (for example, link fault, dying gasp)
- Loopback — A mechanism is provided to support a data link layer frame-level loopback mode. Both remote and local loopback modes are supported.
- Dying Gasp support on 7210 SAS platforms:
  - 7210 SAS-X, 7210 SAS-M, 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE generate EFM OAM dying gasp messages on loss of power. EFM OAM dying gasp messages are generated on either Network ports or Access uplink ports based on the mode in which the device is operating. They are not generated on access ports. These platforms also support generation of SNMP dying gasp messages on power failure and it is mutually exclusive to generation of EFM OAM dying gasp messages. See the 7210 SAS-M, T, X, R6, R12, Mxp, Sx, S System Management Guide for more information about support for SNMP dying gasp.
  - 7210 SAS-R6 and 7210 SAS-R12 devices do not generate SNMP or EFM OAM dying gasp.
  - All 7210 SAS platforms, process the received EFM OAM dying gasp, on a port enabled for EFM and generate a SNMP trap.
- EFM OAMPDU tunneling.
- High resolution timer for EFM OAM in 500ms interval (minimum).

2.11.1 OAM Events

EFM OAM defines a set of events that may impact link operation. The following events are supported:

- Critical link events (defined in 802.3ah clause 57.2.10.1)
  - Link fault: the PHY has determined a fault has occurred in the receive direction of the local DTE.
  - Dying gasp: an unrecoverable local failure condition has occurred.
  - Critical event: an unspecified critical event has occurred.

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

The 7210 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.

2.11.2 Remote Loopback

EFM OAM provides a link-layer frame loopback mode that can be remotely controlled.

To initiate remote loopback, the local EFM OAM client sends a loopback control OAM PDU by enabling the OAM remote-loopback command. After receiving the loopback control OAM PDU, the remote OAM client puts the remote port into local loopback mode.

To exit remote loopback, the local EFM OAM client sends a loopback control OAM PDU by disabling the OAM remote-loopback command. After receiving the loopback control OAM PDU, the remote OAM client puts the port back into normal forwarding mode.

Note that during remote loopback test operation, all frames except EFM OAM PDUs are dropped at the local port for the receive direction, where remote loopback is enabled. If local loopback is enabled, then all frames except EFM OAM PDUs are dropped at the local port for both the receive and transmit directions. This behavior may result in many protocols (such as STP or LAG) resetting their state machines.

2.11.3 802.3ah OAM PDU Tunneling for Epipe Service

The 7210 SAS routers support 802.3ah. Customers who subscribe to Epipe service treat the Epipe as a wire, so they demand the ability to run 802.3ah between their devices which are located at each end of the Epipe.

Note: This feature only applies to port-based Epipe SAPs because 802.3ah runs at port level not VLAN level. Therefore, such ports must be configured as null encapsulated SAPs.

When OAM PDU tunneling is enabled, 802.3ah OAM PDUs received at one end of an Epipe are forwarded through the Epipe. 802.3ah can run between devices that are located at each end of the Epipe. When OAM PDU tunneling is disabled (by default), OAM PDUs are dropped or processed locally according to the **efm-oam** configuration (**shutdown** or **no shutdown**).

Note that by enabling 802.3ah for a specific port and enabling OAM PDU tunneling for the same port are mutually exclusive.

2.11.4 MTU Configuration Guidelines

The 7210 SAS devices provides an option to configure the 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.

2.11.4.1 Default MTU Values

Table 21 describes the default MTU values which 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: Refer to the 7210 SAS release notes for other restrictions with regards to MTU checking and processing on each of the platforms.

2.11.5 Deploying Preprovisioned Components for 7210 SAS-M, 7210 SAS-X, 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE.

Appropriate MDAs are auto-provisioned in 7210 SAS-M, 7210 SAS-X, 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE devices. User is not required to provisions the slots or MDA on these platforms.

2.11.6 Deploying Preprovisioned Components for 7210 SAS-R6 and 7210 SAS-R12

When a line card/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 will not initialize.

When the correct preprovisioned card are installed into the appropriate chassis slot, alarm, status, and performance details will display.

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

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

Note: IMMv1 (imm-sas-r) cannot be installed in the same 7210 SAS-R6 chassis as IMMv2 (imm-sas-r-b) cards or IMM-c (imm-sas-r-c) cards. A mix of IMMv1 and any other type of card is not supported.

On the 7210 SAS-R6, the user is provided with a command to preprovision the chassis to accept either IMMv1 or IMMv2/IMM-c cards. By default, without any configuration, the chassis accepts only IMMv1 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. Refer to the 7210 SAS-M, T, X, R6, R12, Mxp, Sx, S Basic System Configuration Guide for more information about this command.

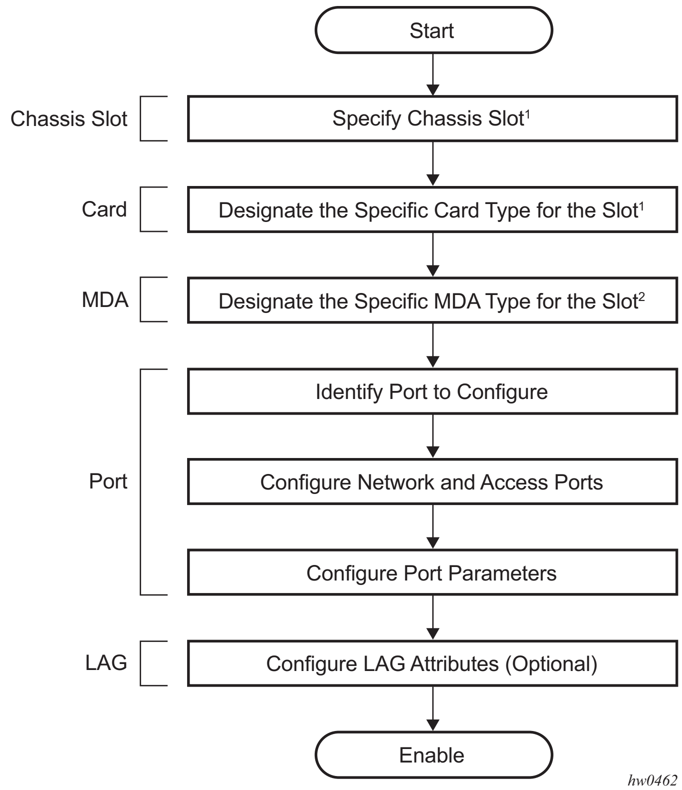
On the 7210 SAS-R12, the user is provided with a command to preprovision the chassis to accept either IMMv2 or IMM-c cards. By default, without any configuration, the chassis accepts IMMv2 cards. Use the **configure**>**system**>**allow-imm-family** command to configure the type of card the chassis can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

The 7210 SAS-R12 does not support IMMv1 (imm-sas-r) cards.

2.12 Configuration Process Overview

Figure 11 shows the process to provision chassis slots (if any), line cards (if any), MDAs (if any), and ports.

Figure 11 **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-M, 7210 SAS-T, 7210 SAS-X, 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 required only if the platform supports use of physical MDAs, such as the 7210 SAS-M. It is not required on platforms that do not support an MDA, such as 7210 SAS-X, 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 a expansion slot and therefore does not support MDAs.

2.13 Configuring Physical Ports with CLI

This section provides information to configure ports.

Topics in this section include:

- Preprovisioning Guidelines
- Basic Configuration
- Common Configuration Tasks
- Service Management Tasks

2.14 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.

2.14.1 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) or those platforms that support expansion slots (7210 SAS-M). On 7210 SAS platforms that do not support any removable cards and/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) or those platforms that support expansion slots (7210 SAS-M). On 7210 SAS platforms that do not support any removable cards and/or MDAs, the MDAs are preprovisioned for all fixed ports.

2.14.2 Preprovisioning a Port

On 7210 SAS chassis-based platforms (7210 SAS-R6 and 7210 SAS-R12) or those that provide an expansion slot (7210 SAS-M), before a port can be configured, the slot must be preprovisioned with an allowed card type and/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, refer to Ethernet Access Port.
  - Configure a network port to participate in the service provider transport or infrastructure network.

    To configure an Ethernet network port, refer to 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.

2.15 Basic Configuration

7210 SAS platforms that do not support any removable cards and/or MDAs (7210 SAS-M (if expansion slot is not used), 7210 SAS-X, 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. If the operators intends to use the expansion slot on the 7210 SAS-M, then they must start with the step in identifying and configuring the MDA slot.

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

2.15.1 Configuring Cards and MDAs

Card configurations include a chassis slot designation.

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#
```

The following is a sample of MDA configuration output for the 7210 SAS-M.

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

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

2.15.2 Configuration Notes for Provisioning of Cards

The following provisioning guidelines and caveats apply.

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

2.15.2.1 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). The IMM version-1 cards (IMMs whose family is displayed as imm-sas-r) and IMM version-2 cards (IMMs whose family is imm-sas-r-b) cannot coexist in a single chassis. The 7210 SAS-R6 chassis can operate with all IMMv1 or all IMMv2 cards. A mix of IMMv1 cards and IMMv2 cards in the same chassis is not allowed. If the user is currently using IMMv1 cards, the user can continue using them without any changes.

From release 7.0R4 by default, the system allows only IMMv1 cards to be provisioned and equipped in the chassis. To use IMMv2 cards, you must provision the chassis using the **config>system>chassis>allow-imm-family** CLI command as shown below. This command lets 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.

CLI Syntax: `config>system>chassis#`
`allow-imm-family` *`imm-family`*

where:

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

- imm-sas-r: use for IMMv1
- imm-sas-r-b: use for IMMv2
- imm-sas-r-c: use for IMM-c

For the list of IMMs supported in a particular release, refer to 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|imm-sas-r-b
*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-10sfp+1xfp            imm-sas-r           Default
imm-sas-10sfp                 imm-sas-r           Default
imm-sas-2xfp                  imm-sas-r           Default
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-10sfp+1xfp            imm-sas-r           Default
imm-sas-10sfp                 imm-sas-r           Default
imm-sas-2xfp                  imm-sas-r           Default
===============================================================================
*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.

2.15.2.2 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. Both the QSFP28 (named imm-sas-c-1qsfp28) and CFP4 (named imm-sas-c-1cfp4) variants are supported, providing the flexibility of using optics based on needs.

The 100GE IMM cards support only network ports, allowing the ports to be used as network uplinks when the 7210 SAS-R6 is deployed as an IP/MPLS router with MPLS LER and LSR functionality.

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. Refer to the scaling guide or contact your Nokia representative for more information.

CLI Syntax: `config>system>chassis#`
`allow-imm-family` *`imm-family`*

where:

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

- imm-sas-r: use for IMMv1
- imm-sas-r-b: use for IMMv2
- imm-sas-r-c: use for IMM-c

The following guidelines and caveats 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.
- Hybrid ports are not supported with IMM-c cards.

2.16 Common Configuration Tasks

The following are basic system tasks that must be performed.

- Configuring Ports

In addition, the following are tasks that are optional:

- Configuring LAG Parameters
- Configuring Access Egress Queue Overrides
- CRC Error Monitoring

2.16.1 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#
```

2.16.1.1 Configuring Ethernet Port Parameters

2.16.1.1.1 Ethernet Network Port

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

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#
```

2.16.1.1.2 Ethernet Access-uplink Port

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

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#
```

2.16.1.1.3 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.

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>
```

2.16.1.1.4 Configuring 802.1x Authentication Port Parameters

The following is a sample 802.1x port configuration output.

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

2.16.1.2 Configuring Channelized Ports

This section is applicable only when using the CES MDA that supports 4 x T1/E1 ports. The CES MDA is available for use only on the 7210 SAS-M platform in network mode (it cannot be used in access-uplink mode). It cannot be used on any other 7210 SAS platform.

When configuring channelized ports, the port ID is specified in different ways depending on the MDA type and level of channelization. Ethernet ports cannot be channelized.

2.16.1.2.1 Configuring a Channelized DS1 Card

The 7210 SAS-M supports a CES MDA that supports 4-port channelized DS-1 cards. The channelization is as follows:

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

To ensure that the MDA is channel-capable, verify the MDA type using the **show mda** *slot-id* command.

In the following example, MDA 2 shows a channelized DS1 MDA.

In the TDM E1 context, configure DS0 channel groups and their parameters. For a DS1 channel group, up to 24 timeslots can be assigned (numbered 1 to 24). For an E1 channel group, up to 31 timeslots can be assigned (numbered 2 to 32). Only CES services (that is, CESoPSN and SAToP) are supported with a CES MDA on the 7210 SAS-M in network mode.

Configuration examples follow:

```
ALA-A>config>port>tdm# e1 1.1
ALA-A>config>port>tdm>e1# channel-group 1
ALA-A>config>port>tdm>e1>channel-group# timeslots 2
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group#
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm>e1# channel-group 2
ALA-A>config>port>tdm>e1>channel-group# timeslots 3
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group# exit
ALA-A>config>port>tdm>e1# channel-group 3
ALA-A>config>port>tdm>e1>channel-group# timeslots 11,12
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group# exit
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm>e1# exit
ALA-A>config>port>tdm# e1 1.2
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm>e1# channel-group 1
ALA-A>config>port>tdm>e1>channel-group# no shutdown
ALA-A>config>port>tdm>e1>channel-group# exit
ALA-A>config>port>tdm>e1# no shutdown
ALA-A>config>port>tdm# info
--------------------------------------------------------------------------------
ALA-A>config>port>tdm#
```

Services can now be applied to the configured channelized ports.

2.16.2 Configuring LAG Parameters

The following guidelines and caveats 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-M, T, Mxp, Sx, S Quality of Service Guide and the 7210 SAS-X, R6, R12 Quality of Service Guide for more information.

The following is a sample 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#
```

2.16.2.1 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.

Step 1. Within the **lag** context, enter the **bfd** context and enable BFD.

Step 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.

Step 3. Configure the local IP address for the BFD sessions.

Step 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 reassociated 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.

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
```

2.16.3 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.

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#
```

2.16.4 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 (multiplier * (10 ^ - (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.

2.17 Service Management Tasks

This section describes the following service management tasks:

- Modifying or Deleting an MDA
- Modifying a Card Type
- Deleting a Card
- Deleting Port Parameters

2.17.1 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.

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

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

2.17.2 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.

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

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

2.17.3 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.

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

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

2.17.4 Deleting Port Parameters

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

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

2.18 Card, MDA, and Port Command Reference

2.18.1 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
- TDM Commands
- LAG Commands
- Multi-chassis Redundancy Commands
- Ethernet Ring Commands
- Show Commands
- Monitor Commands
- Clear Commands
- Debug Commands

2.18.1.1 Configuration Commands

2.18.1.1.1 Hardware Commands

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

2.18.1.1.2 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**

2.18.1.1.3 Port Configuration Commands for PTP Port-based Timestamp

config
- — **port**
- — **no port**
    - — [**no**] **ptp-hw-timestamp**

2.18.1.1.4 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*

2.18.1.1.5 Port Configuration Commands for DWDM Optics

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

2.18.1.1.6 Port Loopback Commands

configure
- **system**
  - **loopback-no-svc-port** {**mirror** | **mac-swap**| **testhead**} *port-id* [**p2mpbud** *p2mpbud-port-id*]
  - **no loopback-no-svc-port**

2.18.1.1.7 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**

2.18.1.1.8 Port Ethernet Commands

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 encap-type**
— **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**
— [**no**] **report-alarm** [**signal-fail**] [**remote**] [**local**]
— **speed** {**10** | **100** | **1000** | **10000**}
— [**no**] **shutdown**

Port Ethernet QoS Commands

config
- — [**no**] **port** {*port-id*}
  - — **ethernet**
    - — **access**
      - — **accounting-policy** *acct-policy-id*
      - — **no accounting-policy**
      - — [**no**] **collect-stats**
      - — **egress**
        - — [**no**] **sap-qos-marking** {**enable** | **disable**}
        - — **scheduler-mode** [**fc-based** | **sap-based**]
        - — **no scheduler-mode**
        - — **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**
        - — **dscp-classification** *policy-id*
        - — **no dscp-classification**
        - — **untagged-fc** *fc*
        - — **no untagged-fc**
      - — **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**

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*

Port Ethernet 802.1x Commands

config
— [**no**] **port** {*port-id*}
— **ethernet**
— **dot1x**
— **max-auth-req** *max-auth-request*
— **port-control** {**auto** | **force-auth** | **force-unauth**}
— **quiet-period** *seconds*
— [**no**] **radius-plcy** *name*
— **re-auth-period** *seconds*
— [**no**] **re-authentication**
— **server-timeout** *seconds*
— no **server-timeout**
— **supplicant-timeout** *seconds*
— no **supplicant-timeout**
— **transmit-period** *seconds*
— no **transmit-period**
— [**no**] **tunneling**

Port Ethernet Down-when-Looped Commands

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

— **retry-timeout** *timer*
— **no retry-timeout**
— [**no**] **shutdown**

Port Ethernet EFM OAM Commands

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

Port Ethernet LLDP Commands

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

Port Ethernet Sync Commands

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

2.18.1.1.9 TDM Commands

Note: TDM commands are only supported on 7210 SAS-M (network operating mode).

config
- — [**no**] **port** {*port-id*}
  - — **tdm**
    - — **buildout** **short**
    - — [**no**] **ds1**
      - — [**no**] **channel-group** *channel-group*
        - — [**no**] **description** *long description-string*
        - — [**no**] **encap-type** {**cem**}
        - — **idle-cycle-flag** {**flags** | **ones**}
        - — **no** **idle-cycle-flag**
        - — **idle-payload-fill** {**all-ones**}
        - — **idle-payload-fill** **pattern** *pattern*
        - — **no** **idle-payload-fill**
        - — **idle-signal-fill** {**all-ones**}
        - — **idle-signal-fill** **pattern** *pattern*
        - — **no** **idle-signal-fill**
        - — [**no**] **mode** {**access**}
        - — [**no**] **shutdown**
        - — **timeslots** *timeslots*
        - — **no** **timeslots**
      - — **clock-source** {**loop-timed** | **node-timed** | **adaptive**}
      - — **framing (DS-1)** {**esf** | **sf** | **ds1-unframed**}
      - — **loopback** {**line** | **internal**| **fdl-ansi** | **fdl-bellcore** | **payload-ansi**}
      - — **no** **loopback**
      - — [**no**] **remote-loop-respond**
      - — [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]
      - — [**no**] **shutdown**
      - — **signal-mode** {**cas**}
    - — [**no**] **e1** [*e1-id*]
      - — [**no**] **channel-group** *channel-group-id*
        - — **description** *long description-string*
        - — **no** **description**
        - — [**no**] **encap-type** {**cem**}
        - — **idle-payload-fill** {**all-ones**}
        - — **idle-payload-fill** **pattern** *pattern*
        - — **no** **idle-payload-fill**
        - — **idle-signal-fill** {**all-ones**}
        - — **idle-signal-fill** **pattern** *pattern*
        - — **no** **idle-signal-fill**
        - — [**no**] **mode** {**access**}
        - — [**no**] **shutdown**
        - — **timeslots** *timeslots*
        - — **no** **timeslots**
      - — **clock-source** {**loop-timed** | **node-timed** | **adaptive**}
      - — **framing (E-1)** {**no-crc-g704** | **g704** | **e1-unframed**}
      - — **loopback** {**line** | **internal**}

— no **loopback**
— [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**]
— [**no**] **shutdown**
— no **signal-mode** {**cas**}
— **lbo** [**0dB** | **-7.5dB** | **-15.0dB** | **-22.5dB**]
— **length** {**133** | **266** | **399** | **533** | **655**}
— **line-impedance** {*Impedance in ohms*}

2.18.1.1.10 LAG Commands

config
— [**no**] **lag** [*lag-id*]
— **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**]
— **max-admin-down-time** **infinite**
— no **max-admin-down-time**
— **max-setup-time** [**up-interval**]
— **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**
— **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**

2.18.1.1.11 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**

2.18.1.1.12 Ethernet Ring Commands

config
- — **eth-ring** *ring-id*
- — **no eth-ring**
  - — [**no**] **ccm-hold-time** {**down** *down-timeout* | **up** *up-timeout*}
  - — [**no**] **compatible-version** *version*
  - — **description** *description-string*
  - — **no description**
  - — [**no**] **guard-time** *time*
  - — [**no**] **revert-time** *time*
  - — [**no**] **rpl-node** {**owner** | **nbr**}
  - — [**no**] **node-id** *mac*
  - — [**no**] **sub-ring** {**virtual-link** | **non-virtual-link**}
    - — [**no**] **interconnect** {**ring-id** *ring-id* | **vpls**}
      - — [**no**] **propagate-topology-change**
  - — [**no**] **path** {**a** | **b**} [{*port-id* | *lag-id*} **raps-tag** *qtag*[.*qtag*]]
    - — **description** *description-string*
    - — [**no**] **rpl-end**
    - — **eth-cfm**
      - — [**no**] **mep** *mep-id* **domain** *md-index* **association** *ma-index*
        - — [**no**] **ccm-enable**
        - — [**no**] **ccm-ltm-priority** *priority*
        - — [**no**] **control-mep**
        - — [**no**] **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**

2.18.1.2 Show Commands

show
- — **chassis** [**environment**] [**power-supply**]
- — **card** [*slot-number*] [**detail**]
- — **card state**
- — [*slot-number*] **active-resource-profile**
- — **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** [**A1**] [**detail**] [**statistics**] [**description**]
— **port** *port-id* **acr** [**detail**]
— **port** *port-id* **ptp-hw-timestamp**
— **lldp** [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**]
— **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**

2.18.1.3 Monitor Commands

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

2.18.1.4 Clear Commands

clear
— **lag** *lag-id* **statistics**
— **mda** *mda-id* [**statistics**]
— **port** *port-id* **statistics**

2.18.1.5 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**]

2.18.2 Command Descriptions

2.18.2.1 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
- TDM Commands (Applicable to 7210 SAS-M when using the CES MDA)
- LAG Commands
- Ethernet Ring Commands
- Ethernet Tunnel Commands
- Multi-Chassis Redundancy Commands
- MC Endpoint Commands
- MC LAG Commands

2.18.2.1.1 Generic Commands

description

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

Context config>port
config>lag
config>port>tdm>e1>channel-group
config>port>tdm>ds1>channel-group

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

Description

Note: The **config**>**port**>**tdm**>**e1**>**channel-group** and **config**>**port**>**tdm**>**ds1**>**channel-group** contexts are only supported on 7210 SAS-M (network operating mode).

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

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

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

shutdown

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

Context config>card
config>card>mda
config>port
config>port>ethernet
config>lag
config>port>ethernet>efm-oam
config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group
config>port>ethernet>ssm

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

Description

Note: The **config**>**port**>**tdm**>**e1**>**channel-group** and **config**>**port**>**tdm**>**ds1**>**channel-group** contexts are only supported on 7210 SAS-M (network operating mode).

