



7210 SERVICE ACCESS SWITCH | RELEASE 11.0.R5

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

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Table of Contents

1	Getting Started	11
1.1	In This Chapter	11
1.2	About This Guide	11
1.2.1	Document Structure and Content	12
1.3	7210 SAS Modes of Operation	12
1.4	7210 SAS Port Modes	15
1.5	Interface Configuration Process	18
2	7210 SAS Interfaces	19
2.1	Configuration Overview	19
2.1.1	Chassis Slots and Cards	19
2.2	Digital Diagnostics Monitoring	20
2.2.1	Nokia SFPs and XFPs	23
2.2.2	Statistics Collection	23
2.3	Ports	24
2.3.1	Port Types	24
2.3.1.1	Port Modes	24
2.3.1.2	Port Dot1q VLAN Etype on 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C	26
2.3.1.3	Configuration Guidelines for Dot1q-Etype for 7210 SAS-D and 7210 SAS-Dxp	26
2.3.2	Port Features	27
2.3.2.1	MACsec	27
2.3.3	Ethernet Combo Ports on 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C	44
2.4	Link Layer Discovery Protocol (LLDP)	44
2.4.1	LLDP Protocol Features	46
2.4.1.1	LLDP Tunneling for Epipe Service	48
2.5	Port Loopback for Ethernet Ports	49
2.5.1	Port Loopback without MAC Swap	49
2.5.2	Port Loopback with MAC Swap	49
2.5.3	Per-SAP Loopback with MAC Swap	50
2.6	LAG	51
2.6.1	LAG Features	51
2.6.2	Configuring LAGs	51
2.6.3	LAG and QoS Policies on 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E	52
2.6.4	LAG and QoS Policies on 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C	53
2.6.5	Port Link Damping	53
2.6.6	LACP	54
2.6.7	LAG and ECMP Hashing	54
2.6.7.1	LAG Hashing Algorithm for the 7210 SAS-D	55
2.6.7.2	LAG Hashing Algorithm for the 7210 SAS-Dxp	56

2.6.7.3	LAG Hashing Algorithm for the 7210 SAS-E	57
2.6.7.4	LAG Hashing Algorithm for the 7210 SAS-K 2F1C2T	59
2.6.7.5	LAG Hashing Algorithm for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C	60
2.6.7.6	Packet Fields Used for Pseudowire Hash-label Generation on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C	64
2.6.7.7	LDP ECMP Hashing Algorithm for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C	65
2.6.8	Multi-Chassis LAG	66
2.6.8.1	Overview	67
2.6.8.2	Point-to-Point Redundant Connection Across Layer 2/3 VPN Network	71
2.6.8.3	Configuration Guidelines	72
2.6.8.4	Configuring Multi-Chassis Redundancy	73
2.6.8.5	MC-LAG Support on 7210 SAS-D, 7210 SAS-K 2F1C2T, and 7210 SAS-E (in client mode)	74
2.6.9	G.8032 Protected Ethernet Rings.....	74
2.6.9.1	802.1x Network Access Control	75
2.6.9.2	802.1x Basics	75
2.6.9.3	802.1x Timers.....	76
2.6.9.4	802.1x Configuration and Limitations	77
2.6.9.5	802.1x Tunneling for Epipe Service.....	77
2.7	802.3ah OAM	78
2.7.1	OAM Events	79
2.7.2	Remote Loopback	79
2.7.3	802.3ah OAM PDU Tunneling for Epipe Service.....	80
2.7.4	MTU Configuration Guidelines	80
2.7.4.1	Default MTU Values	81
2.7.4.2	Modifying MTU Defaults on 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E.....	81
2.7.4.3	Modifying MTU Defaults on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C	82
2.7.4.4	Configuration Example for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C Using SAPs in the Service.....	82
2.7.5	Modifying MTU Defaults on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C when Using SDP in the Service	84
2.7.6	Deploying Preprovisioned Components	84
2.8	MAC Authentication.....	85
2.8.1	MAC Authentication Basics	85
2.8.2	MAC Authentication Limitations.....	87
2.9	VLAN Authentication	87
2.9.1	VLAN Authentication Basics.....	88
2.9.2	VLAN Authentication Limitations	89
2.10	Layer 2 Control Protocol Interaction with Authentication Methods.....	89
2.11	Configuration Process Overview	91
2.12	Configuring Physical Ports with CLI	93
2.13	Preprovisioning Guidelines.....	93
2.13.1	Predefining Entities.....	93

2.13.2	Preprovisioning a Port	94
2.14	Basic Configuration	94
2.15	Common Configuration Tasks	95
2.15.1	Configuring Ethernet Port Parameters	95
2.15.1.1	Ethernet Network Port	95
2.15.1.2	Ethernet Access-Uplink Port.....	95
2.15.1.3	Ethernet Access Port.....	96
2.15.1.4	Configuring 802.1x Authentication Port Parameters	97
2.15.1.5	Configuring MAC Authentication Port Parameters	97
2.15.1.6	Configuring VLAN Authentication Port Parameters	98
2.15.2	Configuring LAG Parameters	99
2.16	CRC Error Monitoring	100
2.17	Service Management Tasks	101
2.17.1	Modifying a Card Type	101
2.17.2	Deleting a Card.....	102
2.17.3	Deleting Port Parameters	102
2.18	Card, MDA, and Port Command Reference	103
2.18.1	Command Hierarchies	103
2.18.1.1	Configuration Commands.....	103
2.18.1.2	Show Commands	112
2.18.1.3	Monitor Commands	113
2.18.1.4	Clear Commands.....	113
2.18.1.5	Debug Commands.....	113
2.18.2	Command Descriptions	113
2.18.2.1	Configuration Commands.....	114
2.18.2.2	Show Commands	201
2.18.2.3	Port Monitor Commands.....	297
2.18.2.4	MACsec Show Commands.....	299
2.18.2.5	Clear Commands.....	307
2.18.2.6	Debug Commands.....	308
3	Standards and Protocol Support	309

List of Tables

1	Getting Started	11
Table 1	Supported Modes of Operation and Configuration Methods	14
Table 2	Supported Port Modes by Mode of Operation	16
Table 3	7210 SAS Platforms Supporting Port Modes	17
Table 4	Configuration Process	18
2	7210 SAS Interfaces	19
Table 5	Real-Time DDM Information	21
Table 6	DDM Alarms and Warnings	22
Table 7	7210 SAS Platforms Supporting Port Modes	25
Table 8	MACsec Key Management Modes	29
Table 9	MACsec Terminology	30
Table 10	MKA PDU Generation	34
Table 11	Tags in Clear Behavior	36
Table 12	MKA Participant Timer Values	37
Table 13	Port Mapping to Security Zone	39
Table 14	MACsec Encryption of 802.1Q Tags with Clear-tag Configured	42
Table 15	LAG Hashing Algorithm for Services Configured on 7210 SAS-D	55
Table 16	LAG Hashing Algorithm for Services Configured on 7210 SAS-Dxp	56
Table 17	LAG Hashing Algorithm for Services Configured on 7210 SAS-E	58
Table 18	LAG Hashing Algorithm for Services Configured on 7210 SAS-K 2F1C2T	60
Table 19	LAG Hashing Algorithm for Services Configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C	61
Table 20	Packet Fields Used for PW Hash-Label Generation on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C	65
Table 21	LDP ECMP Hashing Algorithm for LER and LSR on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C	66
Table 22	MTU Default Values	81
Table 23	MTU Configuration Example Values (ALA-A with Dot1q SAP Type, ALA-B with Null Encap)	83
Table 24	MTU Configuration Example Values (ALA-A with Dot1q-preserve SAP Type, ALA-B with Dot1Q Encap)	83
Table 25	Layer 2 Control Protocol Interaction with Authentication Methods	89
Table 26	Default MTU Values	126
Table 27	Encrypted Dot1q and QinQ Packet Format	129
Table 28	MACsec Basic Settings	130
Table 29	LLDP Behavior	169
Table 30	Output Fields: Chassis	204
Table 31	Output Fields: Card	207
Table 32	Output Fields: Card Detail	210
Table 33	Output Fields: CPM Card	211
Table 34	Output Fields: Card State	213
Table 35	Output Fields: MDA	217