This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics.

The operational state of the entity is disabled as well as the operational state of any entities contained within.

The **no** form of this command administratively enables an entity.

card — The default state for a card is **no shutdown**.

mda — The default state for a mda is **no shutdown**.

lag — The default state for a Link Aggregation Group (LAG) is **shutdown**.

port — The default state for a port is **shutdown**.

2.18.2.1.2 Card Commands

card

Syntax **card** *slot-number*

Context config

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

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

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

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

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

card-type

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

Context config>card

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

Description This mandatory 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-X, 7210 SAS-M, 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* — The type of card to be configured and installed in that slot.

Values
7210 SAS-M, 7210 SAS-Mxp, and 7210 SAS-Sx/S 1/10GE (standalone) — iom-sas

7210 SAS-R6 — imm-sas-10sfp+1xfp, imm-sas-10sfp, imm-sas-2xfp , imm-sas-b-4sfp+, imm-sas-b-2sfp+, imm-sas-b-10sfp-1sfp+, imm-sas-b-11csfp, imm-sas-b-16tx, imm-sas-c-1cfp4, imm-sas-c-1qsfp28

7210 SAS-R12 — imm-sas-b-4sfp+, imm-sas-b-4xfp, imm-sas-b-2sfp+, imm-sas-b-10sfp-1sfp+, imm-sas-b-11csfp, imm-sas-b-16tx, imm-sas-c-1cfp4, imm-sas-c-1qsfp28

7210 SAS-Sx 1/10GE (standalone-vc) — 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

sys-res-profile

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

Context config>card

Description **Platforms Supported:** 7210 SAS-R6, 7210 SAS-12, and 7210 SAS-Sx/S 1/10GE (standalone-VC)

This command provides the context to attach 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, refer to the 7210 SAS-M, T, X, R6, R12, Mxp, Sx, S Basic System Configuration Guide.

Default By default, the 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

2.18.2.1.3 MDA Commands

mda

Syntax **mda** *mda-slot*
no mda *mda-slot*

Context config>card

Supported 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 access to a card MDA CLI context to configure MDAs.

Note: The **mda** command is only required to be configured on 7210 SAS-M when using the T1/E1 CES MDA or 2x10GE MDA. All other 7210 SAS platforms auto-provision MDAs and do not require this command to be configured.

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

Cards inserted in expansion slots are numbered 2.

Values 1, 2

mda-type

Syntax **mda-type** *mda-type*
no mda-type

Context config>card>mda

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

Description This command provisions a specific MDA type to the device configuration for the slot. The MDA can be preprovisioned but an MDA must be provisioned before ports can be configured. Ports can be configured once the MDA is 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.

All 7210 SAS-M platform variants supports an expansion slot which can accept supported MDA types. The MDA in the expansion slot is addressed as mda 2. Users must use this command to configure the MDA slot appropriately based on the supported MDA cards they plan to use. To modify an MDA slot, shut down all port associations. An alarm is raised if partial or complete MDA failure is detected. The alarm is cleared when the error condition ceases.

Note:

- 7210 SAS-X does not support expansion slots and therefore does not support use of the **mda-type** command.
- The **mda-type** command is only required to be configured on 7210 SAS-M when using the T1/E1 CES MDA or 2x10GE MDA. All other 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. The MDA must be administratively shut down before it can be deleted from the configuration.

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

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

Values 7210 SAS-M — m2-xfp |m4-ds1-ces (The logical MDA with fixed ports is auto-provisioned)

7210 SAS-X, 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

Description **Platforms Supported:** 7210 SAS-M, 7210 SAS-T, 7210 SAS-X, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE, 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

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.

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

Default no sync-e

2.18.2.1.4 Interface QoS Commands

access

Syntax **access**

Context config>port

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

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

network

Syntax **network**

Context config>port

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

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

uplink

Syntax **uplink**

Context config>port>access

Description **Platforms Supported:** 7210 SAS-M and 7210 SAS-T

This command enables the context to configure access pool parameters.

egress

Syntax **egress**

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

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

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

ingress

Syntax **ingress**

Context config>port>ethernet>access

Description **Platforms Supported:** 7210 SAS-Mxp, 77210 SAS-R6, and 7210 SAS-R12.

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

Description **Platforms Supported:** 7210 SAS-M, 7210 SAS-T, 7210 SAS-X, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

This command enables the context to configure the slope policy for the queues associated with this port.

slope-policy

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

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

Description **Platforms Supported:** 7210 SAS-M, 7210 SAS-T, 7210 SAS-X, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

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.

qos

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

Context config>port>ethernet>access>egress

Supported 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-M and 7210 SAS-T in access uplink mode, this policy is used to enable port-based marking and configuring port-based queue parameters. For more information, see QoS User Guide.

On 7210 SAS-M and 7210 SAS-T in network mode, this policy is used to enable port-based marking and configuring port-based queue parameters. For more information, see QoS User Guide.

On 7210 SAS-X this policy is used to enable port-based marking and configure values to use marking. For more information, see QoS User Guide.

On 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, when SAP based egress queuing is configured, this policy is to used configure only marking values for packets sent out of access ports. For more information, see QoS User 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 QoS User 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 QoS User Guide.

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

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

Values 1 to 65535

qos

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

Context config>port>ethernet>access>uplink

Supported Platforms Only supported on7210 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-M and 7210 SAS-T in access uplink mode, this policy is used to enable marking on egress and classification and metering/policing on port ingress. Refer to the QoS guide for more details.

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

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

Values 1 to 65535

qos

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

Context config>port>ethernet>network

Supported 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables th context to override 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 the 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** — Defines 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 — Defines 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to override 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 due to 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.

When **no percent-rate** is defined within an egress **queue-override** command, the queue reverts to the defined PIR and CIR within the access egress QoS policy associated with the queue.

Default no percent-rate

Parameters *cir-percent* — 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-percent — 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to override 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 the command associates the queue management policy for this queue as defined in the access egress QoS policy.

Default no queue-mgmt

Parameters *name* — 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to override 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 the command associates the **queue-mode** for this queue as defined in access egress QoS policy.

Default no queue-mode

Parameters *queue-mode* — The queue mode.

Values **strict** or **weighted**

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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to override 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 **queue-override** parameter and applies the **rate** or **percent-rate** as specified for the queue in access egress QoS policy.

Default no rate

Parameters *cir-rate* — 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 100000000, max

Default 0

pir-rate — Defines 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 100000000, 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

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

This command enables the context to override 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 the 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

dscp-classification

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

Context config>port>ethernet>access>ingress

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

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* value.

Values 1 to 65535

untagged-fc

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

Context config>port>ethernet>access>ingress

Description **Platform Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12

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 the command reverts the assigned FC to the default value (be).

Default be

Parameters *fc* — Specifies the *fc* value.

Values be, l2, af, l1, h2, ef, h1, nc

Default be

sap-qos-marking

Syntax **sap-qos-marking** {**enable** | **disable**}
no sap-qos-marking

Context config>port>ethernet>access>egress

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

This command enables the context to enable and disable port based egress marking for all the SAPs configured on an access port and hybrid port.

For SAPs configured on access ports and hybrid ports and associated with an Layer 2 VPN service (example, VPLS, Epipe or PBB I-VPLS or PBB Epipe) user has an option to enable either per SAP marking or per port marking. For SAPs configured on access ports and hybrid ports, associated with an Layer 3 VPRN service only port based marking is available for use. For PBB B-SAPs configured in B-VPLS service only port based marking is available for use.

When enabled on access ports, the system uses the values defined in the remark policy attached to the access port (remark policy is defined in the access-egress policy and associated with a port using the command **config>port>ethernet>access>egress>qos** *policy-id*.

When enabled on hybrid ports, the system uses the values defined in the remark policy attached to the hybrid port (remark policy is defined in the network qos policy of type 'port' and associated with the hybrid port using the command **config>port>ethernet>network>egress>qos** *policy-id*).

User can enable only dot1p marking, by attaching a remark policy of remark-type 'dot1p' or 'dot1p-lsp-exp-shared'. Similarly only DSCP marking can be used, by use of remark policy of remark-type 'dscp'. If a remark policy of remark-type 'dot1p-dscp' is in use both Dot1p and DSCP values will be marked.

Table 22 and Table 23 list the marking behavior by enabling this command and disabling the command.

Table 22 **Default Values for sap-qos-marking in Access and Hybrid Port Modes**

Mode	Default values
Access Mode	sap-qos-marking is enabled
Hybrid Mode	sap-qos-marking is disabled
Network Mode	CLI not available for use

Table 23 **sap-qos-marking Default Value When Port Mode is Changed**

Initial port	New port mode	New value of sap-qos-marking
Access	Network	No effect on CLI and therefore the command is disabled.
	Hybrid	Sap-qos-marking is disabled
Network	Access	No change
	Hybrid	Sap-qos-marking is disabled
Hybrid	Network	No effect on CLI and therefore the command is disabled.
	Access	Sap-qos-marking is enabled

The behavior on access ports are as follows:

- If sap-qos-marking is enabled, the FC to dot1p marking configured in the SAP egress policy is used for remarking traffic sent out of SAPs associated with Layer 2 services. Traffic sent out of SAPs associated with Layer 3 services and B-SAPs configured in PBB B-VPLS service is not marked.
- If sap-qos-marking is disabled, the access-egress policy is used for remarking for all the traffic sent out of the access port. It includes all SAPs configured on the access ports and associated with Layer 2 VPN services, Layer 3 services, and PBB B-SAPS. Port-based marking must be enabled to ensure packets are marked. The user has an option to use dot1p, DSCP, or dot1p + DSCP values for marking. For more information, see the 7210 SAS-X, R6, R12 Quality of Service Guide.

Note: Packets belonging to SAPs configured in a Layer 2 service will also have their DSCP values marked when remarking is enabled on a port and DSCP marking values are configured. Therefore, Nokia recommends to use only dot1p marking, when SAPs belonging to both Layer 3 VPN service and Layer 2 VPN service are configured on the port.

Parameters **enable** — Enables port based marking for all SAPs on an access port and hybrid port.

disable — Disables port based marking for all SAPs on an access port and hybrid port.

scheduler-mode

Syntax **scheduler-mode** <*fc-based* | *sap-based* >
no scheduler-mode

Context config>port>ethernet>access>egress

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

This command specifies the mode of the access egress port scheduler. It operates in the following two modes:

- fc-based
- sap-based

In the fc-based mode, the priority of all egress queues across all SAPs are considered to determine the next queue to be scheduled.

In the sap-based mode, the scheduler uses round-robin scheduling mechanism to schedule each of the SAPs configured on a port. The scheduler considers the priority of all the egress queues in a SAP to determine the next queue to be scheduled.

To use the SAP egress **aggregate-rate-limit** command the port scheduler mode must be set to 'sap-based' using this command. For more information about the **aggregate-rate-limit** command, see 7210 SAS-X, R6, R12 Services Guide.

Default fc-based

2.18.2.1.5 General Port Commands

port

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

Context config

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

Description This command enables the context to configure ports. Before a port can be configured, the chassis slot must be provisioned with a valid card type and the MDA parameter must be provisioned with a valid MDA type. (See **card** and **mda** commands.)

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

dwdm

Syntax **dwdm**

Context config>port

Supported 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

Supported 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

Supported 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.

On 7210 SAS-X, the behavior remains the same, when ingress policing is used, but it is different when ingress queuing is used. When SAP ingress queuing is used, the profile assigned to the packet by user configuration cannot be reassigned by the ingress meters/policers or by ingress queue rate shapers. Therefore, user assigned profile is the final profile assigned to the packet.

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. On 7210 SAS-X, the behavior remains the same, when ingress policing is used, but it is different when ingress queuing is used. When SAP ingress queuing is used, the ingress profile is used to determine the WRED slope to use at ingress (access SAPs), in addition to egress (access SAPs and network/hybrid port).

For more information, see the 7210 SAS-X, R6, R12 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

Description **Platforms Supported:** 7210 SAS-M, 7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

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

Supported 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-M and 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 encap-type can be configured to either null or dot1q.

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

Default network

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

access — Configures the Ethernet port for transport network use.

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

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

monitor-oper-group

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

Context config>port>ethernet

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

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

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

Default no monitor-oper-group

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

mac

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

Context config>port>ethernet
config>lag

Supported 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 returns the MAC address to the default value.

Default A default MAC address is assigned by the system from the chassis MAC address pool.

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

mtu

Syntax **mtu** *mtu-bytes*
no mtu

Context config>port>ethernet

Supported 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 restores the default values.

Default The default MTU value depends on the (sub-)port type, mode and encapsulation and are listed in the following table:

Table 24 **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** {**l2-switch** | **l3-fwd**}
no multicast-egress

Context config>port>ethernet

Supported Platforms Supported on all 7210 SAS platforms as described in this document; not supported on 7210 SAS-X.

Description This command provides an option to configure 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 **l3-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 **l2-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 l3-fwd

Parameters **l2-switch** — Enables IGMP snooping on the port (egress) with Layer 2 multicast lookup.

l3-fwd — Enables IP multicast (Layer 3) lookups on the port (egress).

multicast-ingress

Syntax **multicast-ingress** {**l2-mc** | **ip-mc**}
no multicast-ingress

Context config>port>ethernet

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

Description This command enables the context to turn on either IP multicast or IGMP snooping on a port. The **l2-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** — Enables IGMP snooping on the port (ingress) with Layer 2 multicast lookup.

ip-mc — Enables IP multicast (Layer-3) lookups on the port (ingress).

ptp-hw-timestamp

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

Context config>port

Description **Platforms Supported:** 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx 1/10GE, and 7210 SAS-Sx 10/100GE

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

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

Default ptp-hw-timestamp

2.18.2.1.6 Port Loopback Commands

loopback-no-svc-port

Syntax [**no**] **loopback-no-svc-port** {*mirror* **|** *mac-swap* **|** *testhead*} *port-id* [**p2mpbud** *p2mpbud-port-id*]

Context config>system

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

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

The user cannot share a single port between both these tools/applications, if they intend to use the tools simultaneously. The system displays an error if the user tries to configure the same port for use with multiple OAM tools OR if the user tries to use the tool without first configuring the port resources to be used by the tool.

The user will have to execute the command multiple times, once for each OAM tool with a different port ID, if they intend to use these tools simultaneously. Example: user can dedicate two ports for use, by executing the command loopback-no-svc-port mirror 1/1/1 for use with mirroring, followed by execution of the command loopback-no-svc-port mac-swap 1/1/2 again, for mac-swap OAM tool.

Alternatively, the user can dedicate two ports for use, by executing the command loopback-no-svc-port testhead 1/1/1 for use with testhead, followed by execution of the command loopback-no-svc-port mac-swap 1/1/2 again, for mac-swap OAM tool. For more information, see the platform specific note at the end of this CLI description.

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

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

Note:

- On 7210 SAS-X this command must be used to dedicate as many front-panel ports as necessary, if they intend to use all the OAM tools simultaneously. A maximum of up to 3 front-panel ports is needed when all the OAM tools are used simultaneously. There are no internal virtual port resources available for use.
- On 7210 SAS-M 24F 2XFP(ETR and non-ETR variants), user can use one of the ports configured under the BOF parameter no-service-ports, for use with either mac-swap or mirroring or testhead OAM tool. If user intends to use the OAM tools simultaneously, then additional front-panel ports need to be configured for use with one of the tools.
- On 7210 SAS-M 24F, user can use the internal port 1/1/25 for use with either mac-swap or mirroring OAM tool. If user intends to use the OAM tools simultaneously, then additional front-panel ports need to be configured for use with one of the tools.
- On 7210 SAS-T, user can use the 2 available internal ports (that is, port 1/1/27 and 1/1/28) for use with either mac-swap or mirroring or testhead OAM tool. If user intends to use all the OAM tools simultaneously, then additional front-panel ports need to be configured for use with one of the tools.
- On 7210 SAS-R6 and 7210 SAS-R12, user has a fixed number of internal ports for use with OAM tools (such as testhead OAM tool, mac-swap OAM tool and Dot1q/remote mirroring OAM tool) that need the resources of loopback port. See below to know the number of internal virtual port resources that are available on different flavors of IMMs. It can also be obtained using the command show system internal-loopback-ports detail. User might need to configure resources of a front-panel port for use with OAM tools that needs the loopback port resources, if all the internal port resources are used up. That is, if user intends to use all the OAM tools simultaneously, then additional front-panel ports need to be configured for use with some of the OAM tools. The port configured for use by one OAM tool cannot be shared with other OAM tools. That is, each OAM tool requires dedicated resources for its use.

  When configuring internal port resources or front-panel port resources for testhead OAM tool and mac-swap OAM tool, the port needs to be on the same IMM as the test SAP. It cannot be on a different IMM.
- On 7210 SAS-Mxp, user can use the one available internal port (that is, port 1/1/29) for use with either mac-swap or mirroring or testhead OAM tool. If user intends to use all the OAM tools simultaneously, then additional front-panel ports need to be configured for use with one of the tools.
- The **p2mpbud** *p2mpbud-port-id* parameter is only supported on the 7210 SAS-R6 and 7210 SAS-R12. It allows the user to reserve a loopback for use with the NG-MVPN P2MP LSP feature.

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

mac-swap — Specifies the port specified by the port-id is dedicated for use by the port loopback with mac-swap application/OAM tool.

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

testhead — Specifies the port specified by the port-id dedicated for use by the Testhead application or the OAM tool.

p2mpbud-port-id — Applicable only to 7210 SAS-R6 and 7210 SAS-R12 devices. Specifies the loopback to use for P2MP LSP used with NG-MVPN feature.

2.18.2.1.7 Ethernet Port Commands

ethernet

Syntax **ethernet**

Context config>port

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

Description This command enables the context to configure Ethernet port attributes.

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

mode

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

Context config>port>ethernet
config>port>tdm>ds1>channel-group (7210 SAS-M only)
config>port>tdm>e1>channel-group (7210 SAS-M only)

Supported 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. It also configures a TDM channel or SONET/SDH path (sub-port) for access or network mode operation.

An access port or channel is used for customer facing traffic on which services are configured. A Service Access Point (SAP) can only be configured on an access port or channel. When a port is configured for access mode, the appropriate encap-type must be specified to distinguish the services on the port or SONET path. Once an Ethernet port, a TDM channel or a SONET path has been configured for access mode, multiple services can be configured on the Ethernet port, a TDM channel or SONET path. Note that ATM, frame relay, and cHDLC port parameters can only be configured in the access mode.

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

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

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

Note: For tdm>ds1 and tdm>e1 only access mode is supported. Network and hybrid is not supported.

Default network

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

network — Configures the Ethernet port for transport network use.

hybrid — Configures the Ethernet port for hybrid use.

access

Syntax **access**

Context config>port>ethernet

Supported 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

Supported 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

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

If the **autonegotiate limited** keyword option is specified the port will autonegotiate but will only advertise a specific speed and duplex. The speed and duplex advertised are the **speed** and **duplex** settings configured for the port. One use for limited mode is for multispeed gigabit ports to force gigabit operation while keeping autonegotiation enabled for compliance with IEEE 801.3.

7210 SAS requires that autonegotiation be disabled or limited for ports in a Link Aggregation Group to guarantee a specific port speed.

The **no** form of this command disables autonegotiation on this port.

Default autonegotiate

Parameters **limited** — The Ethernet interface will automatically negotiate link parameters with the far end, but will only advertise the speed and duplex mode specified by the Ethernet speed and duplex commands.

connection-type

Syntax **connection-type**

Context config>port>ethernet

Description Platforms Supported: 7210 SAS-Mxp and 7210 SAS-Sx 1/10GE (fiber variants only)

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

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

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

Default sfp

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

Values sfp, copper, auto

crc-monitor

Syntax **crc-monitor**

Context config>port>ethernet

Supported 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

Supported 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. If the multiplier keyword is omitted or **no sd-threshold** is specified, the multiplier will return to the default value of 1.

Default no sd-threshold

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

Values 1 to 9

multiplier — Represents 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

Supported 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. If the multiplier keyword is omitted or no sf-threshold is specified the multiplier will return to the default value of 1.

Default no sf-threshold

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

Values 1 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

Supported 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 seconds

Parameters *seconds* — 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

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

Context config>port>ethernet

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

Note:

- This command does not change the etype used to match the inner tag for a QinQ SAP. The 7210 SAS devices always uses 0x8100 for matching the inner tag etype. That is, if this command is configured on a port configured for QinQ encapsulation, then it is ignored and 0x8100 is used always.
- This command 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.

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

Values <0x0600..0xffff> — 1536 to 65535 (decimal or hex)

Default 0x8100

duplex

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

Context config>port>ethernet

Supported 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

Supported 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

Supported 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

Supported 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

Supported 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

Supported 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 the 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

Supported 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 returns the value to the default.

Note: The **max-burst** 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** without configuring **egress-rate**. The value should be between 32 and 16384, or default. For more information, see the 7210 SAS-X, R6, R12 Quality of Service Guide.

Default no egress-rate

Parameters *sub-rate* — The egress rate in kilobits per second (kbps).

Values 1 to 10000000

max-burst *size-in-kbits* — 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

Description **Platforms Supported:** 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12.

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

Supported 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 restores the default.

Default null

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

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

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

hold-time

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

Context config>port>ethernet

Supported 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-time up* — 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* — 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

Supported 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 the command disables LACP packet tunneling for the Ethernet port.

Default no lacp-tunnel

poe

Syntax **poe** [**plus**]
no poe

Context config>port>ethernet

Description **Platforms Supported:** 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)

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

Using plus parameter, enabled 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. Once 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 the 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 **no oper-group**
oper-group *name*

Context config>port>ethernet
config>lag

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

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

The **no** form of the command removes the association.

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

qinq-etype

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

Context config>port>ethernet

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

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

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

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

report-alarm

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

Context config>port>ethernet

Supported 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 7210 SAS-M, 7210 SAS-X, 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), 7210 SAS-R6, and 7210 SAS-R12.

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

remote — Reports remote faults.

local — Reports local faults.

port-clock

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

Context config>port>ethernet

Description **Platforms supported:** 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)

This command enables the context to force 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 ink 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 the command allows the node to automatically determine the master or slave status for the copper port based on the nodes capabilities exchanged during auto-negotiation. 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 — Ensures that the local node is the synchronous Ethernet master. A synchronous Ethernet master port distributes the system timing over the copper port to the remote peer node.

slave — Ensures 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

Supported 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

Supported 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 context to configure 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, user might need to assign the resources of a front-panel port if the internal virtual port resources are not available.