Table 36	Output Fields: MDA Detail	217
Table 37	Output Fields: Pool	226
Table 38	Output Fields: Show General Port	237
Table 39	Output Fields: Show Specific Port	251
Table 40	Output Fields: Show Port Detail	255
Table 41	Output Fields: Show Ethernet Port	261
Table 42	Output Fields: Show Ethernet-like Medium Statistics	263
Table 43	Output Fields: Show Ethernet-like Medium Statistics Detailed	264
Table 44	Output Fields: Port Associations	267
Table 45	Output Fields: Show A1 Detailed	269
Table 46	Output Fields: Optical	273
Table 47	Output Fields: Port Ethernet LLDP	276
Table 48	Output Fields: Show MAC Swap Application	278
Table 49	Output Fields: LAG	282
Table 50	Output Fields: LAG Detail	285
Table 51	Output Fields: LAG Statistics	287
Table 52	Output Fields: LAG Associations	288
Table 53	Output Fields: LAG (no MC LAG)	289
Table 54	Show Multi-Chassis Output Fields	294
Table 55	Output Fields: MC-LAG	295
Table 56	Output Fields: MACsec Connectivity Association	300
Table 57	Output Fields: MACsec CA with CA Name	300
Table 58	Output Fields: MACsec MKA-Session Port	302
Table 59	Output Fields: MACsec MKA-Session Port (Detail and Statistics)	304

List of Figures

2	7210 SAS Interfaces	19
Figure 1	802.1 AE LAN-MODE.....	27
Figure 2	SecTAG Format.....	28
Figure 3	802.1 AE LAN/WAN Modes and VLAN Encrypted/Clear	29
Figure 4	MACsec Concepts for Static-CAK	30
Figure 5	MACsec Generating the CAK.....	32
Figure 6	MACsec Control Plane	33
Figure 7	P2P (Switch-to-Switch) Topology	40
Figure 8	P2MP Topology	41
Figure 9	LLDP Internal Architecture for a Network Node	45
Figure 10	Generic Customer Use Case For LLDP	46
Figure 11	LAG Configuration	52
Figure 12	MC-LAG L2 Dual Homing to Remote PE Pairs	69
Figure 13	MC-LAG L2 Dual Homing to Local PE-Pairs	70
Figure 14	P2P Redundant Connection Through a Layer 2 VPN Network	72
Figure 15	MTU Configuration Example	82
Figure 16	Slot, Card, MDA, and Port Configuration and Implementation Flow	91

1 Getting Started

1.1 In This Chapter

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

1.2 About This Guide

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

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

See section [1.3](#) for information about the modes of operation supported by the 7210 SAS product family.



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

- access-uplink mode of operation
7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-E, 7210 SAS-K 2F1C2T,
7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
- network mode of operation
7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C,

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

1.2.1 Document Structure and Content

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



Note: This guide generically covers Release 11.0 content and may include some content that will be released in later maintenance loads. Refer to the 7210 SAS OS Software Release Notes 11.0Rx, part number 3HE14615000xTQZZA, for information about features supported in each load of the Release 11.0 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.

1.3 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 11.0Rx, part number 3HE14615000xTQZZA, and to the appropriate 7210 SAS software user guide for information about features and capabilities supported by a 7210 SAS platform when operating in a specific mode.

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

- access-uplink

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

Platforms Supported: 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-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-Dxp		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

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-Sx 10/100GE	Implicit ³		Explicit BOF Configuration	Explicit BOF Configuration	Explicit BOF Configuration
7210 SAS-T	Explicit BOF Configuration	Explicit BOF Configuration	Implicit		
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 [1.4](#) for information about port mode configuration

1.4 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-Dxp	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.

1.5 Interface Configuration Process

[Table 4](#) describes the tasks necessary to configure cards and ports.

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

Table 4 Configuration Process

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

2 7210 SAS Interfaces

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

2.1 Configuration Overview



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

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

2.1.1 Chassis Slots and Cards

- The 7210 SAS-E supports the following:
 - 12 × 10/100/1000 SFP ports
 - 1 Ethernet out of band management port
 - 1 management console port
 - 12 × 10/100/1000Base-T ports
- The 7210 SAS-D supports the following:
 - 6 × 10/100/1000 SFP ports
 - 4 × 10/100/1000Base-T ports
 - 1 management console port
- The 7210 SAS-Dxp supports the following:

- 2 × 1GE/10GE SFP+ ports
- 6 × 10/100/1000Base-T ports
- 4 × 10/100/1000 SFP ports
- 1 management console port
- The 7210 SAS-K 2F1C2T supports the following:
 - 2 × 10/100/1000Base-T fixed copper ports
 - 1 management console port
- The 7210 SAS-K 2F6C4T supports the following:
 - 2 × 100/1000 SFP ports
 - 4 × 10/100/1000Base-T fixed copper ports
 - 6 Combo ports (100/1000 SFP or 10/100/1000Base-T)
 - 1 management console port
- The 7210 SAS-K 3SFP+ 8C supports the following:
 - 3 × 1GE/10GE SFP ports
 - 8 Combo ports (100/1000 SFP+ or 10/100/1000Base-T)
 - 1 management console port

2.2 Digital Diagnostics Monitoring

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

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

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

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

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

DDM information is populated into the router 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	MSA DWDM
Temperature	Celsius	C	Supported	Supported	Supported
Supply Voltage	Volts	μ V	Supported	Supported	Not supported
TX Bias Current	mA	μ A	Supported	Supported	Supported
TX Output Power	dBm (converted from mW)	mW	Supported	Supported	Supported
RX Received Optical Power ⁴	dBm (converted from dBm) (Avg Rx Power or OMA)	mW	Supported	Supported	Supported
AUX1	parameter dependent (embedded in transceiver)	-	Not supported	Supported	Not supported
AUX2	parameter dependent (embedded in transceiver)	-	Not supported	Supported	Not supported

[Table 6](#) describes supported factory-programmed DDM alarms and warnings.

Table 6 DDM Alarms and Warnings

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

2.2.1 Nokia SFPs and XFPs

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

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

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

2.2.2 Statistics Collection

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

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

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

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

2.3 Ports

2.3.1 Port Types

Nokia routers support the following port types:

- Ethernet — Supported Ethernet port types include:
 - Fast Ethernet (10/100Base-T, 100Mbps SFP)
 - Gigabit Ethernet (10GE SPF+, 1GE SFP, 1000Base-T)

2.3.1.1 Port Modes

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

- Access ports — configured for customer-facing traffic on which services are configured. If a Service Access Port (SAP) is to be configured on the port, it must be configured as an access port. When a port is configured for access mode, the appropriate encapsulation type must be configured to distinguish the services on the port. When a port has been configured for access mode, one or more services can be configured on the port depending on the encapsulation value.
- Access-uplink ports — access-uplink ports are used to provide native Ethernet connectivity in service provider transport or infrastructure network. This can be achieved by configuring port mode as access uplink. With this option, the encapsulation type can be configured to QinQ only. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access uplink port to allow the operator to differentiate multiple services being carried over a single access uplink port.
- Network ports (applicable only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C) — configured for network-facing traffic. These ports participate in the service provider transport or infrastructure network. Dot1q is supported on network ports.

- Hybrid ports (applicable only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C) — configured for access and network-facing traffic. The default mode of an Ethernet port is “network”. The mode of a port cannot be changed unless the port is shut down and the configured SAPs and interfaces are deleted. Hybrid ports allow a single port to operate in both access and network modes. The MTU of a port in hybrid mode is the same as in network mode. The default encapsulation for ports in hybrid mode is dot1q; QinQ encapsulation is also supported at the port level.

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

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

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

[Table 7](#) describes supported port modes on the 7210 SAS platforms.

Table 7 7210 SAS Platforms Supporting Port Modes

Port Mode Platforms	Access	Network	Hybrid	Access-uplink
7210 SAS-E	Yes	No	No	Yes
7210 SAS-D	Yes	No	No	Yes
7210 SAS-Dxp	Yes	No	No	Yes ¹
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

Note:

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

2.3.1.2 Port Dot1q VLAN Etype on 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

2.3.1.3 Configuration Guidelines for Dot1q-Etype for 7210 SAS-D and 7210 SAS-Dxp

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

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

2.3.2 Port Features

2.3.2.1 MACsec



Note: MACsec is supported only on 7210 SAS-K 2F6C4T ETR and 7210 SAS-K 3SFP+ 8C.

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

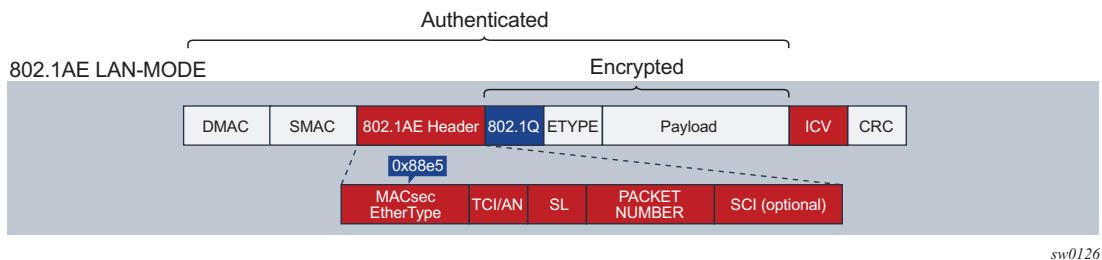
MACsec can identify and prevent most security threats, including:

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

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

Figure 1 shows the 802.1AE LAN-mode structure.