Note:

- On 7210 SAS-M 24F 2XFP, user can configure the second port specified in the no-service-ports configured in the BOF parameter as the assigned port in the command configure> system> loopback-no-svc-port.
- 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 due to timeout and so on.When port loopback feature is to be used for multicast traffic with IGMP snooping enabled in the service, the corresponding data path has to be statically created using static IGMP groups.
- For loop back to be functional, the following are not required:
  – SFP or XFPs need not be inserted into the device.
  – Ethernet cables need not be plugged in for copper ports.
- When the loop back command is enabled, ensure that Ethernet parameters such as, speed, duplex, auto-negotiation and so on are not modified.

For port loopback with mac-swap:

- This command is available for testing VLL services and VPLS services only.
- When enabled, the command affects all services provisioned on the port.
- Before enabling this command, turn off all layer 2 and IP control protocols (such as LACP, EFM, 802.1x and so on) on the device and its peer to prevent errors such as protocol flaps due to timeout and so on.When port loopback feature is to be used for multicast traffic with IGMP snooping enabled in the service, the corresponding data path has to be statically created using static IGMP groups.
- When port loopback with mac-swap enabled, for unicast and unknown-unicast packets, if the packet matches the configured source and destination MAC address it will be swapped and looped back in the service. For broadcast and multicast packets, if the packet matches the configured source MAC address, its source MAC address will be used as the destination MAC address and the system MAC address will be the source MAC address. The packet is looped back in the service as a unicast packet. All other packets sent to the loopback port will be dropped. Since forwarding of these packets after loopback can potentially cause network wide problems.
- For loop back to be functional, the following are not required:
  - SFP or XFPs need not be inserted into the device.
  - Ethernet cables need not be plugged in for copper ports.
- When the loop back is enabled, ensure that Ethernet parameters such as, speed, duplex, auto-negotiation and so on are not modified.
- When the loopback is enabled, ensure that service parameter and attributes such as ingress qos policy, accounting records, ingress/egress ACLs, and so on are not modified.
  - With port loopback in use, the SAP ingress ACLs with IP-criteria is not recommended for use, since only MAC addresses are swapped.

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

- Configure the service and SAP on which loopback is to be enabled.
- Configure the assigned loopback port to be used.
- Send 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, since the recommended procedure for enabling port loopback is to shutdown the port –> enable loopback and then execute no shutdown the port.
- Enable port loopback and specify the service, SAP, and the source MAC address (SA) and the destination MAC address (DA). All packets with source Mac matching SA are the only ones processed in the context of the SAP on ingress after the loopback. Any other traffic, is dropped on ingress, to avoid issues due to mac movement and flooding issues in other services/SAPs, since the whole port is in loopback.
- When the port is in loopback, software disable learning and aging on the specified SAP. Once the loopback configuration is removed for the port, then the software enables learning and aging for specified SAP. 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 the command disables physical layer loopback on the Ethernet port.

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

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

1. Disable the port, execute the command config>port> shutdown.
2. Enable loop back, execute the command config >port>ethernet> loopback internal
3. Enable the port, execute the command config>port> no shutdown.
4. Perform the required tests.
5. Disable the port, execute the command config>port> shutdown.
6. Disable loop back, execute the command config >port>ethernet> no loopback internal
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 <service-id>** — The unique service identification number or string identifying the service in the service domain. This ID must be unique to this service and may not be used for any other service of any type. The service-id must be the same number used for every on which this service is defined.

Values service-id 1 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..1000]
qtag1	- [0..4094]
qtag2	- [*|1..4094]

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

Values SA6-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 DA6-byte unicast mac-address (xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx).

ssm

Syntax **ssm**

Context config>port>ethernet

Supported 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

Supported 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. It is not configurable on TDM ports. For the code-type, SDH refers to ITU-T G.781 Option-1,while SONET refers to G.781 Option 2 (equivalent to Telcordia GR-253-CORE).

Default sdh

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

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

tx-dus

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

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

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

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

Default no tx-dus

2.18.2.1.8 802.1x Port Commands

tunneling

Syntax [*no*] *tunneling*

Context config>port>ethernet>dot1x

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

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

Default no tunneling

max-auth-req

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

Context config>port>ethernet>dot1x

Supported 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* attempts, the 802.1x authentication procedure is considered to have failed.

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

Default 2

Parameters *max-auth-request* — The maximum number of RADIUS retries.

Values 1 to 10

port-control

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

Context config>port>ethernet>dot1x

Supported 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 returns the value to the default.

Default force-auth

Parameters **force-auth** — Disables 802.1x authentication and causes the port to transition to the authorized state without requiring any authentication exchange. The port transmits and receives normal traffic without requiring 802.1x-based host authentication.

force-unauth — Causes the port to remain in the unauthorized state, ignoring all attempts by the hosts to authenticate. The switch cannot provide authentication services to the host through the interface.

auto — Enables 802.1x authentication. The port starts in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. Both the 7210 SAS and the host can initiate an authentication procedure. The port will remain in 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

Supported 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 returns 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

Supported 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 to a port. If the RADIUS policy-id does not exist, an error is returned. Only one 802.1x RADIUS policy can be associated with a port at a time.

The **no** form of this command removes the RADIUS policy association.

Default no radius-plcy

Parameters *name* — Specifies an existing 802.1x RADIUS policy name.

re-auth-period

Syntax **re-auth-period** *seconds*
no re-auth-period

Context config>port>ethernet>dot1x

Supported 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 returns the value to the default.

Default 3600

Parameters *seconds* — The re-authentication delay period in seconds.

Values 1 to 9000

re-authentication

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

Context config>port>ethernet>dot1x

Supported 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 the command returns the value to the default.

Default re-authentication

server-timeout

Syntax **server-timeout** *seconds*
no server-timeout

Context config>port>ethernet>dot1x

Supported 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 responds to its access request message. When this timer expires, the 7210 SAS will re-send the access request message, up to the specified number times.

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

Default 30

Parameters *seconds* — The server timeout period in seconds.

Values 1 to 300

supplicant-timeout

Syntax **supplicant-timeout** *seconds*
no supplicant-timeout

Context config>port>ethernet>dot1x

Supported 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 returns the value to the default.

Default 30

Parameters *seconds* — The server timeout period in seconds.

Values 1 to 300

transmit-period

Syntax **transmit-period** *seconds*
no transmit-period

Context config>port>ethernet>dot1x

Supported 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 returns the value to the default.

Default 30

Parameters *seconds* — The server transmit period in seconds.

Values 1 to 3600

down-when-looped

Syntax **down-when-looped**

Context config>port>ethernet

Supported 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.

dot1x

Syntax **dot1x**

Context config>port>ethernet

Supported 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 context to 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.

keep-alive

Syntax **keep-alive** *timer*
no keep-alive

Context config>port>ethernet>dwl

Supported 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

Supported 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 re-enabling port after loop detection.

Default no retry-timeout

Parameters *timer* — Specifies the minimum wait time before re-enabling port after loop detection.

Values 0, 10 to 160

2.18.2.1.9 LLDP Ethernet Port Commands

lldp

Syntax **lldp**

Context config>port>ethernet

Supported 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 context to configure Link Layer Discovery Protocol (LLDP) parameters on the specified port.

tunnel-nearest-bridge-dest-mac

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

Context config>port>ethernet>lldp

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

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 25 **LLDP Behavior**

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

Table 25 **LLDP Behavior (Continued)**

Nearest-bridge mac Admin Status	**Tunneling Enabled**	**Tunneling Disabled**
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 the command disable LLDP tunneling for frames using nearest-bridge destination MAC address.

Default no tunnel-nearest-bridge-dest-mac

dest-mac

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

Context config>port>ethernet>lldp

Supported 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

Supported 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.

notification

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

Context config>port>ethernet>lldp>dstmac

Supported 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 the 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>dstmac

Supported 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 releases of SAM require the PortID value require the default if-Alias to correctly build the Layer Two topology map using LLDP. Selecting a different option will impact SAM ability to build those Layer Two topologies.

Default portid-subtype tx-local

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

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

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

tx-mgmt-address

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

Context config>port>ethernet>lldp>dstmac

Supported 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, the system IPv6 address or both. Note the system address will only be sent once. When both options are configured both system addresses are sent. The system address must be configured for the specific version of the protocol to sent the management address.

Default no tx-mgmt-address

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

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

Supported 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 the command resets the value to the default.

no tx-tlvs

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

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

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

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

2.18.2.1.10 Port Commands

network

Syntax **network**

Context config>port>ethernet

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

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

uplink

Syntax **uplink**

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

Supported 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 context to 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

Supported 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 to an interface. If the accounting *policy-id* does not exist, an error is returned.

Accounting policies associated with service billing can only be applied to SAPs. Accounting policies associated with network ports can only be associated with interfaces. Only one accounting policy can be associated with an interface at a time.

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

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

Values 1 to 99

collect-stats

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

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

Supported 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.

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

Default no collect-stats

queue-policy

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

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

Supported 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.

2.18.2.1.11 TDM Commands (Applicable to 7210 SAS-M when using the CES MDA)

tdm

Syntax **tdm**

Context config>port

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

This command enables the context to configure DS-1/E-1 parameters for a port on a CES MDA.

TDM is a mechanism to divide the bandwidth of a stream into separate channels or time slots by assigning each stream a different time slot in a set. TDM repeatedly transmits a fixed sequence of time slots over a single transmission channel. Each individual data stream is reassembled at the receiving end based on the timing.

ds1

Syntax [**no**] **ds1**

Context config>port>tdm

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

This command enables the context to configure digital signal level 1 (DS-1) frame parameters on a T1/E1 CES MDA.

T-1 transmits DS-1-formatted data at 1.544 Mbps through the network. If channel has been configured for DS1 on a T1/E1 CES MDA, all ports on that card can be configured for DS1. A combination of DS1 and E1 channels cannot exist on the same card.

The **no** form of this command disables DS-1 capabilities.

Parameters *ds1-id* — Identifies the DS-1 channel being created.

Values DS1: 1 to 28

e1

Syntax **e1**

Context config>port>tdm

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

This command enables the context to configure E1 parameters on a T1/E1 CES MDA. E1 is a basic time division multiplexing scheme used to carry digital circuits. It is also a standard WAN digital communication format designed to operate over copper facilities at a rate of 2.048 Mbps.

If the channel has been configured for E1 on a T1/E1 CES MDA, all ports on that card can be configured for E1. A combination of DS1 and E1 channels cannot exist on the same card.

The **no** form of this command disables E1 capabilities.

bert

Syntax **bert** {**2e3|2e9|2e11|2e15|2e20|2e20q|2e23|ones|zeros|alternating**} **duration** *duration*
no bert

Context config>port>tdm>ds1
config>port>tdm>e1

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

This command initiates or restarts a Bit Error Rate Test (BERT) on the associated DS1/E1 circuit.

The associated DS1 or E1 must be in a shutdown (admin down) state to initiate this test.

The **no** form of the command terminates the BERT test if it has not yet completed.

Note:

- This command is not saved in the router configuration between boots.
- The 4-port OC-3/STM-1 and the 1-port OC-12/STM-4 ASAP MDA supports up to 28 concurrent BERT tests per MDA. An attempt to configure more BERT tests can result in an error indicating an operation failure due to resource exhaustion.
- If the ASAP MDA BERT error insertion **rate** command is executed when tests are running, it will not take effect until test is restarted.

Default 2e3

Parameters *duration* — Sets the duration for the BERT test.

Values Up to 24 hours, in seconds or hh:mm:ss format

2e15 — Sends a pseudo-random 2^15 -1 pattern.

2e20 — Sends a pseudo-random 2^20 -1 pattern.

2e23 — Sends a pseudo-random 2^23 -1 pattern.

buildout

Syntax **buildout short**

Context config>port>tdm

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

This command specifies line buildout (cable length) for physical DS-1 interfaces on the T1/E1 CES MDA.

Default short

Parameters **short** — Sets the line buildout for length runs up to 655 feet.

lbo

Syntax **lbo** [**0dB** | **-7.5dB** | **-15.0dB** | **-22.5dB**]

Context config>port>tdm

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

This command applies only to a DS-1 port configured with a 'short' buildout (see the **buildout** command). Specify the number of decibels the transmission signal decreases over the line.

length

Syntax **length** {**133** | **266** | **399** | **533** | **655**}

Context config>port>tdm

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

This command configures the line length for the physical DS1 port on the T1/E1 card.

Default 133

line-impedance

Syntax **line-impedance** {**75** | **100** | **120**}

Context config>port>tdm

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

This command configures the line impedance of a port. Line impedance is set on a per-port basis and ports on the same card can have different values. Before changing the line impedance of a port, the port must be shut down.

Default 100 for DS1

120 for E1

Parameters **75** — Configures the line impedance of the port to 75 Ω

100 — Configures the line impedance of the port to 100 Ω

120 — Configures the line impedance of the port to 120 Ω

channel-group

Syntax [**no**] **channel-group** *channel-group-id*

Context config>port>tdm>ds1
config>port>tdm>e1

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

This command creates DS0 channel groups in a channelized DS1 or E1 circuit. Channel groups cannot be further subdivided.

The **no** form of this command deletes the specified DS1 or E1 channel.

Parameters *channel-group-id* — Identifies the channel-group ID number.

Values DS1: 1 to 24
E1: 1 to 32

clock-source

Syntax **clock-source** {**loop-timed** | **node-timed** | **adaptive**}

Context config>port>tdm>ds1
config>port>tdm>e1

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

This command specifies the clock source to be used for the link transmit timing. Adaptive timing is supported only on T1/E1 CES MDA card ports used for TDM pseudowires.

Default looped-timed

Parameters

loop-timed — The link recovers the clock from the received data stream.

node-timed — The link uses the internal clock when transmitting data. The internal clock is a free-running clock.

adaptive — The clocking is derived from the incoming pseudowire packets from the MPLS network.

encap-type

Syntax

encap-type {**cem**}
no-encap-type

Context

config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

Description

Platforms Supported: 7210 SAS-M.

This command configures the encapsulation method used to on the specified port, path, or channel for the port on the T1/E1 CES MDA. This parameter can be set on access ports. For access mode, only **cem** encapsulation is supported.

Default

no encap-type

Parameters

cem — Specifies the encapsulation type as circuit emulation mode for TDM pseudowires on the CES MDA.

framing (DS-1)

Syntax

framing {**esf | sf | ds1-unframed**}

Context

config>port>>tdm>ds1

Description

Platforms Supported: 7210 SAS-M.

This command specifies the DS1 framing to be used for the port. The **ds1-unframed** parameter allows the configuration of an unstructured DS1 channel on a T1/E1 MDA. If a DS1 unframed channel is shut down, the channel sends an AIS pattern to the far-end DS1. If the far-end DS1 is configured as unframed, it does not react to the AIS pattern. If the far-end DS1 is configured as framed, the far end declares the AIS pattern. The operational status remains up and no alarms are generated when the near end is operationally down. This is normal behavior for unframed G.703 mode.

Default

dsl-unframed

Parameters

esf — Configures the DS-1 port for extended super frame framing.

sf — Configures the DS-1 port for super frame framing.

ds1-unframed — Specifies the DS1 unframed (G.703) mode for DS1 interfaces. DS1 unframed mode is only applicable if the encapsulation type is set to cem.

framing (E-1)

Syntax **framing** {**no-crc-g704 | g704 | e1-unframed**}

Context config>port>tdm>e1

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

This command specifies the E-1 framing to be used for the port.

Default e1-unframed

Parameters **g704** — Configure the E-1 port for G.704 framing.

no-crc-g70 — Configures the E-1 for G.704 with no CRC4.

e1-unframed — Specifies E1 unframed (G.703) mode for E1 interfaces. E1 unframed mode is only applicable if the encapsulation type is set to ‘cem’.

idle-cycle-flag

Syntax **idle-cycle-flag** {**flags | ones**}

Context config>port>tdm>ds1>channel-group
config>port>tdm>ds3
config>port>tdm>e1
config>port>tdm>e1>channel-group
config>port>tdm>e3

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

This command configures the value that the HDLC TDM DS-0, E-1, E-3, DS-1, or DS-3 interface transmits during idle cycles. For ATM ports/channels/channel-groups, the configuration does not apply and only the no form is accepted.

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

Default flags (0x7E)

no flags (ATM)

Parameters **flags** — Specifies that 0x7E is used as the idle cycle flag.

ones — Specifies that 0xFF is used as the idle cycle flag.

idle-payload-fill

Syntax **idle-payload-fill** {**all-ones** | **pattern** *pattern*}

Context config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

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

This command defines the data pattern to be transmitted when the circuit emulation service is not operational or temporarily experiences under-run conditions.This command is only valid for cesopsn services.

See the 7210 SAS-M, T, Mxp, Sx, S Services Guide for more information about CESoPSN services.

Default all-ones

Parameters **all-ones** — Defines the 8 bit value to be transmitted as 11111111.

pattern — Transmits a user-defined pattern.

Values 0 to 255 (can be entered in decimal, binary, or hexadecimal format)

idle-signal-fill

Syntax **idle-signal-fill** {**all-ones** | **pattern** *pattern*}
no idle-signal-fill

Context config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

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

This command defines the signaling pattern to be transmitted (4-bit value) when the circuit emulation service is not operational or temporarily experiences underrun conditions. This command is only valid for CES with CAS.

See the 7210 SAS-M, T, Mxp, Sx, S Services Guide for more information about CESoPSN services.

Default all-ones

Parameters **all-ones** — Defines the 4 bit value to be transmitted as 1111.

pattern — Transmits a user-defined pattern.

Values 0 to 15 (can be entered in decimal, binary, or hexadecimal format).

loopback

Syntax **loopback** {**line** | **internal** | **fdl-ansi** | **fdl-bellcore** | **payload-ansi**}
no loopback

Context config>port>tdm>ds1
config>port>tdm>e1

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

Note: Only line and internal options are supported for "e1".

This command puts the specified port or channel into a loopback mode. A line loopback, loops frames received on the corresponding port or channel back toward the transmit (egress) direction before reaching the framer. The bit stream is not reframed. The electrical signal is regenerated by the Tx line interface unit (LIU) and the timing is provided by the Rx LIU.

An internal loopback, loops the frames from the local router back to the framer. This is usually referred to as an equipment loopback. The Tx signal is looped back and received by the interface.

The **no** form of this command disables the specified type of loopback.

Note:

- The loopback command is not saved to the system configuration.
- The fdl-ansi, fdl-bellcore and payload-ansi options can only be configured if DS1 framing is set to ESF.

Default no loopback

Parameters **line** — Places the associated port or channel into a line loopback mode. A line loopback loops frames received on the corresponding port or channels back to the remote router.

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

fdl-ansi — Requests FDL line loopback according to ANSI T1.403.

fdl-bellcore — Requests FDL line loopback according to Bellcore TR-TSY-000312.

payload-ansi — Requests payload loopback using ANSI signaling.

mode

Syntax **mode** {**access**}
no mode

Context config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

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

This command configures a TDM channel for access mode operation. An **access** port or channel is used for customer-facing traffic on which services are configured. A Service Access Point (SAP) can only be configured on an access port or channel. When a port is configured for access mode, the **encap-type** cem must be specified to distinguish the services on the port.

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

Default access

Parameters **access** — Configures the port or channel as service access.

remote-loop-respond

Syntax [**no**] **remote-loop-respond**

Context config>port>tdm>ds1

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

This command configures the DS1 channel response to remote loop backs. When enabled, the channel responds to remote loop backs; when disabled, the channel does not respond.

Default no remote-loop-respond

report-alarm

Syntax [**no**] **report-alarm** [**ais**] [**los**] [**oof**] [**rai**] [**looped**] [**ber-sd**] [**ber-sf**]

Context config>port>tdm>ds1
config>port>tdm>e1

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

This command enables logging of DS-1 or E-1 alarms for DS-1 or E-1 ports or channels.

The **no** form of this command disables logging of the specified alarms.

Parameters **ais** — Reports alarm indication signal errors. When configured, **ais** alarms are not raised and cleared.

Default **ais** alarms are issued

los — Reports loss of signal errors. When configured, **los** traps are not raised and cleared.

Default **los** traps are issued.

oof — Reports out-of-frame errors. When configured, **oof** alarms are not raised and cleared.

Default **oof** alarms are not issued.

rai — Reports resource availability indicator events. When configured, **rai** events are not raised and cleared.

Default **rai** alarms are not issued

looped — Reports looped packets errors.

Default **looped** alarms are not issued

signal-mode

Syntax **no signal-mode** {**cas**}

Context config>port>tdm>ds1
config>port>tdm>e1

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

This command activates the signal mode on the channel.

When enabled, control signals (such as those for synchronizing and bounding frames) are carried in the same channels as voice and data signals. Configure the signal mode before configuring the Cpipe service to support T1 or E1 with CAS.

Refer to the 7210 SAS-M, T, Mxp, Sx, S Services Guide, “Creating a Cpipe Service”, for information about configuring a Cpipe service.

This command is valid when:

- T1 framing is set to esf or sf
- E1 framing is set to g704 or no-crc-g704.

Note: On the 7210 SAS, CAS is enabled at the port level, rather than at the 64 kb/s channel level. This means that control signals and voice and data signals are all carried in the same channels. However, T1 and E1 links with a mix of voice and data channels cannot be transported directly across a 7210 SAS network. For a workaround, contact your Nokia technical service representatives.

This limitation does not apply to Serial Data Interface card and E&M card traffic transported over MPLS as the signaling is transported in individual pseudowires.

Parameters **cas** — Specifies channel associated signaling.

timeslots

Syntax **timeslots** *timeslots*
no timeslots

Context config>port>tdm>ds1>channel-group
config>port>tdm>e1>channel-group

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

This command defines the list of DS-0 timeslots to be used in the DS-1 or E-1 channel-group. The timeslots need not be consecutive.

The **no** form of this command removes DS-0 timeslots from a channel group.

Default no timeslots

Parameters *timeslots* — Specifies the timeslots to be associated with the channel group. The value can consist of a list of timeslots. Each member of the list can either be a single timeslot or a range of timeslots.

Values 1 to 24 for DS-1 interfaces
2 to 32 for E-1 interfaces

2.18.2.1.12 LAG Commands

lag

Syntax [**no**] **lag** [*lag-id*]

Context config

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

Description This command enables the context to configure 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 the 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* — The LAG identifier, expressed as a decimal integer.

Values 7210 SAS-M, 7210 SAS-X, 7210 SAS-T, 7210 SAS-Mxp — 1 to 25
7210 SAS-R6 and 7210 SAS-R12 — 1 to 125
7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE — 1 to 125

bfd

Syntax **bfd**

Context config>lag

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command enables the **bfd** context and enables BFD over the associated LAG links.

disable-soft-reset-extension

Syntax [**no**] **disable-soft-reset-extension**

Context config>lag>bfd

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command enables BFD over LAG links; additional parameter configuration is required to make the links operational.