Figure 1 802.1 AE LAN-MODE



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

2.3.2.1.1 MACsec 802.1AE Header (SecTAG)

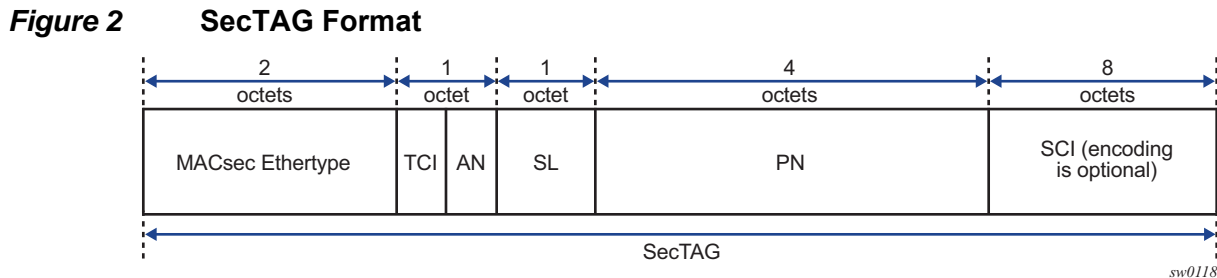
The 802.1AE header has a security tag (SecTAG) which includes:

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

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

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

Figure 2 shows the format of the SecTAG.



2.3.2.1.2 MACsec Encryption Mode

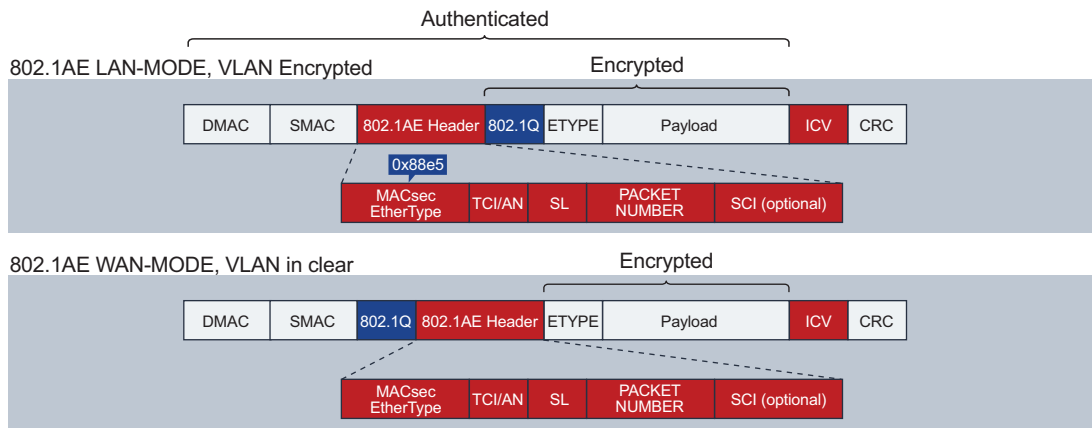
MACsec uses the following main modes of encryption:

- VLAN in clear text (WAN Mode)
- VLAN encrypted

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

Figure 3 shows VLAN encrypted and VLAN in clear text.

Figure 3 802.1AE LAN/WAN Modes and VLAN Encrypted/Clear



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MACsec Encryption per Traffic Flow Encapsulation Matching

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

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

2.3.2.1.3 MACsec Key Management Modes

Table 8 describes the key management modes in MACsec.

Table 8 MACsec Key Management Modes

Keying	Explanation	SR OS Support	Where Used
Static SAK	Manually configures each node with a static SAK using CLI or NSP.	N/A	Switch to switch
Static CAK PRE SHARED KEY	Uses dynamic MACsec Key Management (MKA) and uses a configured pre-shared key to derive the CAK. The CAK encrypts the SAK between two peers and authenticates the peers.	Supported	Switch to switch

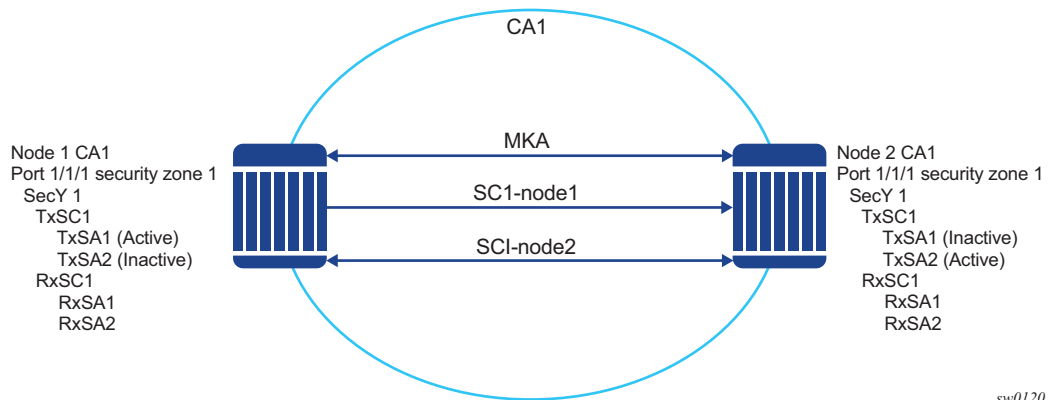
Table 8 MACsec Key Management Modes (Continued)

Keying	Explanation	SR OS Support	Where Used
Dynamic CAK EAP Authentication	Uses dynamic MKA and an EAP MSK (Master System Key) to derive the CAK. The CAK encrypts the SAK between two peers and authenticates the peers.	Not Supported	Switch to switch
Dynamic CAK MSK Distribution via RADIUS and EAP-TLS	MSKs are stored in the RADIUS server and distributed to the hosts via EAP-TLS. This is typically used in access networks where there are a large number of hosts using MACsec and connecting to an access switch. MKA uses MSK to derive the CAK. The CAK encrypts the SAK between 2 peers and authenticates the peers.	Not Supported	Host to switch

2.3.2.1.4 MACsec Terminology

Figure 4 shows the main concepts used in MACsec for the static-CAK scenario.

Figure 4 MACsec Concepts for Static-CAK



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Table 9 describes MACsec terminology.

Table 9 MACsec Terminology

MACsec Term	Description
Connectivity Association (CA)	A security relationship, established and maintained by the MKA, that comprises a fully connected subset of the service access points in stations attached to a single LAN that are to be supported by MACsec.

Table 9 MACsec Terminology (Continued)

MACsec Term	Description
MACsec Key Agreement Protocol (MKA)	Control protocol between MACsec peers, which is used for peer aliveness and encryption key distribution. MKA is responsible for discovering, authenticating, and authorizing the potential participants in a CA.
MAC Security Entity (SecY)	Operates the MAC security protocol within a system. Manages and identifies the SC and the corresponding active SA.
Port Access Entity (PAE)	The protocol entity associated with a port. May support the functionality of authenticator, supplicant, or both.
Security Channel (SC)	Provides a unidirectional point-to-point or point-to-multipoint communication. Each SC contains a succession of SAs, and each SC has a different SAK.
Security Association Key (SAK)	The key used to encrypt the datapath of MACsec.
Security Association (SA)	<p>A security relationship that provides security guarantees for frames transmitted from one member of a CA to the others.</p> <p>In the case of 2 SAs per SC, each with a different SAK, each SC comprises a succession of SAs. Each SA has an SC identifier, concatenated with a two-bit association number. The Secure Association Identifier (SAI) that has been created allows the receiving SecY to identify the SA, and thereby the SAK used to decrypt and authenticate the received frame. The AN (and the SAI) is only unique for the SAs that can be used or recorded by participating SecYs at any time.</p> <p>MKA creates and distributes SAKs to each of the SecYs in a CA. This key creation and distribution is independent of the cryptographic operation of each of the SecYs. The decision to replace one SA with its successor is made by the SecY that transmits using the SC, after MKA has informed it that all the other SecYs are prepared to receive using that SA. No notification, other than receipt of a secured frame with a different SAI, is sent to the receiver. A SecY must always be capable of storing SAKs for two SAs for each inbound SC, and of swapping from one SA to another without notice. Certain LAN technologies can reorder frames of different priority, so reception of frames on a single SC can use interleaved SA.</p>