BFD session timers are automatically extended during soft-reset operation on the IOMs and IMMs to avoid BFD sessions timing out and causing protocol events. However, in some cases this behavior is not desired as it can delay fast reroute transitions if they are in place. The optional **disable-soft-reset-extension** keyword disables the behavior so that the BFD timers are not automatically extended.

Default no disable-soft-reset-extension

Parameters **disable-soft-reset-extension** — Disables the automatic extension of BFD timers during an IOM/IMM soft-reset.

family

Syntax **family** {**ipv4**}

Context config>lag>bfd

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the address family for the micro-BFD session over the associated LAG links.

Default family ipv4

Parameters **ipv4** — Specifies that IPv4 encapsulation should be used for the micro-BFD session.

bfd-on-distributing-only

Syntax [**no**] **bfd-on-distributing-only**

Context config>lag>bfd>family

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command restricts the micro-BFD sessions to links in LACP state distributing.

The **no** form of the 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

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the IPv4 address of the BFD source.

The **no** form of the 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

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the maximum amount 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 link or links.

The **no** form of the 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 — Specifies 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

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the maximum amount of time the router will forward traffic over a link that has transitioned from Standby to Active, before the micro-BFD session must be fully established (Up state).

The **no** form of the command returns the timer value to the default (0), 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

infinite — Specifies no end time to forward traffic.

multiplier

Syntax **multiplier** [*multiplier*]
no multiplier

Context config>lag>bfd>family

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

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:

multiplier × *receive-interval*

The **no** form of the 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

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the receive timer used for micro-BFD sessions over the associated LAG links.

The **no** form of the 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

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the IPv4 address of the BFD destination.

The **no** form of the 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

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command disables micro-BFD sessions for this address family.

The **no** form of the command reenables micro-BFD sessions for this address family.

Default shutdown

transmit-interval

Syntax **transmit-interval** *transmit-interval*

no transmit-interval

Context config>lag>bfd>family

Description **Platforms Supported**: 7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12

This command specifies the transmit timer used for micro-BFD session over the associated LAG links.

The **no** form of the command removes the transmit timer from the configuration.

Default transmit-interval 100

Parameters *transmit-interval* — Specifies the 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

Supported 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 provided the number of links available exceeds the configured LAG threshold value at which time the configured threshold action determines if this LAG will be advertised.

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

Default no dynamic-cost

encap-type

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

Context config>lag

Supported 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.

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

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

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

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

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

hold-time

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

Context config>lag

Supported 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

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

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

Supported 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** — Transmits packets every 30 seconds.

fast — Transmits packets every second.

lacp-xmit-stdby

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

Context config>lag

Supported 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

load-balancing

Syntax **load-balancing** *hash parameters*

Context config>lag

Supported Platforms Supported on all 7210 SAS platforms as described in this document; not support on 7210 SAS-X.

Description **Platforms Supported:** 7210 SAS-M, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC),7210 SAS-Sx 10/100GE, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-T

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.

By default, the **default** value is assigned to *hash parameters*, unless explicitly configured by the user to a different value.

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 load-balancing default

Parameters *hash parameters* — 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 —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

Supported 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-M, 7210 SAS-X, 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 added to the LAG.

All ports added to a LAG must share the same characteristics (speed, duplex mode, and so on). An error message will be 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* — The physical port ID in the *slot/mda/port* format.

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

Values 1 to 65535

sub-group-id — 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

Supported 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 — 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

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

slave-to-partner — The slave-to-partner keyword specifies that it, together with the selection criteria, should be used to select the active sub-group. An eligible member is a lag-member link which can potentially become active. This means it is operationally up (not disabled) for use by the remote side. The **slave-to-partner** parameter can be used to control whether or not this latter condition is taken into account.

standby-signaling

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

Context config>lag

Supported 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 — The laser of the standby links in the LAG are shutoff to indicate standby status. It allows user to use LAG standby link feature without LACP, if the peer node does not support LACP. This parameter is not supported on 7210 SAS platforms configured in the access-uplink operating mode.

2.18.2.1.13 Ethernet Ring Commands

eth-ring

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

Context config

Supported 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

Supported 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

Supported 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 restores the default guard-time.

Default 5 deciseconds

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

Supported 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 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

Supported 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

Supported 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

Supported 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

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

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

Default no rpl-node

node-id

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

Context config>eth-ring

Supported 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

Supported 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

Supported 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

Supported 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.

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.

Values *ring-ind*ex: 1 to 128

propagate-topology-change

Syntax **propagate-topology-change**
[**no**] **propagate-topology-change**

Context config>eth-ring>sub-ring>interconnect

Supported 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. Since 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**} *portid* **raps-tag** *qtag* [.*qtag*]
[**no**] **path** {**a** | **b**}

Context config>eth-ring

Supported 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 *qtag [.qtag]* — Specifies the VIDqtag.

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

Supported 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

Supported 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 end. The ring should be declared as either a RPL owner or RPL neighbor for this command to be allowed. Only path a or path b can be declared an RPL-end.

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

Default no rpl-end

eth-cfm

Syntax **eth-cfm**

Context config>eth-ring>path

Supported 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 context to configure ETH-CFM parameters.

mep

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

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

Supported 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 the command reverts to the default values.

Parameters *mep-id* — Specifies the maintenance association 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

Supported 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 the command disables the generation of CCM messages.

ccm-ltm-priority

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

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

Supported 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 the command removes the priority value from the configuration.

Default The highest priority on the bridge-port.

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

Values 0 to 7

control-mep

Syntax **no control-mep**

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

Supported 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

Description **Platforms Supported:** 7210 SAS-T, 7210 SAS-X, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), 7210 SAS-Sx 10/100GE, 7210 SAS-Mxp, 7210 SAS-R6 and 7210 SAS-R12.

To support sub-second CCM timers in hardware for G.8032 MEPs, user needs to reserve a VLAN tag value for exclusive use by G.8032 MEPs configured for a particular ring port (for the MEP configured under the path command). This command allows the user to tell the system which VLAN tag is reserved for use with this G.8032 MEP. This value can be the same one as configured with raps-tag value. Use of this command turns on use of sub-second 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. Maximum of four hardware based control MEPs can be configured on a port.

The VLAN should be reserved for all port encapsulation type. That is, NULL encapsulated port, Dot1q encapsulated port, and QinQ encapsulated ports that need to use G.8032 MEPs with sub-second 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:

- User needs to 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, then any SAP (NULL, dot1q, dot1q Default SAP, Q1.Q2 SAP, Q1.* SAP) configured on the port cannot receive any CFM packet that matches the VLAN tag 550.
- Configuration of control-sap-tag 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 the command reverts the ring port to use the raps-tag configured for the path and use of 1second CCM timers.

Parameters *tag-range* — Specifies the tag range.

Values

512 to 768 — 7210 SAS-X (100 ms CCM timer support)

512 to 768 — 7210 SAS-T in network mode (100 ms CCM timer support)

512 to 768 — 7210 SAS-Mxp (10 ms and 100 ms CCM timer support)

512 to 768 — 7210 SAS-Sx/S 1/10GE (10 ms and 100 ms CCM timer support; **control-sap-tag** range must be mentioned under resource profile)

3000 to 3512 — 7210 SAS-R6 and 7210 SAS-R12 (10 ms and 100 ms CCM timer support, **control-sap-tag** range must be mentioned under resource profile)

eth-test-enable

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

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

Supported 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

Supported 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 the 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 — Generates a CRC checksum.

bit-error-threshold

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

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

Supported 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

Supported 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

Values	allDef	DefRDICCM, DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM
	macRemErrXcon	Only DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM
	remErrXcon	Only DefRemoteCCM, DefErrorCCM, and DefXconCCM
	errXcon	Only DefErrorCCM and DefXconCCM
	xcon	Only DefXconCCM; or
	noXcon	No defects DefXcon or lower are to be reported

mac-address

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

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

Supported 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 MAC address of the MEP.*

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

one-way-delay-threshold

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

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

Supported 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

Supported 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

Supported 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

Supported 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

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

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**”. 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 the command takes affect only on reboot.

Default no g8032-fast-flood-enable

2.18.2.1.14 Ethernet Tunnel Commands

split-horizon-group

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

Context config>lag
config>port

Description **Platforms Supported:** 7210 SAS-M, 7210 SAS-X, 7210 SAS-Sx/S 1/10GE (standalone), 7210 SAS-Sx 10/100GE, 7210 SAS-T.

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

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

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

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

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

2.18.2.1.15 Multi-Chassis Redundancy Commands

redundancy

Syntax **redundancy**

Context config

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

Description This command enables the context to configure redundancy operations.

multi-chassis

Syntax **multi-chassis**

Context config>redundancy

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

Description This command enables the context to configure multi-chassis parameters.

peer

Syntax [**no**] **peer** *ip-address* **create**

Context config>redundancy>multi-chassis

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

Description This command configures up to 20 multi-chassis redundancy peers. Note that this is only for mc-lag (20) not for mc-sync (4).

Parameters *ip-address* — Specifies the IP address.

Values ipv4-address: a.b.c.d

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

Supported 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, etc.), the entire string must be enclosed within double quotes.

hash-key — The hash key. The key can be any combination of ASCII characters up to 33 (hash1-key) or 55 (hash2-key) characters (encrypted). If spaces are used in the string, enclose the entire string in quotation marks (“ ”).

hash — Specifies the key is entered in an encrypted form. If the hash or hash2 parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the hash or hash2 parameter specified.

hash2 — Specifies the key is entered in a more complex encrypted form that involves more variables then the key value alone, this means that hash2 encrypted variable cannot be copied and pasted. If the hash or hash2 parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the hash or hash2 parameter specified.

MC Endpoint Commands

hold-on-neighbor-failure

Syntax **hold-on-neighbor-failure** *multiplier*
no hold-on-neighbor-failure

Context config>redundancy>multi-chassis>peer>mc-ep

Supported 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 will wait for packets from the MC-EP peer before assuming failure. After this time interval passed the all the mc-endpoints configured under services will revert to single chassis behavior, activating the best local pseudowire.

The **no** form of this command sets the multiplier to default value

Default 3

Parameters *multiplier* — Specifies the hold time applied on neighbor failure.

Values 2 to 25

MC LAG Commands

mc-lag

Syntax [**no**] **mc-lag**

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

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

Description This command enables the context to configure multi-chassis LAG operations and related parameters.

The **no** form of this command administratively disables multi-chassis LAG. MC-LAG can be issued only when mc-lag is shutdown.

hold-on-neighbor-failure

Syntax **hold-on-neighbor-failure** *multiplier*
no hold-on-neighbor-failure

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

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

Description This command specifies the interval that the standby node will wait for packets from the active node before assuming a redundant-neighbor node failure. This delay in switch-over operation is required to accommodate different factors influencing node failure detection rate, such as IGP convergence, or HA switch-over times and to prevent the standby node to take action prematurely.

The **no** form of this command sets this parameter to default value.

Default 3

Parameters *multiplier* — The time interval that the standby node will wait for packets from the active node before assuming a redundant-neighbor node failure.

Values 2 to 25

keep-alive-interval

Syntax **keep-alive-interval** *interval*
no keep-alive-interval

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

Supported 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 sets the interval to default value

Default 1s (10 hundreds of milliseconds means interval value of 10)

Parameters *interval* — 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

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

Description This command defines a LAG which is forming 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 MC-LAG to become operational, all parameters (**lacp-key**, **system-id**, **system-priority**) must be configured the same on both nodes of the same redundant pair.

The partner system (the system connected to all links forming MC-LAG) will consider all ports using the same **lacp-key**, **system-id**, **system-priority** as the part of the same LAG. To achieve this in MC operation, both redundant-pair nodes have to be configured with the same values. In case of the mismatch, MC-LAG is kept in oper-down status.

Note that 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. MC LAG is disabled (regardless of the mode) for a specific LAG with **no lag** *lag-id.*

Parameters *lag-id* — The LAG identifier, expressed as a decimal integer. Specifying the *lag-id* allows the mismatch between lag-id on redundant-pair. If no **lag-id** is specified it is assumed that neighbor system uses the same *lag-id* as a part of the 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..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

Supported 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

Supported 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

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

Description This command enables the context to configure synchronization parameters.

igmp-snooping

Syntax [**no**] **igmp-snooping**

Context config>redundancy>multi-chassis>peer>sync

Supported 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

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

Description This command specifies the port to be synchronized with the multi-chassis peer and a synchronization tag to be used while synchronizing this port with the multi-chassis peer.

Parameters *port-id* — Specifies the port to be synchronized with the multi-chassis peer.

lag-id — Specifies the LAG ID to be synchronized with the multi-chassis peer.

sync-tag *sync-tag* — Specifies a synchronization tag to be used while synchronizing this port with the multi-chassis peer.

range

Syntax **range** *encap-range* **sync-tag** *sync-tag*
no range *encap-range*

Context config>redundancy>multi-chassis>peer>sync>port

Supported 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>
	- <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 while synchronizing this encapsulation value range with the multi-chassis peer.

2.18.2.2 Show Commands

2.18.2.2.1 Hardware Commands

chassis

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

Context show

Supported 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, IMMs, power supplies, and fans.

Parameters **environment** — Displays chassis environmental status information.

Default Displays all chassis information.

power-supply — Displays chassis power supply status information.

Default Displays all chassis information.

Output The following output is an example of chassis status information, and Table 26 describes the output fields.

Sample Output

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

Hardware Data
    Part number                       :
    CLEI code                         :
```

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

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

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

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


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

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

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

Table 26 Show Chassis Output Fields

Label	Description
Name	The system name for the router.
Type	Displays the model number.
Location	The system location for the device.

Table 26 Show Chassis Output Fields (Continued)

Label	Description
Coordinates	A user-configurable string that indicates the Global Positioning System (GPS) coordinates for the location of the chassis. For example: N 45 58 23, W 34 56 12 N37 37' 00 latitude, W122 22' 00 longitude N36*39.246' W121*40.121'
CLLI Code	The Common Language Location Identifier (CLLI) that uniquely identifies the geographic location of places and certain functional categories of equipment unique to the telecommunications industry.
Number of slots	The number of slots in this chassis that are available for plug-in cards. The total number includes the IOM slots and the CPM slots.
Number of ports	The total number of ports currently installed in this chassis. This count does not include the Ethernet ports on the CPMs that are used for management access.
Critical LED state	The current state of the Critical LED in this chassis.
Major LED state	The current state of the Major LED in this chassis.
Minor LED state	The current state of the Minor LED in this chassis.
Base MAC address	The base chassis Ethernet MAC address.
Admin chassis mode	The configured chassis mode.
Oper chassis mode	The current chassis mode.
Part number	The CPM part number.
CLEI code	The code used to identify the router.
Serial number	The CPM part number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Administrative state	Up — The card is administratively up. Down — The card is administratively down.
Operational state	Up — The card is operationally up.
	Down — The card is operationally down.
Time of last boot	The date and time the most recent boot occurred.

Table 26 Show Chassis Output Fields (Continued)

Label	Description
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

Sample Output for 7210 SAS-X

```
A:7210-SAS-X>show# chassis

===============================================================================
Chassis Information
===============================================================================
    Name                          : SASX2595
    Type                          : 7210 SAS-X 24F 2XFP-1
    Location                      :
    Coordinates                   :
    CLLI code                     :
    Number of slots               : 2
    Number of ports               : 26
    Critical LED state            : Off
    Major LED state               : Off
    Minor LED state               : Off
    Over Temperature state        : OK
```

```
    Base MAC address              : 7c:20:64:ac:ff:8f

Hardware Data
    Part number                   : 3HE05171AAAA0501
    CLEI code                     : IPMNX10GRA
    Serial number                 : NS1035F0181
    Manufacture date              : 08242010
    Manufacturing string          :
    Manufacturing deviations      : D01669 D01696
    Time of last boot             : 2010/11/10 20:38:27
    Current alarm state           : alarm cleared
-------------------------------------------------------------------------------
Environment Information
    Number of fan trays           : 1
    Number of fans                : 3

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

    Power supply number           : 1
    Configured power supply type  : ac single
    Status                        : up
    AC power                      : within range
    Over temp                     : within range
    Input power                   : within range
    Output power                  : within range

    Power supply number           : 2
    Configured power supply type  : ac single
    Status                        : up
    AC power                      : within range
    Over temp                     : within range
    Input power                   : within range
    Output power                  : within range
===============================================================================


*A:7210-SAS-X>show# chassis environment

===============================================================================
Chassis Information
===============================================================================
Environment Information
    Number of fan trays           : 1
    Number of fans                : 3

    Fan tray number               : 1
    Status                        : up
    Speed                         : half speed
===============================================================================
*A:7210-SAS-X>show#


*A:7210-SAS-X>show# chassis power-supply
```

```
===============================================================================
Chassis Information
===============================================================================
Power Supply Information
    Number of power supplies      : 2

    Power supply number           : 1
    Configured power supply type  : ac single
    Status                        : up
    AC power                      : within range
    Over temp                     : within range
    Input power                   : within range
    Output power                  : within range

    Power supply number           : 2
    Configured power supply type  : ac single
    Status                        : up
    AC power                      : within range
    Over temp                     : within range
    Input power                   : within range
    Output power                  : within range
===============================================================================
*A:7210-SAS-X>show#
```

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 48F4SFP+
  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                         : Ok
  Power Status                       : Failed(Slots:7)
===============================================================================
```

card

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

Context show

Supported 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 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 none of the optional command parameters have been specified; see Sample Output — 7210 SAS Virtual Chassis (VC). IMM-only nodes that have been preprovisioned will show as provisioned but not equipped. When a slot number is specified along with the **detail** keyword, this command displays detailed information about a specific node in a VC; see Sample Output — Detailed, 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 state

Default Displays all cards.
Displays provisioned and equipped card and MDA information.

detail — Displays detailed card information.

Default Displays summary information only.

Output The following outputs are examples of card information, and Table 27 describes the output fields.

Sample Output

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

*A:ces-A# show card

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

```
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up
A         sfm-sas             sfm-sas             up         up/active
===============================================================================
```

Table 27 Show Card Output Fields

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

Sample Output — 7210 SAS-X

```
A:7210-SAS-X > show card

===============================================================================
Card Summary
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up
A         sfm-sas             sfm-sas             up         up/active
===============================================================================
A:7210-SAS-X >
```

Sample Output — 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 — 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 — Detailed, 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                 : XYZ-VC
    VC-stack-node-type            : imm-only
    Vc-stack fabric port #1 Oper State  : Up (Inbuilt stacking port #1)
    Vc-stack fabric port #2 Oper State  : Up (Inbuilt stacking port #2)
    VC-stack Right Node                 : Up (slot-num)
    VC-stack Left Node                 : Up (slot-num)
-----------------------------------------------------------------------------
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 — 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 — 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 — 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 — 7210 SAS in Standalone VC Mode, Detailed

```
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             : TiMOS-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              : TiMOS-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 — 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#
```

Show Card State Output

The following table describes show card state output fields.

Table 28 Show Card State Output Fields

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

Sample Output

```
*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.
```

Sample Output — 7210 SAS-X

```
A:7210-SAS-X> show card state

===============================================================================
Card State
===============================================================================
Slot/  Provisioned      Equipped         Admin Operational   Num   Num Comments
Id     Type             Type             State State         Ports MDA
-------------------------------------------------------------------------------
1      iom-sas          iom-sas          up    up                  2
1/1    m24-1gb+2-10gb   m24-1gb+2-10gb   up    up            26
A      sfm-sas          sfm-sas          up    up                      Active
===============================================================================
A:7210-SAS-X>
```

Show Card Detail Output

The following table describes detailed card output fields.

Table 29 **Show Card Detailed Output Fields**

Label	Description
Available MDA slots	The number of MDA slots available on the IOM.
Installed MDAs	The number of MDAs installed on the IOM
Part number	The IOM part number.
CLEI code	The Common Language Location Identifier (CLLI) code string for the router.
Serial number	The serial number. Not user modifiable.
Manufacture date	The chassis manufacture date. Not user modifiable.
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Manufacturing deviations	Displays a record of changes by manufacturing to the hardware or software and which is outside the normal revision control process.
Administrative state	Up — The card is administratively up.
	Down — The card is administratively down.
Operational state	Up — The card is operationally up.
	Down — The card is operationally down.
Temperature	Internal chassis temperature.
Temperature threshold	The value above which the internal temperature must rise to indicate that the temperature is critical.
Software boot version	The version of the boot image.
Software version	The software version number.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Base MAC address	Displays the base MAC address of the hardware component.
Memory Capacity	Displays the memory capacity of the card.

Sample Output

```
*A:MTU-A# show card detail
===============================================================================
```

```
Card 1
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-24g             iom-24g             up         up


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

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

Sample Output — 7210 SAS-X

```
A:7210-SAS-X> show card detail

===============================================================================
Card 1
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up


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

Hardware Data
    Part number                   : 3HE05170AAAA0501
    CLEI code                     : IPMNX10GRA
    Serial number                 : NS1034F0924
    Manufacture date              : 08312010
    Manufacturing string          :
```

```
    Manufacturing deviations      : D01696 D01669
    Administrative state          : up
    Operational state             : up
    Temperature                   : 26C
    Temperature threshold         : 50C
    Software boot (rom) version   : X-0.0.I906 on Tue Nov 9 23:01:33 IST 2010 b*
    Software version              : TiMOS-B-2.0.B1-129 both/hops NOKIA SAS-X *
    Time of last boot             : 2010/11/10 20:51:20
    Current alarm state           : alarm cleared
    Base MAC address              : 7c:20:64:ad:00:ef
    Last bootup reason            : hardReboot
    Memory capacity               : 1,024 MB

===============================================================================
Card A
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
A         sfm-sas             sfm-sas             up         up/active


BOF last modified                 : N/A
Config file version               : TUE NOV 09 20:28:32 2010 UTC
Config file last modified         : N/A
Config file last saved            : N/A
M/S clocking ref state            : primary

Flash - cf1:
    Administrative State          : up
    Operational state             : up
    Serial number                 : serial-1
    Firmware revision             : v1.0
    Model number                  : Flash 1
    Size                          : 110,984 KB
    Free space                    : 88,548 KB

Hardware Data
    Part number                   : 3HE05170AAAA0501
    CLEI code                     : IPMNX10GRA
    Serial number                 : NS1034F0924
    Manufacture date              : 08312010
    Manufacturing string          :
    Manufacturing deviations      : D01696 D01669
    Administrative state          : up
    Operational state             : up
    Temperature                   : 26C
    Temperature threshold         : 50C
    Software boot (rom) version   : X-0.0.I906 on Tue Nov 9 23:01:33 IST 2010 b*
    Software version              : TiMOS-B-2.0.B1-129 both/hops NOKIA SAS-X *
    Time of last boot             : 2010/11/10 20:50:25
    Current alarm state           : alarm cleared
    Base MAC address              : 7c:20:64:ad:00:ef
    Memory capacity               : 1,024 MB
===============================================================================
A:7210-SAS-X>
```

```
*A:ces-A# show card 1 detail

===============================================================================
Card 1
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
1         iom-sas             iom-sas             up         up


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

Hardware Data
    Part number                  : 3HE05029AA
    CLEI code                    : IPMK410JRA
    Serial number                : NS0950C1606
    Manufacture date             : 12202009
    Manufacturing string         :
    Manufacturing deviations     :
    Administrative state         : up
    Operational state            : up
    Temperature                  : 41C
    Temperature threshold        : 50C
    Software boot (rom) version  : 9-V-0.0.I771 on Thu Jun 24 21:47:52 IST 201*
    Software version             : TiMOS-B-2.0.S75 both/mpc NOKIA SAS-M 7210*
    Time of last boot            : 2010/07/06 11:29:53
    Current alarm state          : alarm cleared
    Base MAC address             : 00:25:ba:01:cc:30
    Last bootup reason           : hardReboot
    Memory capacity              : 1,024 MB
===============================================================================
```

CPM Output

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

Table 30 **Show CPM Output Fields**

Label	Description
Slot	The slot of the card in the chassis.
Card Provisioned	The SF/CPM type that is configured for the slot.
Card Equipped	The SF/CPM type that is actually populated in the slot.
Admin State	Up — The SF/CPM is administratively up.
	Down — The SF/CPM is administratively down.

Table 30 Show CPM Output Fields (Continued)

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

Table 30 Show CPM Output Fields (Continued)

Label	Description
Operational state	Up — The card is operationally up.
	Down — The card is operationally down.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific board.
Status	Displays the current status.
Temperature	Internal chassis temperature.
Temperature threshold	The value above which the internal temperature must rise to indicate that the temperature is critical.
Software boot version	The version of the boot image.
Memory capacity	The total amount of memory.

Sample Output

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


BOF last modified                  : N/A
Config file version                : WED JUN 27 11:12:21 2008 UTC
Config file last modified          : 2008/06/27 11:42:06
Config file last saved             : N/A
M/S clocking ref state             : primary

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

Hardware Data
    Part number                    :
    CLEI code                      :
    Serial number                  : MTUSN107210
    Manufacture date               :
    Manufacturing string           :
    Manufacturing deviations       :
```

```
    Administrative state          : up
    Operational state             : up
    Temperature                   : 40C
    Temperature threshold         : 50C
    Software boot (rom) version   : 7
    Software version              : TiMOS-B-1.1.S29 both/mpc NOKIA SAS-M 721*
    Time of last boot             : 2008/06/27 11:14:43
    Current alarm state           : alarm cleared
    Base MAC address              : 00:11:00:22:bc:11
    Memory capacity               : 1,024 MB
===============================================================================
*A:MTU-A#
```

Sample Output — 7210 SAS-X

```
A:7210-SAS-X> show card A detail

===============================================================================
Card A
===============================================================================
Slot      Provisioned         Equipped            Admin      Operational
          Card-type           Card-type           State      State
-------------------------------------------------------------------------------
A         sfm-sas             sfm-sas             up         up/active


BOF last modified                 : N/A
Config file version               : TUE NOV 09 20:28:32 2010 UTC
Config file last modified         : N/A
Config file last saved            : N/A
M/S clocking ref state            : primary

Flash - cf1:
    Administrative State          : up
    Operational state             : up
    Serial number                 : serial-1
    Firmware revision             : v1.0
    Model number                  : Flash 1
    Size                          : 110,984 KB
    Free space                    : 88,548 KB

Hardware Data
    Part number                   : 3HE05170AAAA0501
    CLEI code                     : IPMNX10GRA
    Serial number                 : NS1034F0924
    Manufacture date              : 08312010
    Manufacturing string          :
    Manufacturing deviations      : D01696 D01669
    Administrative state          : up
    Operational state             : up
    Temperature                   : 26C
    Temperature threshold         : 50C
    Software boot (rom) version   : X-0.0.I906 on Tue Nov 9 23:01:33 IST 2010 b*
    Software version              : TiMOS-B-2.0.B1-129 both/hops NOKIA SAS-X *
    Time of last boot             : 2010/11/10 20:50:25
    Current alarm state           : alarm cleared
    Base MAC address              : 7c:20:64:ad:00:ef
```

```
    Memory capacity               : 1,024 MB
===============================================================================
A:7210-SAS-X>
```

Sample Output — 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#
```

card

Syntax **card** [*slot-number*] **active-resource-profile**

Context show

Description **Platforms Supported:** 7210 SAS-R6 and 7210 SAS-R12.

This command displays card information.

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

Values state

Default Displays all cards.

Displays provisioned and equipped card and MDA information.

active-resource-profile — With this parameter, the show command displays the active resource profile currently in use by the system.

Output The following output is an example of card information, and Table 31 describes the output fields.

Sample Output

```
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 31 **Show Card Output Fields**

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 will take affect after a reboot or reset of the card.
G8032 Control Sap Tags	Displays the Control VLANs reserved for use by G8032.

Table 31 Show Card Output Fields (Continued)

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 QoS guide for more details.
IPv4-IPv6 Resource	Resources allocated toward SAP ingress IPv4-IPv6 classification. See the QoS guide for more details.
Mac Resource	Resources allocated toward SAP ingress MAC classification. See the QoS guide for more details.
IPv4-Mac Resource	Resources allocated toward SAP ingress IPv4 and MAC classification. See the QoS guide for more details.
Net Ingress Qos resource	Resources allocated toward Network Ingress Qos classification (both port-based and IP -interface based). See the QoS guide for more details.
Sap Ingress ACL resource	Resources allocated toward ingress ACLs (both SAP and network ingress). See the Router Configuration guide for more details.
IPv4-IPv6 128 bit Resource	Resources allocated toward ingress ACLs using IPv4 and/or IPv6 (with 128-bit IP addresses) classification. See the Router Configuration guide for more details.
IPv6 64 bit Resource	Resources allocated toward ingress ACLs using IPv4 and/or IPv6 (with 64-bit IP addresses) classification. See the Router Configuration guide for more details.
Eth CFM	Resources allocated toward Ethernet CFM (UP MEP, Down MEP, MIPs, etc.).
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).
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.

Table 31 **Show Card Output Fields (Continued)**

Label	Description
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.

mda

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

Context show

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

Description This command displays MDA information.

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

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

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

Values 1 — 2 (for 7210 SAS-M)

Values 1 (for all 7210 SAS platforms)

detail — Displays detailed MDA information.

Output The following output is an example of MDA information, and Table 32 describes the output fields.

Sample Output

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

Table 32 **Show MDA Output Fields**

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

Sample Output

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


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

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

Table 33 describes detailed MDA output fields.

Table 33 **Show MDA Detailed Output Fields**

Label	Description
Slot	The chassis slot number.
Slot	The MDA slot number.
Provisioned Provisioned-type	The provisioned MDA type.
Equipped Mda-type	The MDA type that is physically inserted into this slot in this chassis.
Admin State	Up — The MDA is administratively up.
	Down — The MDA is administratively down.
Operational State	Up — The MDA is operationally up.
	Down — The MDA is operationally down.
Maximum port count	The maximum number of ports that can be equipped on the MDA card.
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. Not user modifiable.
Manufacture date	The MDA manufacture date. Not user modifiable.

Table 33 Show MDA Detailed Output Fields (Continued)

Label	Description
Manufacturing string	Factory-inputted manufacturing text string. Not user modifiable.
Administrative state	Up — The MDA is administratively up.
	Down — The MDA is administratively down.
Operational state	Up — The MDA is operationally up.
	Down — The MDA is operationally down.
Time of last boot	The date and time the most recent boot occurred.
Current alarm state	Displays the alarm conditions for the specific MDA.
Base MAC address	The base chassis Ethernet MAC address. Special purpose MAC addresses used by the system software are constructed as offsets from this base address.

Sample Output — 7210 SAS-X

```
A:7210-SAS-X> show mda 1/1 detail
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
1     1     m24-1gb+2-10gb        m24-1gb+2-10gb        up        up


MDA Specific Data
    Maximum port count             : 26
    Number of ports equipped       : 26
    Network ingress queue policy   : default
    Capabilities                   : Ethernet

Hardware Data
    Part number                    : 3HE05170AAAA0501
    CLEI code                      : IPMNX10GRA
    Serial number                  : NS1034F0924
    Manufacture date               : 08312010
    Manufacturing string           :
    Manufacturing deviations       : D01696 D01669
    Administrative state           : up
    Operational state              : up
    Temperature                    : 26C
    Temperature threshold          : 50C
    Software version               : N/A
    Time of last boot              : 2010/11/10 20:51:23
    Current alarm state            : alarm cleared
    Base MAC address               : 7c:20:64:ad:00:f1

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

```
QOS Settings
-------------------------------------------------------------------------------
Ing. Named Pool Policy            : None
Egr. Named Pool Policy            : None
===============================================================================
A:7210-SAS-X>


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


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

Hardware Data
    Part number                   : 3HE05029AA
    CLEI code                     : IPMK410JRA
    Serial number                 : NS0950C1606
    Manufacture date              : 12202009
    Manufacturing string          :
    Manufacturing deviations      :
    Administrative state          : up
    Operational state             : up
    Temperature                   : 36C
    Temperature threshold         : 50C
    Software version              : N/A
    Time of last boot             : 2010/07/06 11:30:00
    Current alarm state           : alarm cleared
    Base MAC address              : 00:25:ba:01:cc:32
-------------------------------------------------------------------------------
QOS Settings
-------------------------------------------------------------------------------
Ing. Named Pool Policy            : None
Egr. Named Pool Policy            : None

===============================================================================
MDA 1/2 detail
===============================================================================
Slot  Mda   Provisioned           Equipped              Admin     Operational
            Mda-type              Mda-type              State     State
-------------------------------------------------------------------------------
      2     m4-ds1-ces            m4-ds1-ces            up        up


MDA Specific Data
    Maximum port count            : 4
    Number of ports equipped      : 4
    Network ingress queue policy  : default
    Capabilities                  : TDM, CEM
```

```
    Min channel size              : PDH DS0 Group
    Max channel size              : PDH DS1
    Max number of channels        : 4
    Channels in use               : 4

CEM MDA Specific Data
    Clock Mode                    : adaptive

Hardware Data
    Part number                   : 3HE05561AA
    CLEI code                     :
    Serial number                 : NS102110177
    Manufacture date              : 06022010
    Manufacturing string          :
    Manufacturing deviations      :  82-0234-02 rev 1
    Administrative state          : up
    Operational state             : up
    Temperature                   : 41C
    Temperature threshold         : 50C
    Software version              : N/A
    Time of last boot             : 2010/07/06 11:31:37
    Current alarm state           : alarm cleared
    Base MAC address              : 00:03:fa:1d:7d:d2
-------------------------------------------------------------------------------
QOS Settings
-------------------------------------------------------------------------------
Ing. Named Pool Policy            : None
Egr. Named Pool Policy            : None
===============================================================================
```

Sample Output —7210 SAS-T

```
A:SAST>show# mda detail

===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned Type                           Admin     Operational
                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#
```

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
                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                   : AABBCCDD-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#
```

Sample Output — 7210 SAS-R6 and 7210 SAS-R12

```
A:dut-a>show# mda detail
```

```
===============================================================================
MDA 1/1 detail
===============================================================================
Slot  Mda   Provisioned Type                            Admin     Operational
                Equipped Type (if different)            State     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                            Admin     Operational
                Equipped Type (if different)            State     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

Supported 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 34 describes the output fields.

Sample Output

```
*A:MTU-A# show pools 1/1/2 access-egress
===============================================================================
Pool Information
===============================================================================
Port                  : 1/1/2
Application           : Acc-Egr           Pool Name           : default
Resv CBS              : Sum
-------------------------------------------------------------------------------
High Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State      Start-Avg(%)   Max-Avg(%)    Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           70            90            75
Queue2          Down           70            90            75
Queue3          Down           70            90            75
Queue4          Down           70            90            75
```

```
Queue5          Down            70           90           75
Queue6          Down            70           90           75
Queue7          Down            70           90           75
Queue8          Down            70           90           75
-------------------------------------------------------------------------------
Low Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down            50           75           75
Queue2          Down            50           75           75
Queue3          Down            50           75           75
Queue4          Down            50           75           75
Queue5          Down            50           75           75
Queue6          Down            50           75           75
Queue7          Down            50           75           75
Queue8          Down            50           75           75
-------------------------------------------------------------------------------
Non Tcp Slope
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down            50           75           75
Queue2          Down            50           75           75
Queue3          Down            50           75           75
Queue4          Down            50           75           75
Queue5          Down            50           75           75
Queue6          Down            50           75           75
Queue7          Down            50           75           75
Queue8          Down            50           75           75
-------------------------------------------------------------------------------
Time Avg Factor
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Queue Id   Time Avg Factor
-------------------------------------------------------------------------------
Queue1          7
Queue2          7
Queue3          7
Queue4          7
Queue5          7
Queue6          7
Queue7          7
Queue8          7
MMU Pool Total In Use: 0 KB             MMU Pool Shared In*: 0 KB
Pool Total           : 163 KB
Pool Shared          : 89 KB            Pool Resv          : 68 KB
Pool Total In Use    : 0 KB
Pool Shared In Use   : 0 KB             Pool Resv In Use   : 0 KB
-------------------------------------------------------------------------------
FC-Maps                         ID       CBS (B)    Depth  A.CIR     A.PIR
                                                           O.CIR     O.PIR
-------------------------------------------------------------------------------
be                              1/1/2    8698        0     0         1000000
                                                           0         Max
l2                              1/1/2    8698        0     0         1000000
                                                           0         Max
```

```
af                               1/1/2    8698        0      0         1000000
                                                             0         Max
l1                               1/1/2    8698        0      0         1000000
                                                             0         Max
h2                               1/1/2    8698        0      0         1000000
                                                             0         Max
ef                               1/1/2    8698        0      0         1000000
                                                             0         Max
h1                               1/1/2    8698        0      0         1000000
                                                             0         Max
nc                               1/1/2    8698        0      0         1000000
                                                             0         Max
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

Table 34 **Show Pool Output Fields**

Label	Description
Type	Specifies the pool type.
ID	Specifies the card/mda or card/MDA/port designation.
Application/Type	Specifies the nature of usage the pool would be used for. The pools could be used for access or network traffic at either ingress or egress.
Pool Name	Specifies the name of the pool being used.
Resv CBS	Specifies the percentage of pool size reserved for CBS.
Utilization	Specifies the type of the slope policy.
State	The administrative status of the port.
Start-AvgThreshold	Specifies the percentage of the buffer utilized after which the drop probability starts to rise above 0.
Max-Avg	Specifies the percentage of the buffer utilized after which the drop probability is 100 percent. This implies that all packets beyond this point will be dropped.
Time Avg Factor	Specifies the time average factor the weighting between the previous shared buffer average utilization result and the new shared buffer utilization in determining the new shared buffer average utilization.
Actual ResvCBS	Specifies the actual percentage of pool size reserved for CBS.
Admin ResvCBS	Specifies the percentage of pool size reserved for CBS.
PoolSize	Specifies the size in percentage of buffer space. The value '-1' implies that the pool size should be computed as per fair weighting between all other pools.

Table 34 Show Pool Output Fields (Continued)

Label	Description
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.

Sample Output — 7210 SAS-M

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

```
-------------------------------------------------------------------------------
QueueId        State     Start-Avg(%)   Max-Avg(%)   Max-Prob(%)
-------------------------------------------------------------------------------
Queue1          Down           50           75          75
Queue2          Down           50           75          75
Queue3          Down           50           75          75
Queue4          Down           50           75          75
Queue5          Down           50           75          75
Queue6          Down           50           75          75
Queue7          Down           50           75          75
Queue8          Down           50           75          75
-------------------------------------------------------------------------------
Time Avg Factor
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Queue Id   Time Avg Factor
-------------------------------------------------------------------------------
Queue1           7
Queue2           7
Queue3           7
Queue4           7
Queue5           7
Queue6           7
Queue7           7
Queue8           7
MMU Pool Total In Use: 0 KB              MMU Pool Shared In*: 0 KB
Pool Total           : 163 KB
Pool Shared          : 89 KB             Pool Resv          : 68 KB
Pool Total In Use    : 0 KB
Pool Shared In Use   : 0 KB              Pool Resv In Use   : 0 KB
-------------------------------------------------------------------------------
FC-Maps                         ID       CBS (B)     Depth  A.CIR     A.PIR
                                                            O.CIR     O.PIR
-------------------------------------------------------------------------------
be                              1/1/1    8698        0      0         1000000
                                                            0         Max
l2                              1/1/1    8698        0      250000    1000000
                                                            250000    Max
af                              1/1/1    8698        0      250000    1000000
                                                            250000    Max
l1                              1/1/1    8698        0      250000    1000000
                                                            250000    Max
h2                              1/1/1    8698        0      1000000   1000000
                                                            Max       Max
ef                              1/1/1    8698        0      1000000   1000000
                                                            Max       Max
h1                              1/1/1    8698        0      100000    1000000
                                                            100000    Max
nc                              1/1/1    8698        0      100000    1000000
                                                            100000    Max
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:MTU-A#
```

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)            O.CIR     O.PIR
-------------------------------------------------------------------------------
Sap Egress Queues:

No Match Found
Network/Access Queues:

1/1/1                           be       131328    0        0         1000000
                                         262656             0         1000448
1/1/1                           l2       131328    0        100000    1000000
                                         262656             100032    1000448
1/1/1                           af       131328    0        100000    1000000
                                         262656             100032    1000448
1/1/1                           l1       131328    0        100000    1000000
                                         262656             100032    1000448
1/1/1                           h2       131328    0        200000    1000000
                                         262656             200064    1000448
1/1/1                           ef       131328    0        200000    1000000
                                         262656             200064    1000448
1/1/1                           h1       131328    0        50000     1000000
                                         262656             50016     1000448
1/1/1                           nc       131328    0        50000     1000000
                                         262656             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)            O.CIR     O.PIR
-------------------------------------------------------------------------------
Sap Egress Queues:

No Match Found
Network/Access Queues:
```

```
1/1/1                          be       131328    0        0          1000000
                                        131328             0          1000448
1/1/1                          l2       131328    0        100000     1000000
                                        131328             100032     1000448
1/1/1                          af       131328    0        100000     1000000
                                        131328             100032     1000448
1/1/1                          l1       131328    0        100000     1000000
                                        131328             100032     1000448
1/1/1                          h2       131328    0        200000     1000000
                                        131328             200064     1000448
1/1/1                          ef       131328    0        200000     1000000
                                        131328             200064     1000448
1/1/1                          h1       131328    0        50000      1000000
                                        131328             50016      1000448
1/1/1                          nc       131328    0        50000      1000000
                                        131328             50016      1000448
===============================================================================
*A:7210SAS>show#
```

2.18.2.2.2 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* **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

Supported 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.

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

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

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

Values 1, 2 (for 7210 SAS-M)

1 (for all 7210 SAS platforms)

1 to 24 (depending on the MDA type)

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

description — Displays port description strings.

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

ethernet — Displays Ethernet port information.

efm-oam — Displays EFM OAM information.

detail — Displays detailed information about the Ethernet port.

A1 — Displays the out-of-band Ethernet port information.

acr — Displays ACR-capable port information. This keyword is only supported on the 7210 SAS-M configured on a T1 or E1 MDA.

ptp-hw-timestamp — The 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx 1/10GE, and 7210 SAS-Sx 10/100GE 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 **Port Output**

The following tables describe port output fields:

- Sample Output — General Port Output Fields
- Sample Output — General Port Output, 7210 SAS-X
- Sample Output — Specific Port Output
- Sample Output — Detailed Port Output
- 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 — Ethernet Output Fields, 7210 SAS-X
- Sample Output — Access Egress Queue Override
- Sample Output — Ethernet Statistics
- Sample Output — Ethernet-like Medium Statistics
- Sample Output — Port Associations
- Sample Output — A1 Detailed
- Sample Output — A1 Detailed, 7210 SAS-X
- Sample Output — Port ACR Detail
- Sample Output — Dot1x Detail
- Sample Output — Detail, 7210 SAS-Sx 10/100GE
- Sample Output — Port PTP Hardware Timestamp

Sample Output — General Port Output Fields

Table 35 Show Port Output Fields

Label	Description
Port ID	The port ID configured or displayed in the *slot/mda/port* format.
Admin State	Up — The administrative state is up.
	Down — The administrative state is down.
Phy Link	Yes — A physical link is present.
	No — A physical link is not present.
Port State	Up — The port is physically present and has physical link present.
	Down — The port is physically present but does not have a link.
	Ghost — A port that is not physically present.
	None — The port is in its initial creation state or about to be deleted.
	Link Up — A port that is physically present and has physical link present.
	Link Down — A port that is physically present but does not have a link.
Cfg MTU	The configured MTU.
Oper MTU	The negotiated size of the largest packet which can be sent on the port specified in octets.
LAG ID	The LAG or multi-link trunk (MLT) that the port is assigned to.
Port Mode	network — The port is configured for transport network use.
	access — The port is configured for service access.
Port Encap	Null — Ingress frames will not use tags or labels to delineate a service.
	dot1q — Ingress frames carry 802.1Q tags where each tag signifies a different service.
	QinQ — Encapsulation type specified for QinQ Access SAPs.
Port Type	The type of port or optics installed.

Table 35 Show Port Output Fields (Continued)

Label	Description
SFP/MDI MDX	GIGE — Indicates the GigE SFP type.
	FASTE — Indicates the FastE SFP type.
	MDI — Indicates that the Ethernet interface is of type MDI (Media Dependent Interface).
	MDX — Indicates that the Ethernet interface is of type MDX (Media Dependent Interface with crossovers).
IP MTU	Displays the configured IP MTU value.

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

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

```
A:SASR-12-A-Ring># show port 1/1/1
===============================================================================
Ethernet Interface
```

```
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                      Oper Speed       : 1 Gbps
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : up                         Oper Duplex      : full
Oper State         : up                         Config Duplex    : full
Physical Link      : Yes                        MTU              : 9212
Single Fiber Mode  : No                         LoopBack Mode    : None
IfIndex            : 35684352                   Hold time up     : 0 seconds
Last State Change  : 12/04/2017 16:06:54        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled
Phys State Chng Cnt: 3
Ptp timestamp      : enabled
Configured Mode    : network                    Encap Type       : null


*A:7210SAS>show# port

==============================================================================
Ports on Slot 1
==============================================================================
Port        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
------------------------------------------------------------------------------
1/1/1       Down  No   Down    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        Admin Link Port    Cfg  Oper LAG/ Port Port Port   SFP/XFP/
Id          State      State   MTU  MTU  Bndl Mode Encp Type   MDIMDX
------------------------------------------------------------------------------
A/1         Up    Yes  Up      1514 1514    - netw null faste  MDI
==============================================================================
```

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

Sample Output — General Port Output, 7210 SAS-X

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

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/2                      Oper Speed       : N/A
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : down                       Oper Duplex      : N/A
Oper State         : down                       Config Duplex    : full
Physical Link      : No                         MTU              : 9212
Single Fiber Mode  : No                         LoopBack Mode    : None
IfIndex            : 35717120                   Hold time up     : 0 seconds
Last State Change  : 03/03/2012 15:10:30        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled

Configured Mode    : network                    Encap Type       : null
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7                     Acc Egr Sch Mode : N/A
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                    Network Qos Pol  : 1
Egr. Remark        : False                      Egr. Remark Plcy : N/A

Acc Egr Marking    : N/A                        Acc Egr Policy ID: 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
Code-Type          : SDH                        Tx Quality Level : N/A
Tx DUS/DNU         : Disabled

Down On Int. Error : Disabled

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

Configured Address : 7c:20:64:ad:00:f2
Hardware Address   : 7c:20:64:ad:00:f2
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
```

```
Model Number       : 0000000000000000000000000000000
TX Laser Wavelength: 0 nm                            Diag Capable     : no
Connector Code     : LC                              Vendor OUI       : 00:30:d3
Manufacture date   : 2006/01/13                      Media            : Ethernet
Serial Number      : AM060202TW
Part Number        : HFBR-5710L
Optical Compliance : GIGE-SX
Link Length support: 550m for 50u MMF; 270m for 62.5u MMF

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

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

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

Alignment Errors :                   0  Sngl Collisions  :                   0
FCS Errors       :                   0  Mult Collisions  :                   0
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
===============================================================================
*A:7210SAS>show#
```

Sample Output — Specific Port Output

The following table describes port output fields for a specific port.