2.3.2.1.5 MACsec Static CAK

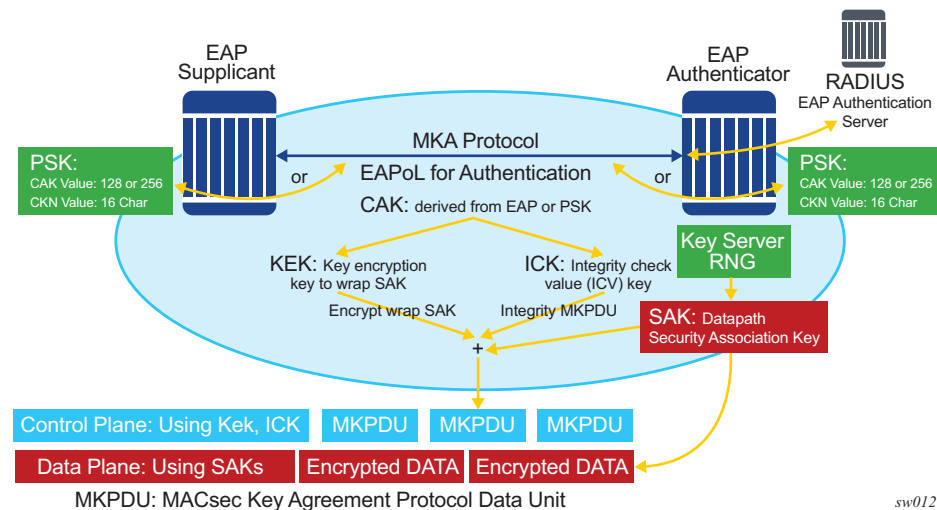
MACsec uses SAs to encrypt packets. Each SA has a single SAK that contains the cryptographic operations used to encrypt the datapath PDUs.

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

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

Figure 5 shows MACsec generating the CAK.

Figure 5 MACsec Generating the CAK



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

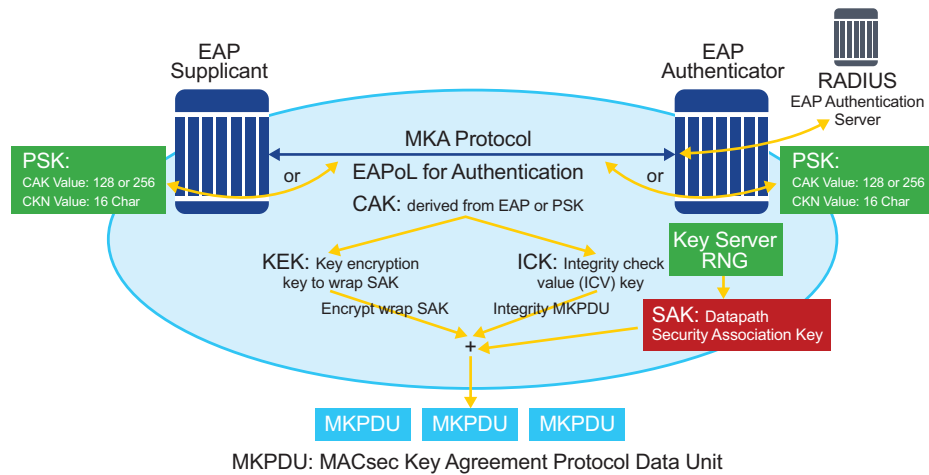
The control plane is secured using CAK, which is generated using one of the following methods:

- EAPoL
- pre-shared key (CAK and CKN values are configured using the CLI). The following CAK and CKN rules apply.
 - CAK uses 32 hexadecimal characters for a 128-bit key, and 64 hexadecimal characters for a 256-bit key, depending on the algorithm used for control plane encryption; for example, **aes-128-cmac** or **aes-256-cmac**.
 - CKN is a 32-octet character (64 hex) and is the name that identifies the CAK. This allows each of the MKA participants to select which CAK to use to process a received MKPDU. MKA places the following restrictions on the format of the CKN:
 - it must comprise an integral number of octets, between 1 and 32 (inclusive)

- all potential members of the CA must use the same CKN
- CAK and CKN must match on peers to create a MACsec-secure CA.

Figure 6 shows MACsec control plane authentication and encryption.

Figure 6 MACsec Control Plane



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

- KEK (Key Encryption Key)
The KEK is used to wrap and encrypt the SAKs.
- ICK (Integrity Connection Value (ICV) Key)
The ICK is used for an integrity check of each MKPDU send between two CAs.

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

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

2.3.2.1.6 SAK Rollover

The SAK is regenerated after the following events:

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

2.3.2.1.7 MKA

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

MKA PDU Generation

[Table 10](#) describes the MKA PDUs generated for different traffic encapsulation matches.