Table 36 **Show Specific Port Output Fields**

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.

Table 36 Show Specific Port Output Fields (Continued)

Label	Description
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.
	Additionally, the *lag-id* of the LAG it belongs to in addition to the status of the LAG member (active or standby) is specified.
Duplex	Full — The link is set to full duplex mode.
	Half — The link is set to half duplex mode.
Hold time up	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
Hold time down	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
Physical Link	Yes — A physical link is present.
	No — A physical link is not present.
IfIndex	Displays the interface's index number which reflects its initialization sequence.
Last State chg	Displays the system time moment that the peer is up.
Configured Mode	network — The port is configured for transport network use.
	access — The port is configured for service access.
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.

Table 36 **Show Specific Port Output Fields (Continued)**

Label	Description
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. 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 sub-layer.
Transceiver Type	Type of the transceiver.
Model Number	The model number of the transceiver.
Transceiver Code	The code for the transmission media.
Laser Wavelength	The light wavelength transmitted by the transceiver's laser.
Connector Code	The vendor organizationally unique identifier field (OUI) contains the IEEE company identifier for the vendor.

Table 36 Show Specific Port Output Fields (Continued)

Label	Description
Diag Capable	Indicates if the transceiver is capable of doing diagnostics.
Vendor OUI	The vendor-specific identifier field (OUI) contains the IEEE company identifier for the vendor.
Manufacture date	The manufacturing date of the hardware component in the mmddyyyy ASCII format.
Media	The media supported for the SFP.
Serial Number	The vendor serial number of the hardware component.
Part Number	The vendor part number contains ASCII characters, defining the vendor part number or product name.
Input/Output	When the collection of accounting and statistical data is enabled, then octet, packet, and error statistics are displayed.
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.
Speed	The speed of the interface
Link-level	Ethernet — The port is configured as Ethernet.
	SONET — The port is configured as SONET-SDH
MTU	The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets.
Admin State	Up — The port is administratively up.
	Down — The port is administratively down.
Oper State	Up — The port is operationally up.
	Down — The port is operationally down.
Duplex	Full — The link is set to full duplex mode.
	Half — The link is set to half duplex mode.
Hold time up	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
Hold time down	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
IfIndex	Displays the interface's index number which reflects its initialization sequence.

Table 36 Show Specific Port Output Fields (Continued)

Label	Description
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. enabled — PTP port-based timestamping is enabled. 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.
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.

Table 36 Show Specific Port Output Fields (Continued)

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 Buf (Acc)	The access-buffer policy for the egress buffer.
Egress Buf (Net)	The network-buffer policy for the egress buffer.
Ingress Buf (Acc)	The access-buffer policy for the ingress buffer.
Ingress Pool Size	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Unicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both group and functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.

Table 36 Show Specific Port Output Fields (Continued)

Label	Description
Broadcast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Discards Input/Output	The number of inbound packets chosen to be discarded to possibly free up buffer space.
Unknown Proto Discards Input/Output	For packet-oriented interfaces, the number of packets received through the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
Errors	This field displays the number of cells discarded due to uncorrectable HEC errors. Errors do not show up in the raw cell counts.
Sync. Status Msg	Whether synchronization status messages are enabled or disabled.
Tx DUS/DNU	Whether the QL value is forcibly set to QL-DUS/QL-DNU.
Rx Quality Level	Indicates which QL value has been received from the interface.
Tx Quality Level	Indicates which QL value is being transmitted out of the interface.
SSM Code Type	Indicates the SSM code type in use on the port.

Sample Output — Detailed Port Output

The following table describes detailed port output fields.

Table 37 Show Detailed Port Output Fields

Label	Description
Description	A text description of the port.
Interface	The port ID displayed in the *slot/mda/port* format.

Table 37 **Show Detailed Port Output Fields (Continued)**

Label	Description
Speed	The speed of the interface.
Link-level	Ethernet — The port is configured as Ethernet.
MTU	The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets.
Admin State	Up — The port is administratively up.
	Down — The port is administratively down.
Oper State	Up — The port is operationally up.
	Down — The port is operationally down.
Duplex	Full — The link is set to full duplex mode.
	Half — The link is set to half duplex mode.
Hold time up	The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.
Hold time down	The link down dampening time in seconds. The **down** timer controls the dampening timer for link down transitions.
IfIndex	Displays the interface's index number which reflects its initialization sequence.
Phy Link	Yes — A physical link is present.
	No — A physical link is not present.
Configured Mode	network — The port is configured for transport network use.
	access — The port is configured for service access.
Network Qos Pol	The QoS policy ID applied to the port.
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.

Table 37 Show Detailed Port Output Fields (Continued)

Label	Description
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.
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.

Table 37 Show Detailed Port Output Fields (Continued)

Label	Description
Ingress Pool Size	The amount of ingress buffer space, expressed as a percentage of the available buffer space, that will be allocated to the port for ingress buffering.
Configured Address	The base chassis Ethernet MAC address.
Hardware Address	The interface's hardware or system assigned MAC address at its protocol sub-layer.
Errors Input/Output	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Unicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Multicast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Broadcast Packets Input/Output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.

Table 37 Show Detailed Port Output Fields (Continued)

Label	Description
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.
Acc Egr Marking	Displays the type of marking enabled on the access egress policy. (supported only on SAS-X)
Acc Egr Policy ID	Displays the policy ID of the access egress policy associated with the port. (supported only on SAS-X)

```
*A:MTU-A# show port 1/1/1
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                    Oper Speed       : 1 Gbps
Link-level         : Ethernet                 Config Speed     : 1 Gbps
Admin State        : up                       Oper Duplex      : full
Oper State         : up                       Config Duplex    : full
Physical Link      : Yes                      MTU              : 1578
Single Fiber Mode  : No                                          : Internal
```

```
IfIndex           : 35684352                 Hold time up     : 0 seconds
Last State Change : 06/27/2001 11:15:22      Hold time down   : 0 seconds
Last Cleared Time : 06/27/2001 11:14:44

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

Down-when-looped   : Disabled                Keep-alive       : 10
Loop Detected      : False                   Retry            : 120
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:11:00:22:bc:13
Hardware Address   : 00:11:00:22:bc:13
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00027AAAA02  ALA  IPUIAELDAB2
TX Laser Wavelength: 850 nm                  Diag Capable     : yes
Connector Code     : LC                      Vendor OUI       : 00:90:65
Manufacture date   : 2008/09/29              Media            : Ethernet
Serial Number      : PEC5184
Part Number        : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                           1556859                1766709
Packets                                            18523                   5849
Errors                                                 0                      0
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                     3324                   5847
Multicast Packets                                  15199                      0
Broadcast Packets                                      0                      2
Discards                                               0                      0
Unknown Proto Discards                                 0
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                 0  Sngl Collisions  :                    0
FCS Errors       :                 0  Mult Collisions  :                    0
```

```
SQE Test Errors  :                   0  Late Collisions  :                   0
CSE              :                   0  Excess Collisns  :                   0
Too long Frames  :                   0  Int MAC Tx Errs  :                   0
Symbol Errors    :                   0  Int MAC Rx Errs  :                   0
===============================================================================
*A:MTU-A#

*A: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  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
===============================================================================
* 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
===============================================================================
*A:SAS-M>config>port#


*A:SAS-M>config>port# /show port 1/1/1 detail
===============================================================================
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                                          : Internal
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  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                       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  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:MTU-A#

*A:MTU-A# show port 1/1/1
===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                          Oper Speed       : 1 Gbps
Link-level         : Ethernet                       Config Speed     : 1 Gbps
Admin State        : up                             Oper Duplex      : full
Oper State         : up                             Config Duplex    : full
Physical Link      : Yes                            MTU              : 1578
Single Fiber Mode  : No                                              : Internal
IfIndex            : 35684352                       Hold time up     : 0 seconds
Last State Change  : 06/27/2001 11:15:22            Hold time down   : 0 seconds
Last Cleared Time  : 06/27/2001 11:14:44

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

Down-when-looped   : Disabled                       Keep-alive       : 10
Loop Detected      : False                          Retry            : 120
Down On Int. Error : Disabled

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

Transceiver Data

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

```
Part Number        : FTRJ8519P2BNL-A5
Optical Compliance : GIGE-SX
Link Length support: 300m for 50u MMF; 150m for 62.5u MMF;
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                           1556859                1766709
Packets                                            18523                   5849
Errors                                                 0                      0
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                     3324                   5847
Multicast Packets                                  15199                      0
Broadcast Packets                                      0                      2
Discards                                               0                      0
Unknown Proto Discards                                 0
===============================================================================
Ethernet-like Medium Statistics
===============================================================================
Alignment Errors :                  0  Sngl Collisions  :                     0
FCS Errors       :                  0  Mult Collisions  :                     0
SQE Test Errors  :                  0  Late Collisions  :                     0
CSE              :                  0  Excess Collisns  :                     0
Too long Frames  :                  0  Int MAC Tx Errs  :                     0
Symbol Errors    :                  0  Int MAC Rx Errs  :                     0
===============================================================================
*A:MTU-A#
```

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                      Oper Speed       : N/A
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : down                       Oper Duplex      : N/A
Oper State         : down                       Config Duplex    : full
Physical Link      : No                         MTU              : 9212
Single Fiber Mode  : No                                          : Internal
IfIndex            : 35684352                   Hold time up     : 0 seconds
Last State Change  : 03/03/2011 04:34:26        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled

Configured Mode    : network                    Encap Type       : null
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
```

```
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: 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
Code-Type          : SDH                        Tx Quality Level : N/A
Tx DUS/DNU         : Disabled
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:25:ba:02:bd:62
Hardware Address   : 00:25:ba:02:bd:62
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   : 2010/01/06                 Media            : Ethernet
Serial Number      : PH22J35
Part Number        : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
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>


*A:ces-A# show port 1/2/1 detail
===============================================================================
TDM DS1 Physical Interface
===============================================================================
Description        : DS1/E1
Interface          : 1/2/1                  Port IfIndex         : 37781504
Admin Status       : up                     Oper Status          : up
Physical Link      : Yes
Line Impedance     : 100
Type               : ds1                    Buildout             : short
Length             : 133
===============================================================================
===============================================================================
Port Statistics
===============================================================================
                                                   Input               Output
-------------------------------------------------------------------------------
Packets                                         20062480              1887151
Discards                                               0                    0
Unknown Proto Discards                                 0
===============================================================================
*A:ces-A#

*A:ces-A# show port 1/2/1.ds1 detail
===============================================================================
TDM DS1 Interface
===============================================================================
Description        : DS1
Interface          : 1/2/1.ds1
Type               : ds1                     Framing              : ds1-unframed
Admin Status       : up                      Oper Status          : up
Physical Link      : yes                     Clock Source         : adaptive
Clock Sync State   : normal
Last State Change  : 07/06/2010 11:31:37     Channel IfIndex      : 574652417
Loopback           : none
Remote Loop respond: N/A                     In Remote Loop       : N/A
```

```
Cfg Alarm          : ais los
Alarm Status       :
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                        3853385856              363722496
Packets                                         20069718                1894388
Errors                                                 0                      0
===========================
DS1/E1 Line
===========================

---------------------------
ES                     1
SES                    1
SEFS                   1
UAS                    0
CSS                    1
PCV                    0
LES                    1
BES                    0
DM                     0
LCV      :
==========================
==========================
Transmit:

AIS      :             0

Receive:

AIS      :             0
LOS      :             0
LOF      :             0

Looped   :             0
==========================
===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Packets                                         20069718                1894388
Discards                                               0                      0
Unknown Proto Discards                                 0
===============================================================================
*A:ces-A#

*A:ces-A# show port 1/2/1.1 detail
===============================================================================
TDM DS0 Chan Group
===============================================================================
Description        : DS0GRP
Interface          : 1/2/1.1
TimeSlots          : 1-24
Speed              : 64
```

```
Admin Status       : up                     Oper Status         : up
Last State Change  : 07/06/2010 11:31:38    Chan-Grp IfIndex    : 574652477

Configured mode    : access                 Encap Type          : cem
Admin MTU          : 1514                   Oper MTU            : 1514
Scramble           : false
Physical Link      : yes                    Idle Cycle Flags    : n/a
Payload Fill Type  : all-ones               Payload Pattern     : N/A
Signal Fill Type   : n/a                    Signal Pattern      : N/A
===============================================================================
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                        3854167488              364504128
Packets                                         20073789                1898459
Errors                                                 0                      0
===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Packets                                         20073789                1898459
Discards                                               0                      0
Unknown Proto Discards                                 0
===============================================================================

*A:MTU-T1>show# port 1/1/6

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/6                     Oper Speed       : N/A
Link-level         : Ethernet                  Config Speed     : 1 Gbps
Admin State        : down                      Oper Duplex      : N/A
Oper State         : down                      Config Duplex    : full
Physical Link      : No                        MTU              : 9212
Single Fiber Mode  : No
IfIndex            : 35848192                  Hold time up     : 0 seconds
Last State Change  : 04/06/2001 07:30:45       Hold time down   : 0 seconds
Last Cleared Time  : N/A                       DDM Events       : Enabled

Configured Mode    : network                   Encap Type       : null
Dot1Q Ethertype    : 0x8100                    QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                       Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: 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
===============================================================================
* 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
===============================================================================
*A:MTU-T1>show#


*A:MTU-T1>show# port 1/1/6 detail

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/6                      Oper Speed       : N/A
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : down                       Oper Duplex      : N/A
Oper State         : down                       Config Duplex    : full
Physical Link      : No                         MTU              : 9212
Single Fiber Mode  : No                                          : None
IfIndex            : 35848192                   Hold time up     : 0 seconds
Last State Change  : 04/06/2001 07:30:45        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled

Configured Mode    : network                    Encap Type       : null
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: 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                    Oper Speed       : N/A
Link-level         : Ethernet                 Config Speed     : 1 Gbps
Admin State        : down                     Oper Duplex      : N/A
Oper State         : down                     Config Duplex    : full
Reason Down        : noServicePort
Physical Link      : No                       MTU              : 9212
Single Fiber Mode  : No                                        : Internal
IfIndex            : 35717120                 Hold time up     : 0 seconds
Last State Change  : 12/20/2010 20:51:55      Hold time down   : 0 seconds
Last Cleared Time  : N/A                      DDM Events       : Enabled

Configured Mode    : network                  Encap Type       : null
Dot1Q Ethertype    : 0x8100                   QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                      Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: 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: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                       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: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                      Oper Speed       : 10 Gbps
Link-level         : Ethernet                   Config Speed     : N/A
Admin State        : up                         Oper Duplex      : full
Oper State         : down                       Config Duplex    : N/A
Physical Link      : No                         MTU              : 1518
Single Fiber Mode  : No                         LoopBack Mode    : None
IfIndex            : 35684352                   Hold time up     : 0 seconds
Last State Change  : 01/01/2000 00:10:14        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled
Phys State Chng Cnt: 0
Ptp timestamp      : enabled
Configured Mode    : access                     Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                    Network Qos Pol  : n/a
Table-based        : disabled
DSCP Class Pol Id  : n/a                        Untagged-Fc      : n/a
Acc Egr Policy ID  : 1
Auto-negotiate     : N/A                        MDI/MDX          : N/A
Accounting Policy  : None                       Collect-stats    : Disabled
Acct Plcy Eth Phys : None                       Collect Eth Phys : Disabled
Egress Rate        : Default                    Max Burst        : Default
LACP Tunnel        : Disabled                   DEI Classificati*: Disabled
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                   Keep-alive       : 10
Loop Detected      : False                      Retry            : 120
Use Broadcast Addr : False
Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A
Tx DUS/DNU         : Disabled                   Tx Quality Level : N/A
SSM Code Type      : sdh
Down On Int. Error : Disabled
CRC Mon SD Thresh  : Disabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled
EFM OAM            : Disabled                   EFM OAM Link Mon : Disabled
Configured Address :
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
===============================================================================
```

```
===============================================================================
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                      Oper Speed       : 1 Gbps
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : up                         Oper Duplex      : full
Oper State         : up                         Config Duplex    : full
Physical Link      : Yes                        MTU              : 9212
```

```
Config Conn Type   : SFP                        Oper Conn Type   : SFP
Single Fiber Mode  : No                         LoopBack Mode    : None
IfIndex            : 35684352                   Hold time up     : 0 seconds
Last State Change  : 09/03/2015 06:28:58        Hold time down   : 0 seconds
Last Cleared Time  : N/A                        DDM Events       : Enabled
Phys State Chng Cnt: 1

Configured Mode    : network                    Encap Type       : null
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                    Network Qos Pol  : 1
Egr. Remark        : False                      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
===============================================================================

===============================================================================
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                       Oper Speed       : N/A
Link-level         : Ethernet                    Config Speed     : 1 Gbps
Admin State        : up                          Oper Duplex      : N/A
Oper State         : down                        Config Duplex    : full
Physical Link      : No                          MTU              : 1518
Single Fiber Mode  : No                          LoopBack Mode    : None
IfIndex            : 169902080                   Hold time up     : 0 seconds
Last State Change  : 11/07/2017 05:02:44         Hold time down   : 0 seconds
Last Cleared Time  : N/A                         DDM Events       : Enabled
Phys State Chng Cnt: 0
Ptp timestamp      : enabled
Configured Mode    : access                      Encap Type       : 802.1q
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                     Network Qos Pol  : n/a
Table-based        : enabled
DSCP Class Pol Id  : 1                           Untagged-Fc      : be
Acc Egr Policy ID  : 1
Auto-negotiate     : true                        MDI/MDX          : unknown
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*: Enabled
Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                   Keep-alive       : 10
Loop Detected      : False                      Retry            : 120
Use Broadcast Addr : False
Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A
Tx DUS/DNU         : Disabled                   Tx Quality Level : N/A
SSM Code Type      : sdh
Down On Int. Error : Disabled
CRC Mon SD Thresh  : Disabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled
EFM OAM            : Disabled                   EFM OAM Link Mon : 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                     Diag Capable     : yes
Connector Code     : LC                         Vendor OUI       : 00:90:65
Manufacture date   : 2010/05/28                 Media            : Ethernet
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
===============================================================================
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 — Ethernet Output Fields, 7210 SAS-X

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

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/2                    Oper Speed       : N/A
Link-level         : Ethernet                 Config Speed     : 1 Gbps
Admin State        : up                       Oper Duplex      : N/A
Oper State         : down                     Config Duplex    : full
Physical Link      : No                       MTU              : 1514
Single Fiber Mode  : No                                        : None
IfIndex            : 35717120                 Hold time up     : 0 seconds
Last State Change  : 11/11/2010 11:45:40      Hold time down   : 0 seconds
Last Cleared Time  : N/A                      DDM Events       : Enabled

Configured Mode    : access                   Encap Type       : null
Dot1Q Ethertype    : 0x8100                   QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                      Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                  Network Qos Pol  : n/a
Acc Egr Marking    : Sap-based                Acc Egr Policy ID: 1
Auto-negotiate     : true                     MDI/MDX          : unknown
Accounting Policy  : None                     Collect-stats    : Disabled
Egress Rate        : Default                  Max Burst        : Default
Load-balance-algo  : default                  LACP Tunnel      : Disabled
LACP Tunnel        : Disabled
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 : 7c:20:64:ad:00:f2
Hardware Address   : 7c:20:64:ad:00: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   : 2008/03/17               Media            : Ethernet
Serial Number      : PDC0C4V
Part Number        : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
Link Length support: 100m for copper

===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                                 0                   1408
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                         :              1408
Packets                        :                 0
Packets of 64 Octets           :                22
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
===============================================================================

A:7210-SAS-X>show#
*A:SAS-M>show# show port 1/1/1

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100/Gig Ethernet SFP
Interface          : 1/1/1                      Oper Speed       : 1 Gbps
Link-level         : Ethernet                   Config Speed     : 1 Gbps
Admin State        : up                         Oper Duplex      : full
Oper State         : up                         Config Duplex    : full
Physical Link      : Yes                        MTU              : 1522
Single Fiber Mode  : No                                          : Internal
IfIndex            : 35684352                   Hold time up     : 0 seconds
Last State Change  : 04/29/2001 06:59:15        Hold time down   : 0 seconds
Last Cleared Time  : 04/28/2001 03:09:37        DDM Events       : Enabled

Configured Mode    : access                     Encap Type       : QinQ
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol: default                    Network Qos Pol  : n/a
Egr. Sched. Pol    : default                    Access Egr. Qos *: 1
Auto-negotiate     : true                       MDI/MDX          : MDI
Accounting Policy  : None                       Collect-stats    : Disabled
Egress Rate        : Default                    Max Burst        : Default
LACP Tunnel        : Disabled

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

Sync. Status Msg.  : Enabled                   Rx Quality Level : N/A
Down On Int. Error : Enabled

CRC Mon SD Thresh  : Disabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Disabled
Configured Address : 00:25:ba:02:ea:02
Hardware Address   : 00:25:ba:02:ea:02
Cfg Alarm          :
Alarm Status       :

Transceiver Data

Transceiver Type   : SFP
Model Number       : 3HE00028AAAA02  ALA  IPUIAEMDAB
TX Laser Wavelength: 1310 nm                    Diag Capable     : yes
Connector Code     : LC                         Vendor OUI       : 00:06:b5
Manufacture date   : 2008/09/17                 Media            : Ethernet
```

```
Serial Number      : 8AIT200082
Part Number        : SPGBLXTDBAL
Optical Compliance : GIGE-LX
Link Length support: 10km for SMF

===============================================================================
Transceiver Digital Diagnostic Monitoring (DDM), Externally Calibrated
===============================================================================
                              Value High Alarm  High Warn   Low Warn  Low Alarm
-------------------------------------------------------------------------------
Temperature (C)              +40.5     +98.0      +96.0      -42.0     -43.0
Supply Voltage (V)            3.23      4.12       3.60       3.00      2.80
Tx Bias Current (mA)          25.5     100.0       85.0        7.5       5.0
Tx Output Power (dBm)        -5.67     -1.00      -2.00     -10.00    -11.00
Rx Optical Power (avg dBm)   -1.87     -1.00      -2.00!    -23.01    -24.01
===============================================================================

===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                     9670292997181                      0
Packets                                     142210189554                      0
Errors                                              2651                      0
===============================================================================
* indicates that the corresponding row element may have been truncated.

===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                             142210189554                      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       :              1095  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    :              1509  Int MAC Rx Errs  :                  0
===============================================================================
```

Sample Output — Access Egress Queue Override

The following table describes Ethernet access egress queue override output fields.

Table 38 Show Ethernet Access Egress Queue Override Output Fields

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 **strict** or **weighted**.
weight	The *weight* value that overrides the value configured in the access egress QoS policy assigned to the port.
rate cir	The *rate-cir* value that overrides the value configured in the access egress QoS policy assigned to the port. The displayed CIR value is specified in kilobits per second (kbps) when the **rate** command is used or as a percentage of egress port line rate (that is, the port limit) when the **percent-rate** command is used.
rate pir	The *rate-pir* value that overrides the value configured in the access egress QoS policy assigned to the port. The displayed PIR value is specified in kilobits per second (kbps) when the **rate** command is used or as a percentage of egress port line rate (that is, the port limit) when the **percent-rate** command is used.
adaptation-rule cir	The adaptation rule CIR setting (**min**, **max**, or **closest**) that overrides the setting configured in the access egress QoS policy assigned to the port.
adaptation-rule pir	The adaptation rule PIR setting (**min**, **max**, or **closest**) 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 39 Show Ethernet Statistics Output Fields

Label	Description
Broadcast Pckts	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Multicast Pckets	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses. The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses.
Undersize Pckets	The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed.
Oversize Pckts	The total number of packets received that were longer than can be accepted by the physical layer of that port (9900 octets excluding framing bits, but including FCS octets for GE ports) and were otherwise well formed.
Collisions	The best estimate of the total number of collisions on this Ethernet segment.

Table 39 Show Ethernet Statistics Output Fields (Continued)

Label	Description
Drop Events	The total number of events in which packets were dropped by the probe due to lack of resources. Note that this number is not necessarily the number of packets dropped; it is just the number of times this condition has been detected.
CRC Align Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Fragments	The total number of packets received that were less than 64 octets (excluding framing bits but including FCS octets) and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Jabbers	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Ingress Pool Size	The amount of ingress buffer space, expressed as a percentage of the available buffer space that will be allocated to the port for ingress buffering.
Octets	The total number of octets received.
Packets	The total number of packets received.
Packets to	The number of packets received that were equal to or less than the displayed octet limit.

```
===============================================================================
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 40 **Show Ethernet-like Medium Statistics Output Fields**

Label	Description
Alignment Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets.
FCS Errors	The number of frames received that are an integral number of octets 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 due to excessive collisions.
Int MAC Tx Errs	The number of frames for which a transmission fails due to an internal MAC sub-layer transmit error.
Int MAC Rx Errs	The number of frames for which a reception fails due to an internal MAC sub-layer receive error.

Table 40 Show Ethernet-like Medium Statistics Output Fields (Continued)

Label	Description
Multicast Pckts	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Undersize Pckts	The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed.
Oversize Pckts	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed.
Collisions	The best estimate of the total number of collisions on this Ethernet segment.
Drop Events	The total number of times that packets were detected as being dropped due to a lack of resources (not necessarily the total number of packets dropped).
CRC Align Errors	The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Fragments	The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
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.

Table 40 Show Ethernet-like Medium Statistics Output Fields (Continued)

Label	Description
Unicast packets input/output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Multicast packets input/output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sub-layer, including those that were discarded or not sent.
Broadcast packets input/output	The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast or multicast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sub-layer, including those that were discarded or not sent.
Discards input/output	The number of inbound packets chosen to be discarded to possibly free up buffer space.
Unknown proto discards input/output	For packet-oriented interfaces, the number of packets received via the interface that were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing, the number of transmission units received via the interface that were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0.
Unknown proto	Discards do not show up in the packet counts.

```
*A:MTU-A#
===============================================================================
Ethernet-like Medium Statistics
===============================================================================

Alignment Errors :                  0  Sngl Collisions  :                  0
FCS Errors       :                  0  Mult Collisions  :                  0
SQE Test Errors  :                  0  Late Collisions  :                  0
CSE              :                  0  Excess Collisns  :                  0
Too long Frames  :                  0  Int MAC Tx Errs  :                  0
Symbol Errors    :                  0  Int MAC Rx Errs  :                  0
===============================================================================
*A:MTU-A#
```

Sample Output — Port Associations

The following table describes port associations output fields.

Table 41 Show Port Associations Output Fields

Label	Description
Svc ID	The service identifier.
Name	The name of the IP interface.
Encap Value	The dot1q or qinq encapsulation value on the port for this IP interface

```
*A:MTU-A>config# show port 1/1/23 associations
===============================================================================
Interface Table
===============================================================================
Router/ServiceId                Name                            Encap Val
-------------------------------------------------------------------------------
Router: Base                    one                             0
-------------------------------------------------------------------------------
Interfaces
===============================================================================
*A:MTU-A>config#
```

Sample Output — A1 Detailed

The following table describes A1 detailed output fields.

Table 42 Show A1 Detailed Output Fields

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.

Table 42 Show A1 Detailed Output Fields (Continued)

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.

Table 42 Show A1 Detailed Output Fields (Continued)

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 sub-layer.
Traffic Statistics	Octets input/output – the total number of octets received and transmitted on the port Packets input/output – the number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a multicast or broadcast address at this sublayer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a multicast or broadcast address at this sub-layer, including those that were discarded or not sent. Errors input/output – for packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Ethernet Statistics	Broadcast Pckts — the number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast or multicast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or multicast address at this sub-layer, including those that were discarded or not sent.

```
A:7210>show# port A/1

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
Interface          : A/1                      Oper Speed       : 10 mbps
Link-level         : Ethernet                 Config Speed     : 100 mbps
Admin State        : up                       Oper Duplex      : half
```

```
Oper State         : up                          Config Duplex    : full
Physical Link      : Yes                         MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 67141632                    Hold time up     : 0 seconds
Last State Change  : 07/12/2010 14:26:43         Hold time down   : 0 seconds
Last Cleared Time  : N/A

Configured Mode    : network                     Encap Type       : null
Dot1Q Ethertype    : 0x8100                      QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                         Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol:                             Access Egr. Qos *: n/a
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        : Disabled

Split Horizon Group: (Not Specified)
Down-when-looped   : N/A                         Keep-alive       : N/A
Loop Detected      : N/A                         Retry            : N/A
Use Broadcast Addr : N/A

Sync. Status Msg.  : Disabled                    Rx Quality Level : N/A
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                    CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 00:0a: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 — A1 Detailed, 7210 SAS-X

```
A:7210-SAS-X>show# port A/1

===============================================================================
Ethernet Interface
===============================================================================
Description        : 10/100 Ethernet TX
Interface          : A/1                        Oper Speed       : 100 mbps
Link-level         : Ethernet                   Config Speed     : 100 mbps
Admin State        : up                         Oper Duplex      : full
Oper State         : up                         Config Duplex    : full
Physical Link      : Yes                        MTU              : 1514
Single Fiber Mode  : No
IfIndex            : 67141632                   Hold time up     : 0 seconds
Last State Change  : 11/10/2010 20:50:27        Hold time down   : 0 seconds
Last Cleared Time  : N/A

Configured Mode    : network                    Encap Type       : null
Dot1Q Ethertype    : 0x8100                     QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                        Egr. Pool % Rate : 100
Ing. Pool Policy   : n/a
Egr. Pool Policy   : n/a
Net. Egr. Queue Pol:                            Network Qos Pol  : n/a
Auto-negotiate     : true                       MDI/MDX          : MDI
Accounting Policy  : None                       Collect-stats    : Disabled
Egress Rate        : Default                    Max Burst        : Default
Load-balance-algo  : default                    LACP Tunnel      : Disabled
LACP Tunnel        : Disabled

Down-when-looped   : N/A                        Keep-alive       : N/A
Loop Detected      : N/A                        Retry            : N/A
Use Broadcast Addr : N/A

Sync. Status Msg.  : Disabled                   Rx Quality Level : N/A
Down On Int. Error : Disabled

CRC Mon SD Thresh  : Enabled                   CRC Mon Window   : 10 seconds
CRC Mon SF Thresh  : Enabled
Configured Address : 7c:20:64:ad:00:f0
Hardware Address   : 7c:20:64:ad:00:f0
Cfg Alarm          :
Alarm Status       :
```

```
===============================================================================
Traffic Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Octets                                            411179                      0
Packets                                             5415                      0
Errors                                                 0                      0
===============================================================================

===============================================================================
Port Statistics
===============================================================================
                                                   Input                 Output
-------------------------------------------------------------------------------
Unicast Packets                                        0                      0
Multicast Packets                                      0                      0
Broadcast Packets                                   5415                      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-SAS-X>show#
```

Sample Output — Port ACR Detail

The following table describes ACR detail output fields.

Table 43 **Show Port ACR Detailed Output Fields**

Label	Description
Clock Master PW	The SAP being used by the port for recovering the clock.
Clock Sync State	The current state of the ACR adaptive algorithm.
Endpoint	The type of endpoint.
Bit-rate	The number of DS0s or timeslots in the channel group.
Payload Size	The number of octets contained in the payload of a TDM PW packet when the packet is transmitted.
Jitter Buffer	The size of the receive jitter buffer, expressed in milliseconds.

Table 43 Show Port ACR Detailed Output Fields (Continued)

Label	Description
Use RTP Header	Whether RTP headers are used in CES packets (Yes or No).
CAS Framing	The type of CAS framing.
Effective PDVT	The peak-to-peak packet delay variation (PDV) used by the circuit emulation service. Since the operating system may adjust the jitter buffer setting to ensure no packet loss, the configured jitter buffer value may not be the value used by the system. The effective PDVT provides an indication that the PDV has been adjusted by the operating system.
Cfg Alarm	The alarms that have alarm reporting enabled.
Alarm Status	The current alarm state (for example, stray, malformed, packet loss, overrun, underrun, remote packet loss, remote fault, or remote RDI).
ACR DPLL Statistics	**Frequency offset mean** — The ACR frequency offset mean for the previous 15 sets of 60-second intervals. **Frequency offset stddev** — The ACR frequency offset standard deviation for the previous 15 sets of 60-second intervals. **Phase error mean** — The ACR input phase error mean and output DCO mean for the previous 15 sets of 60-second intervals. **Phase error stddev** — The ACR input phase error standard deviation and output DCO standard deviation for the previous 15 sets of 60-second intervals.
Algorithm State Counts	**Normal** — The number of 2-second intervals the ACR algorithm was in the normal state. **Phase-tracking** — The number of 2-second intervals the ACR algorithm was in the phase-tracking state. **Freq-tracking** — The number of 2-second intervals the ACR algorithm was in the frequency tracking state. **Holdover** — The number of 2-second intervals the ACR algorithm was in the holdover state. **Free-run** — The number of 2-second intervals the ACR algorithm was in the free-run state.

Table 43 Show Port ACR Detailed Output Fields (Continued)

Label	Description
Events	**ACR Calc Out of Range** — The number of times the ACR algorithm was internally reset. **Prolonged ACR failure** — The number of times the ACR algorithm was in the phase-tracking or holdover state for an extended period of time. **Excessive Packet Loss** — Increments every 2-second interval that ACR is in the phase-tracking state and the tolerated packet loss threshold is exceeded. **Excessive Phase Shift** — Increments each time the ACR algorithm transitions to the phase-tracking state from normal as a result of a phase shift above the tolerated shift level.

```
*A:ces-A# show port 1/2/1.ds1 acr detail

===============================================================================
Adaptive Clock Recovery (ACR) Configuration
===============================================================================
Clock Master PW  : 1/2/1.1
Clock Sync State : normal
-------------------------------------------------------------------------------
CEM SAP Configuration Information
-------------------------------------------------------------------------------
Endpoint Type          : Unstruct. T1     Bit-rate                   : 24
Payload Size           : 192              Jitter Buffer (ms)         : 5
Jitter Buffer (packets): 6                Playout Threshold (packets): 4
Use RTP Header         : No               Differential               : No
Timestamp Freq         : 0                CAS Framing                : No CAS
Effective PDVT         : +/-2.984 ms

Cfg Alarm      : stray malformed pktloss overrun underrun
Alarm Status   :
-------------------------------------------------------------------------------
CEM SAP Statistics
-------------------------------------------------------------------------------
                         Packets          Seconds          Events
Egress Stats
Forwarded              :  852539
Dropped                :  0
Missing                :  0
Reordered Forwarded    :  0
Underrun               :  11119                            3
Overrun                :  0                                0
Misordered Dropped     :  0
Malformed Dropped      :  0
LBit Dropped           :  0
Multiple Dropped       :  0
Error                  :                  17
Severely Error         :                  15
Unavailable            :                  0
Failure Count          :                                   1
Jitter Buffer Depth    :  3
```

```
Ingress Stats
Forwarded            :  852590
Dropped              :  0
===============================================================================
===============================================================================
Adaptive Clock Recovery (ACR)
  - Internal Digital Phase Locked Loop (DPLL) Statistics
===============================================================================
                      frequency    frequency        phase        phase
                         offset       offset        error        error
                           mean       stddev         mean       stddev
time                      (ppb)        (ppb)         (ns)          (ns)
-------------------------------------------------------------------------------
07/06/2010 19:25:51         -548           0            1           31
07/06/2010 19:24:51         -548           1            6           38
07/06/2010 19:23:51         -548           1           20           48
07/06/2010 19:22:51         -549           1           -2           49
~07/06/2010 19:21:51           0           0            0            0
~07/06/2010 19:20:50           0           0            0            0
07/06/2010 19:19:50         -549           1          -19           31
07/06/2010 19:18:50         -549           1           -4           36
07/06/2010 19:17:50         -548           2           18          139
07/06/2010 19:16:50         -548           1           35           38
07/06/2010 19:15:50         -549           1           28           33
07/06/2010 19:14:50         -549           1          -18           47
07/06/2010 19:13:50         -550           1          -56           38
07/06/2010 19:12:50         -549           0          -36           37
07/06/2010 19:11:50         -548           1          -21           40
-------------------------------------------------------------------------------
(~ - indicates an invalid interval)
-------------------------------------------------------------------------------
Current
24 Hour
(105 min)             -388         217
===============================================================================

===============================================================================
ACR State Statistics
===============================================================================
Algorithm State Counts
  normal                : 1386
  Phase-tracking        : 35
  Freq-tracking         : 0
  Holdover              : 12741
  Free-run              : 64
Events
  ACR Calc Out of Range : 0
  Prolonged ACR Failure : 293
  Excessive Packet Loss : 0
  Excessive Phase Shift : 0
===============================================================================
```

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                    Oper Speed       : 0 mbps
Link-level         : Ethernet                 Config Speed     : 10 Gbps
Admin State        : down                     Oper Duplex      : full
Oper State         : down                     Config Duplex    : N/A
Physical Link      : No                       MTU              : 9212
Config Conn Type   : N/A                      Oper Conn Type   : N/A
Single Fiber Mode  : No                       LoopBack Mode    : None
Single Fiber Mode  :                          Decommissioned   : No
IfIndex            : 35684352                 Hold time up     : 0 seconds
Last State Change  : 01/01/2000 00:29:06      Hold time down   : 0 seconds
Last Cleared Time  : N/A                      DDM Events       : Enabled
Phys State Chng Cnt: 0

Configured Mode    : network                  Encap Type       : null
Dot1Q Ethertype    : 0x8100                   QinQ Ethertype   : 0x8100
PBB Ethertype      : 0x88e7
Ing. Pool % Rate   : 100                      Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default                  Network Qos Pol  : 1
Egr. Sched. Pol    : default                  Access Egr. Qos *: n/a
Auto-negotiate     : N/A                      MDI/MDX          : N/A
Accounting Policy  : None                     Collect-stats    : Disabled
Acct Plcy Eth Phys : None                     Collect Eth Phys : Disabled
Egress Rate        : Default                  Max Burst        : Default
LACP Tunnel        : Disabled                 DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped   : Disabled                 Keep-alive       : 10
Loop Detected      : False                    Retry            : 120
Use Broadcast Addr : False

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

Down On Int. Error : Disabled

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

EFM OAM            : Disabled                 EFM OAM Link Mon : Disabled

Configured Address : 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 44 **Show Port PTP Hardware Timestamp Output Fields**

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>#
```

lldp

Syntax **lldp** [**nearest-bridge** | **nearest-non-tpmr** | **nearest-customer**] [**remote-info**] [**detail**]

Context show>port>ethernet

Supported 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 — Shows detailed information.

Output The following output is an example of LLDP information.

Sample Output

```
*A:hw_sasm_duta>show# port 1/1/1 ethernet lldp

==============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
==============================================================================

Port 1/1/1 Bridge nearest-bridge
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::


Port 1/1/1 Bridge nearest-non-tpmr
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local
```

```
Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::


Port 1/1/1 Bridge nearest-customer
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::

===============================================================================
*A:hw_sasm_duta>show#
```

```
*A:hw_sasm_duta>show# port 1/1/1 ethernet lldp nearest-bridge

===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================

Port 1/1/1 Bridge nearest-bridge
-------------------------------------------------------------------------------
Admin State           : disabled       Notifications         : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs         : None
PortID TLV Subtype    : tx-local

Management Address Transmit Configuration:
Index 1 (system)      : Disabled       Address               : 0.0.0.0
Index 2 (IPv6 system) : Disabled       Address               : ::
===============================================================================
*A:hw_sasm_duta>show#
```

```
*A:7210-SAS# show port 1/1/3 ethernet lldp remote-info detail
===============================================================================
Link Layer Discovery Protocol (LLDP) Port Information
===============================================================================
Port 1/1/3 Bridge nearest-bridge Remote Peer Information
-------------------------------------------------------------------------------
No remote peers found

Port 1/1/3 Bridge nearest-non-tpmr Remote Peer Information
-------------------------------------------------------------------------------
Remote Peer Index 142 at timestamp 06/10/2010 00:23:22:
Supported Caps        : bridge router
Enabled Caps          : bridge router
Chassis Id Subtype    : 4 (macAddress)
Chassis Id            : 0a:a5:ff:00:00:00
PortId Subtype        : 7 (local)
Port Id               : 35749888
Port Description      : 10/100/Gig Ethernet SFP
```

```
System Name           : Dut-B
System Description    : TiMOS-B-0.0.I927 both/i386 NOKIA SAS 7210
                        Copyright (c) 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:
```

poe

Syntax **poe** [**detail**]

Context show>port>ethernet

Description **Platforms Supported**: 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

This command displays the PoE support status.

Parameters *detail* — Shows detailed information.

Output The following output is an example of detailed PoE support status information, and Table 45 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 **Show PoE Detailed Output Fields**

Label	Description
PSE Maximum Power Budget	
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.

Table 45 **Show PoE Detailed Output Fields (Continued)**

Label	Description
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

Supported 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* — Includes application information

Output The following outputs are examples of internal loopback port information.

Sample Output — 7210 SAS-M

```
*A:7210SAS>config>port# show system internal-loopback-ports detail

===============================================================================
Internal Loopback Port Status
===============================================================================
Port                Loopback            Application         Service
Id                  Type                                    Enabled
-------------------------------------------------------------------------------
1/1/12              Physical            Mac-Swap            Yes
1/1/25              Virtual             Mac-Swap            No

========================================
Mac-swap Application Status
========================================
Enabled             : Yes
Test Service Id     : 1
Test Sap Id         : 1/1/12:90
Loopback Src Addr   : 00:00:01:00:02:00
Loopback Dst Addr   : 00:00:01:00:03:00
========================================
===============================================================================
*A:7210SAS>config>port#
```

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-X

```
A:SASX# show system internal-loopback-ports detail

===============================================================================
Internal Loopback Port Status
===============================================================================
Port                Loopback            Application         Service
Id                  Type                                    Enabled
-------------------------------------------------------------------------------
1/1/10              Physical            Mac-Swap            No
1/1/11              Physical            Testhead            No

========================================
Mac-swap Application Status
========================================
Enabled             : Yes
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#
```

Mac-swap Application Status

The following table describes Mac-swap Application Status associations output fields.

Table 46 **Show MAC Swap Application Status Associations Output Fields**

Label	Description
LoopBack Type	The Loopback type indicates whether the port is in Physical Front panel port or Internal Virtual port.
Application	Application mentions the application in use of the port.
Service enabled	The Service enabled displays, if services can be configured over this port.
Enabled	Displays the current status.
Test Service Id	The service ID that is used in the configuration of Mac-swap test.
Test Sap Id	The SAP ID that is used to configure the loopback SAP for the Mac-swap application.
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

Supported 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:hw_sasm_duta>show>system# lldp

===============================================================================
LLDP Configuration
===============================================================================
Transmit Interval      : 30
Hold Multiplier        : 4
Reinit Delay           : 2
Notification Interval  : 5
Tx Credit Max          : 5
Message Fast Tx        : 1
Message Fast Tx Init   : 4
Admin Enabled          : True

-------------------------------------------------------------------------------
LLDP System Information
-------------------------------------------------------------------------------
Chassis Id Subtype     : 4
Chassis Id             : 00:12:cf:b4:71:b8
System Name            : hw_sasm_duta
System Description     : TiMOS-B-9.0.B1-12 both/mpc Nokia SAS-M 7210 Copyright
                         (c) 2000-2016 Nokia.
                         All rights reserved. All use subject to applicable
                         license agreements.
                         Built on Tue Oct 18 15:22:40 IST 2016 by builder in /
                         home/builder/9.0B1/panos/main
Capabilities Supported : bridge router
Capabilities Enabled   : bridge router

-------------------------------------------------------------------------------
LLDP Destination Addresses
-------------------------------------------------------------------------------
Index 1                : 01:80:c2:00:00:0e
Index 2                : 01:80:c2:00:00:03
Index 3                : 01:80:c2:00:00:00

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

```
LLDP Remote Statistics
-------------------------------------------------------------------------------
Last Change Time       : 10/21/2016 00:08:29
Rem Table Inserts      : 0
Rem Table Deletes      : 0
Rem Table Drops        : 0
Rem Table Ageouts      : 0

-------------------------------------------------------------------------------
LLDP System Management Addresses
-------------------------------------------------------------------------------

===============================================================================
*A:hw_sasm_duta>show>system#

show system lldp neighbor

Link Layer Discovery Protocol (LLDP) System Information
===============================================================================
NB = nearest-bridge   NTPMR = nearest-non-tpmr   NC = nearest-customer
===============================================================================
Lcl Port  Scope  Remote Chassis ID   Index  Remote Port     Remote System Name
-------------------------------------------------------------------------------
1/1/2     NB     D8:1D:FF:00:00:00   1      1/2/2           cses-v29
1/1/5     NB     D8:1E:FF:00:00:00   2      1/1/4           cses-v30
1/1/7     NB     D8:1E:FF:00:00:00   3      1/1/6           cses-v30
1/1/4     NB     D8:20:FF:00:00:00   5      1/1/5           cses-v32
1/1/6     NB     D8:20:FF:00:00:00   6      1/1/7           cses-v32
1/1/1     NB     D8:1C:FF:00:00:00   9      1/2/2           cses-V28
===============================================================================
```

2.18.2.2.3 LAG Commands

lag

Syntax **lag** [*lag-id*] [**detail**] [**statistics**]
lag *lag-id* **associations**
lag [*lag-id*] **description**
lag [*lag-id*] **port**

Context show

Supported 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.

If **no** command line options are specified, a summary listing of all LAGs is displayed.

Parameters *lag-id* — Displays only information about the specified LAG ID.

Values 7210 SAS-M,7210 SAS-X ,7210 SAS-T, 7210 SAS-Mxp [1..25]
7210 SAS-R6 and 7210 SAS-R12 [1..63]
7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE [1..125]

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 output is an example of LAG information, and Table 47 describes the output fields.

Sample Output

```
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 **Show LAG Output Fields**

Label	Description
LAG ID	The LAG ID that the port is assigned to.
Adm	Up — The LAG is administratively up.
	Down — The LAG is administratively down.
Opr	Up — The LAG is operationally up.
	Down — The LAG is operationally down.

Table 47 **Show LAG Output Fields (Continued)**

Label	Description
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 — 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
Prtr System Id      : 4c:5f:d2:c1:5d:3a     Prtr System Priority : 32768
Prtr Oper Key       : 31776
Standby Signaling   : lacp                  DEI Classification   : Disabled

-------------------------------------------------------------------------------
Port-id    Adm     Act/Stdby Opr     Primary Sub-group    Forced   Prio
-------------------------------------------------------------------------------
1/1/1      up      active    up      yes     1          -      32768
1/1/7      up      active    up              1          -      32768

-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
-------------------------------------------------------------------------------
1/1/1      actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/1      partner   No    No    Yes   Yes   Yes   Yes   Yes      No
1/1/7      actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/7      partner   No    No    Yes   Yes   Yes   Yes   Yes      No
```

```
===============================================================================
*A:PE4-M2>show#
```

Table 48 Show LAG Detailed Output Fields

Label	Description
LAG ID	The LAG or multi-link trunk (MLT) that the port is assigned to.
Adm	Up — The LAG is administratively up. Down — The LAG is administratively down.
Port Threshold	If the number of available links is equal or below this number, the threshold action is executed.
Thres. Last Cleared	The last time that keepalive 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.
Prtr System Priority	System priority used by partner in LACP messages.
Mode	LAG in access or network mode.

Table 48 Show LAG Detailed Output Fields (Continued)

Label	Description
Opr	Up — The LAG is operationally up. Down — The LAG is operationally down.
Port Threshold	Configured port threshold.
Thres. Exceeded Cnt	The number of times that the drop count was reached.
Threshold Action	Action to take when the number of available links is equal or below the port threshold.
Encap Type	The encapsulation method used to distinguish customer traffic on a LAG.
Lag-IFIndex	A box-wide unique number assigned to this interface.
Port ID	The specific slot/MDA/port ID.
(LACP) Mode	LACP active or passive mode.
LACP xmit standby	LACP transmits on standby links enabled / disabled.
Slave-to-partner	Configured enabled/disabled.
Port-id	Displays the member port ID.
Adm	Displays the member port administrative state.
Active/stdby	Indicates that the member port is selected as the active or standby link.
Opr	Indicates that the member port operational state.
Primary	Indicates that the member port is the primary port of the LAG.
Sub-group	Displays the member subgroup where the member port belongs to.
Priority	Displays the member port priority.

Sample Output — 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   Show LAG Statistics Detailed Output Fields

Label	Description
LAG ID	The LAG or multi-link trunk (MLT) that the port is assigned to.
Port ID	The port ID configured or displayed in the *slot/mda/port* format.
Input Bytes	The number of incoming bytes for the LAG on a per-port basis.
Input Packets	The number of incoming packets for the LAG on a per-port basis.
Output Bytes	The number of outbound bytes for the LAG on a per-port basis.
Output Packets	The number of outbound packets for the LAG on a per-port basis.
Input/Output Errors	For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character- oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol. For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.
Totals	Displays the column totals for bytes, packets, and errors.

Sample Output — 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 Show LAG Associations Output Fields

Label	Description
Service ID	The service associated with the LAG.
Name	The name of the IP interface.
Encap Val	The values of the port for the IP interface.

Sample Output — 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               1             -        32768

-------------------------------------------------------------------------------
Port-id        Role      Exp   Def   Dist  Col   Syn   Aggr  Timeout  Activity
-------------------------------------------------------------------------------
1/1/5          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/5          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/6          actor     No    No    Yes   Yes   Yes   Yes   Yes      Yes
1/1/6          partner   No    No    Yes   Yes   Yes   Yes   Yes      Yes
===============================================================================
*A:dut-c#
```

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)             up              up    N/A
       6/1/1     up    active    up    10-Gig Ethernet
15(e)            up              up    N/A
       3/1/2     up    active    up    10/100/Gig Ethernet SFP
       4/1/1     up    active    up    10/100/Gig Ethernet SFP
25(d)            up              up    N/A
       3/1/1     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 **Show LAG Statistics Detailed Output Fields**

Label	Description
LACP Status	The service associated with the LAG.
Lag-id	The LAG or multi-link trunk (MLT) that the port is assigned to.
Port-id	The port ID configured or displayed in the *slot/mda/port* format.
Adm	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/Stdby	Indicate if the member port of the LAG is active link or standby link.
Opr	Operational state of the LAG/port.
Primary	Indicates if the port is a primary member port of the LAG.
Sub-group	Displays the subgroup the port belongs to.
Forced	Indicates if the ports of the subgroup were forced to be the active/ standby member ports by the user.
Priority	The user configured priority for the port.
Fld-port	Indicates the active member port of the LAG which 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

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

Description This command enables the context to show 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

Supported 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.

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


*A:SAS# show redundancy multi-chassis sync peer 3.3.3.3

===============================================================================
Multi-chassis Peer Table
===============================================================================
Peer
-------------------------------------------------------------------------------
Peer IP Address         : 3.3.3.3
Description             : (Not Specified)
Authentication          : Enabled
Source IP Address       : 2.2.2.2
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         : 3.3.3.3
Description             : (Not Specified)
Authentication          : Enabled
Source IP Address       : 2.2.2.2
Admin State             : Enabled
-------------------------------------------------------------------------------
Sync: Not-configured
-------------------------------------------------------------------------------
```

```
===============================================================================
Ports synced on peer 3.3.3.3
===============================================================================
Port/Encap                    Tag
-------------------------------------------------------------------------------
===============================================================================

===============================================================================
DHCP Server instances synced on peer 3.3.3.3
===============================================================================
Router-Name                      Server-Name
  Tag
-------------------------------------------------------------------------------
No instances found
===============================================================================
```

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

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

Description This command displays multi-chassis LAG information.

Output The following output is an example of multi-chassis LAG information.

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
```

2.18.2.2.4 Port Monitor Commands

port

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

Context monitor

Supported 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.

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

Configures the interval for each display in seconds.

Values 3 to 60

Default 10

repeat — Configures 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.

Output The following output is an example of port traffic monitoring information.

Sample Output

```
A:ALA-12>monitor# port 1/4 interval 3 repeat 3 absolute
```

```
===============================================================================
Monitor statistics for Port 1/4
===============================================================================
                                             Input                      Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                         39                         175
Errors                                           0                           0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                         39                         175
Errors                                           0                           0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                         39                         175
Errors                                           0                           0
-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                         39                         175
Errors                                           0                           0
===============================================================================
A:ALA-12>monitor#

A:ALA-12>monitor# port 1/4 interval 3 repeat 3 rate
===============================================================================
Monitor statistics for Port 1/4
===============================================================================
                                             Input                      Output
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                         39                         175
Errors                                           0                           0
-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                          0                           0
Errors                                           0                           0
-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                          0                           0
Errors                                           0                           0
-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                           0                           0
Packets                                          0                           0
```

```
Errors                                              0                            0
===============================================================================
A:ALA-12>monitor#


*A:ces-A# monitor port 1/2/1

===============================================================================
Monitor statistics for Port 1/2/1
===============================================================================
                                                    Input                  Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                         3828256704               338593536
Packets                                          19938837                 1763508
Errors                                                  0                       0

-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Delta)
-------------------------------------------------------------------------------
Octets                                            1929984                 1929984
Packets                                             10052                   10052
Errors                                                  0                       0

*A:ces-A# monitor port 1/2/1 rate

===============================================================================
Monitor statistics for Port 1/2/1
===============================================================================
                                                    Input                  Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                         3831865920               342202752
Packets                                          19957635                 1782306
Errors                                                  0                       0

-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                             192998                  192998
Packets                                              1005                    1005
Errors                                                  0                       0
Utilization (% of port capacity)                    99.99                   99.99

-------------------------------------------------------------------------------
At time t = 20 sec (Mode: Rate)
-------------------------------------------------------------------------------
Octets                                             192998                  192998
Packets                                              1005                    1005
Errors                                                  0                       0
Utilization (% of port capacity)                    99.99                   99.99

^C
*A:ces-A# monitor port 1/2/1 absolute
```

```
===============================================================================
Monitor statistics for Port 1/2/1
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                         3836382144             346718976
Packets                                          19981157               1805828
Errors                                                  0                     0

-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                         3838312128             348648960
Packets                                          19991209               1815880
Errors                                                  0                     0

-------------------------------------------------------------------------------
At time t = 20 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                         3840242304             350578944
Packets                                          20001262               1825932
Errors                                                  0                     0
```

Sample Output — 7210 SAS-X

```
A:7210-SAS-X>monitor# port 1/1/2 interval 3 repeat 3 absolute

===============================================================================
Monitor statistics for Port 1/1/2
===============================================================================
                                                    Input                Output
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Octets                                                  0                  1408
Packets                                                 0                     0
Errors                                                  0                     0

-------------------------------------------------------------------------------
At time t = 3 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                  0                  1408
Packets                                                 0                     0
Errors                                                  0                     0

-------------------------------------------------------------------------------
At time t = 6 sec (Mode: Absolute)
-------------------------------------------------------------------------------
Octets                                                  0                  1408
Packets                                                 0                     0
Errors                                                  0                     0

-------------------------------------------------------------------------------
At time t = 9 sec (Mode: Absolute)
```

```
-------------------------------------------------------------------------------
Octets                                                 0                   1408
Packets                                                0                      0
Errors                                                 0                      0

===============================================================================
A:7210-SAS-X>monitor#
```

2.18.2.3 Clear Commands

lag

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

Context clear

Supported 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* — The LAG ID to clear statistics.

Values 7210 SAS-M,7210 SAS-X,7210 SAS-T, 7210 SAS-Mxp — 1 to 25
7210 SAS-R6 and 7210 SAS-R12 — 1 to 63
7210 SAS-Sx 1/10GE, 7210 SAS-Sx 10/100GE — 1 to 125

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

mda

Syntax **mda** *mda-id*

Context clear

Supported 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* — Clears the specified slot and MDA/CMA.

Values

mda-id: slot/mda

slot: 1
mda: 1, 2 (for 7210 SAS-M)

mda: 1 (for 7210 SAS-X)

port

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

Context clear

Supported 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* — The port identifier.

statistics — Specifies that port statistics will be cleared.

slot — The slot number.

Values 1

mda — The MDA number.

Values 1, 2

Default All MDAs.

2.18.2.4 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

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

Description This command enables debugging for LAG.

Parameters *lag-id* — Specifies the link aggregation group ID.

port-id — Specifies the physical port ID.

sm — Specifies to display trace LACP state machine.

pkt — Specifies to display trace LACP packets.

cfg — Specifies to display trace LAG configuration.

red — Specifies to display trace LAG high availability.

iom-upd — Specifies to display trace LAG IOM updates.

port-state — Specifies to display trace LAG port state transitions.

timers — Specifies to display trace LAG timers.

sel-logic — Specifies to display trace LACP selection logic.

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 presented is subject to change without notice.

Nokia assumes no responsibility for inaccuracies contained herein.

BGP

draft-ietf-idr-add-paths-04, Advertisement of Multiple Paths in BGP is supported on M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-sidr-origin-validation-signaling-04, BGP Prefix Origin Validation State Extended Community is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4456, BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4659, BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN is supported on K12, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4724, Graceful Restart Mechanism for BGP (Helper Mode) is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4893, BGP Support for Four-octet AS Number Space is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Circuit Emulation

RFC 4553, Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) is supported on M(N)

RFC 5086, Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN) is supported on M(N)

RFC 5287, Control Protocol Extensions for the Setup of Time-Division Multiplexing (TDM) Pseudowires in MPLS Networks is supported on M(N)

Ethernet

IEEE 802.1AB, Station and Media Access Control Connectivity Discovery is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1ad, Provider Bridges is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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 M(N), X, and T(N)

IEEE 802.1ax, Link Aggregation is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, K5, K12, K30, M(A,N), 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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 K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ITU-T G.8032, Ethernet Ring Protection Switching is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Fast Reroute

draft-ietf-rtgwg-lfa-manageability-08, Operational management of Loop Free Alternates is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5286, Basic Specification for IP Fast Reroute: Loop-Free Alternates is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Internet Protocol (IP) — General

draft-grant-tacacs-02, The TACACS+ Protocol is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 768, User Datagram Protocol is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2866, RADIUS Accounting is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4252, The Secure Shell (SSH) Authentication Protocol (password only) is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4253, The Secure Shell (SSH) Transport Layer Protocol is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4632, Classless Inter-domain Routing (CIDR): The Internet Address Assignment and Aggregation Plan is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5881, Bidirectional Forwarding Detection (BFD) IPv4 and IPv6 (Single Hop) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5883, Bidirectional Forwarding Detection (BFD) for Multihop Paths is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6528, Defending against Sequence Number Attacks is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IP — Multicast

RFC 1112, Host Extensions for IP Multicasting is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2236, Internet Group Management Protocol, Version 2 is supported on K12, K30, M(N), T(N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3446, Anycast Rendevous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4601, Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised) is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4607, Source-Specific Multicast for IP is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, R6, and R12

RFC 6514, BGP Encodings and Procedures for Multicast in MPLS/IP VPNs is supported on T(N), Mxp, R6, and R12

RFC 6515, IPv4 and IPv6 Infrastructure Addresses in BGP Updates for Multicast VPNs is supported on T(N), Mxp, R6, and R12

RFC 6625, Wildcards in Multicast VPN Auto-Discover Routes is supported on T(N), Mxp, R6, and R12

RFC 6826, Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Path is supported on T(N), Mxp, R6, and R12

RFC 7385, IANA Registry for P-Multicast Service Interface (PMSI) Tunnel Type Code Points is supported on T(N), Mxp, R6, and R12

IP — Version 4

RFC 791, Internet Protocol is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2460, Internet Protocol, Version 6 (IPv6) Specification is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IP — Version 6

RFC 2464, Transmission of IPv6 Packets over Ethernet Networks is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3021, Using 31-Bit Prefixes on IPv4 Point-to-Point Links is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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 K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4007, IPv6 Scoped Address Architecture is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4193, Unique Local IPv6 Unicast Addresses is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4291, Internet Protocol Version 6 (IPv6) Addressing Architecture is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4443, Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4861, Neighbor Discovery for IP version 6 (IPv6) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4862, IPv6 Stateless Address Autoconfiguration (Router Only) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5095, Deprecation of Type 0 Routing Headers in IPv6 is supported on K12, K30, M(N), T(N), X, 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 K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6106, IPv6 Router Advertisement Options for DNS Configuration is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IPsec

RFC 2401, Security Architecture for the Internet Protocol is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2406, IP Encapsulating Security Payload (ESP) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IS-IS

draft-ietf-isis-mi-02, IS-IS Multi-Instance is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-kaplan-isis-ext-eth-02, Extended Ethernet Frame Size Support is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ISO/IEC 10589:2002, Second Edition, Nov. 2002, Intermediate system to Intermediate system intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473) is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5130, A Policy Control Mechanism in IS-IS Using Administrative Tags is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5309, Point-to-Point Operation over LAN in Link State Routing Protocols is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Management

draft-ieft-snmpv3-update-mib-05, Management Information Base (MIB) for the Simple Network Management Protocol (SNMP) is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-mpls-ldp-mib-07, Definitions of Managed Objects for the Multiprotocol Label Switching, Label Distribution Protocol (LDP) is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ianaiftype-mib, IANAifType-MIB is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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

RFC 2021, Remote Network Monitoring Management Information Base Version 2 using SMIv2 is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2115, Management Information Base for Frame Relay DTEs Using SMIv2 is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2494, Definitions of Managed Objects for the DS0 and DS0 Bundle Interface Type is supported on M(N)

RFC 2571, An Architecture for Describing SNMP Management Frameworks is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2573, SNMP Applications is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2574, User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3) is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, K5, K12, K30, M(A,N), 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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 K5, K12, K30, M(A,N), T(A,N), X, 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, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3895, Definitions of Managed Objects for the DS1, E1, DS2, and E2 Interface Types is supported on M(N)

RFC 4001, Textual Conventions for Internet Network Addresses is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6241, Network Configuration Protocol (NETCONF) is supported on K5, K12, R6, and R12

RFC 6242, Using the NETCONF Protocol over Secure Shell (SSH) is supported on K5, K12, R6, and R12

MPLS — General

RFC 3031, Multiprotocol Label Switching Architecture is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, R6, and R12

MPLS — GMPLS

draft-ietf-ccamp-rsvp-te-srlg-collect-04, RSVP-TE Extensions for Collecting SRLG Information is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

MPLS — LDP

draft-pdutta-mpls-ldp-adj-capability-00, LDP Adjacency Capabilities is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-pdutta-mpls-tldp-hello-reduce-04, Targeted LDP Hello Reduction is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, R6, and R12

MPLS — MPLS-TP

RFC 5586, MPLS Generic Associated Channel is supported on T(N), R6, and R12

RFC 5921, A Framework for MPLS in Transport Networks is supported on T(N), R6, and R12

RFC 5960, MPLS Transport Profile Data Plane Architecture is supported on T(N), R6, and R12

RFC 6370, MPLS Transport Profile (MPLS-TP) Identifiers is supported on T(N), R6, and R12

RFC 6378, MPLS Transport Profile (MPLS-TP) Linear Protection is supported on T(N), R6, and R12

RFC 6426, MPLS On-Demand Connectivity and Route Tracing is supported on T(N), R6, and R12

RFC 6428, Proactive Connectivity Verification, Continuity Check and Remote Defect indication for MPLS Transport Profile is supported on T(N), R6, and R12

RFC 6478, Pseudowire Status for Static Pseudowires is supported on T(N), R6, and R12

RFC 7213, MPLS Transport Profile (MPLS-TP) Next-Hop Ethernet Addressing is supported on T(N), R6, and R12

MPLS — OAM

RFC 6424, Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels is supported on K12, K30, M(N), T(N), X, 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

MPLS — RSVP-TE

RFC 2702, Requirements for Traffic Engineering over MPLS is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, R6, and R12

RFC 4950, ICMP Extensions for Multiprotocol Label Switching is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

OSPF

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1765, OSPF Database Overflow is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4577, OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4970, Extensions to OSPF for Advertising Optional Router Capabilities is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5243, OSPF Database Exchange Summary List Optimization is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Pseudowire

draft-ietf-l2vpn-vpws-iw-oam-04, OAM Procedures for VPWS Interworking is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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 Mxp, R6, and R12

RFC 6718, Pseudowire Redundancy is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Quality of Service

RFC 2430, A Provider Architecture for Differentiated Services and Traffic Engineering (PASTE) is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, 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, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RIP

RFC 1058, Routing Information Protocol is supported on Mxp

RFC 2082, RIP-2 MD5 Authentication is supported on Mxp

RFC 2453, RIP Version 2 is supported on Mxp

Timing

GR-1244-CORE, Clocks for the Synchronized Network: Common Generic Criteria, Issue 3, May 2005 is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

GR-253-CORE, SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000 is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

IEEE 1588-2008, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx-1/10GE, R6, and R12

ITU-T G.781, Synchronization layer functions, issued 09/2008 is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.813, Timing characteristics of SDH equipment slave clocks (SEC), issued 03/2003 is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8261, Timing and synchronization aspects in packet networks, issued 04/2008 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8262, Timing characteristics of synchronous Ethernet equipment slave clock (EEC), issued 08/2007 is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8264, Distribution of timing information through packet networks, issued 10/2008 is supported on D-ETR, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

ITU-T G.8265.1, Precision time protocol telecom profile for frequency synchronization, issued 10/2010 is supported on D-ETR, K5, K12, M(A,N), T(A,N), X, Mxp, Sx-1/10GE, R6, and R12

ITU-T G.8275.1, Precision time protocol telecom profile for phase/time synchronization with full timing support from the network, issued 07/2014 is supported on K12, K30, M(N), T(N), X, Mxp, R6, and R12

RFC 5905, Network Time Protocol Version 4: Protocol and Algorithms Specification is supported on D, E, K5, K12, K30, M(A,N), T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

VPLS

RFC 4761, Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling is supported on K12, K30, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4762, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling is supported on K12, K30, M(N), T(N), X, 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, M(N), T(N), X, 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, M(N), T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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