Table 10 MKA PDU Generation

Configuration	Configuration Example (<s-tag>.<c-tag>)	MKA Packet Generation	Traffic Pattern Match/ Behavior	Supported on 7210 SAS
All-encap	Config>port>ethernet>do t1x>macsec ca-name 10	untagged MKA packet	Matches all traffic on port, including untagged, single-tag, and double-tag. Default behavior.	Yes
UN-TAG	Config>port>ethernet>do t1x>macsec sub-port 1 encap-match untagged ca-name 2	untagged MKA packet	Matches only untagged traffic on port	No
802.1Q single S-TAG (specific S-TAG)	Config>port>ethernet>do t1x>macsec sub-port 2 encap-match dot1q 1 ca-name 3	MKA packet generated with S-TAG=1	Matches only single-tag traffic on port with tagID of 1	No

Table 10 MKA PDU Generation (Continued)

Configuration	Configuration Example (<s-tag>.<c-tag>)	MKA Packet Generation	Traffic Pattern Match/ Behavior	Supported on 7210 SAS
802.1Q single S-TAG (any S-TAG)	Config>port>ethernet>do t1x>macsec sub-port 3 encap-match dot1q * ca-name 4	untagged MKA packet	Matches any dot1q single-tag traffic on port	No
802.1ad double tag (both tag have specific TAGs)	Config>port>ethernet>do t1x>macsec sub-port 4 encap-match qinq 1.1 ca-name 5	MKA packet generated with S-tag=1 and C-TAG=1	Matches only double-tag traffic on port with service tag of 1 and customer tag of 1	No
802.1ad double tag (specific S-TAG, any C-TAG)	Config>port>ethernet>do t1x>macsec sub-port 6 encap-match qinq 1.* ca-name 7	MKA packet generated with S-TAG=1	Matches only double-tag traffic on port with service tag of 1 and customer tag of any	No
802.1ad double tag (any S-TAG, any C-TAG)	Config>port>ethernet>do t1x>macsec sub-port 7 encap-match qinq *.* ca-name 8	untagged MKA packet	Matches any double-tag traffic on port	No

Tags in Clear Behavior by Traffic Encapsulation Types

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

[Table 11](#) describes how single or double tags in clear configuration under a CA affect different traffic flow encryptions.

Table 11 Tags in Clear Behavior

Configuration	Traffic Pattern Match/Behavior	CA Configuration: No Tag in Clear Text	CA Configuration: Single-tag in Clear Text	CA Configuration: Double-tag in Clear Text
PORT	Matches all traffic on port, including untagged, single-tag, double-tag (default behavior)	MKA PDU: untagged Untagged traffic: encrypted Single-tag traffic: encrypted, no tag in clear Double-tag traffic: encrypted, no tag in clear	MKA PDU: untagged Untagged traffic: in clear Single-tag traffic: encrypted, single-tag in clear Double-tag traffic: encrypted, single-tag in clear	MKA PDU: untagged Untagged traffic: in clear Single-tag traffic: in clear Double-tag traffic: encrypted, double-tag in clear

2.3.2.1.8 PSK

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

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

- CKN
- CAK value

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

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

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

2.3.2.1.9 MKA Hello Timer

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

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

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

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



Note:

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

Table 12 lists the MKA participant timer values.

Table 12 MKA Participant Timer Values

Timer Use	Timeout (parameter)	Timeout (parameter)
Per participant periodic transmission, initialized on each transmission on expiry	MKA Hello Time or MKA Bounded Hello Time	2.0 0.5

Table 12 MKA Participant Timer Values (Continued)

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

2.3.2.1.10 MACsec Capability, Desire, and Encryption Offset

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

- MACsec Capability
- Desire

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

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

2.3.2.1.11 Key Server

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

- deciding on the use of MACsec
- cipher suite selection
- SAK generation and distribution
- SA assignment

- identifying the CA when two or more CAs merge

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

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



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

2.3.2.1.12 SA Limits and Network Design

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

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

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

[Table 13](#) describes the port mapping to security zones.

Table 13 Port Mapping to Security Zone

Platform	Ports in Security Zone 1	Ports in Security Zone 2	Ports in Security Zone 3	SA Limit per Security Zone
7210 SAS-K 2F6C4T	Ports 1, 2, 3, 4	Ports 5, 6, 7, 8	Ports 9, 10, 11, 12	Rx-SA = 64 Tx-SA = 64

Table 13 Port Mapping to Security Zone (Continued)

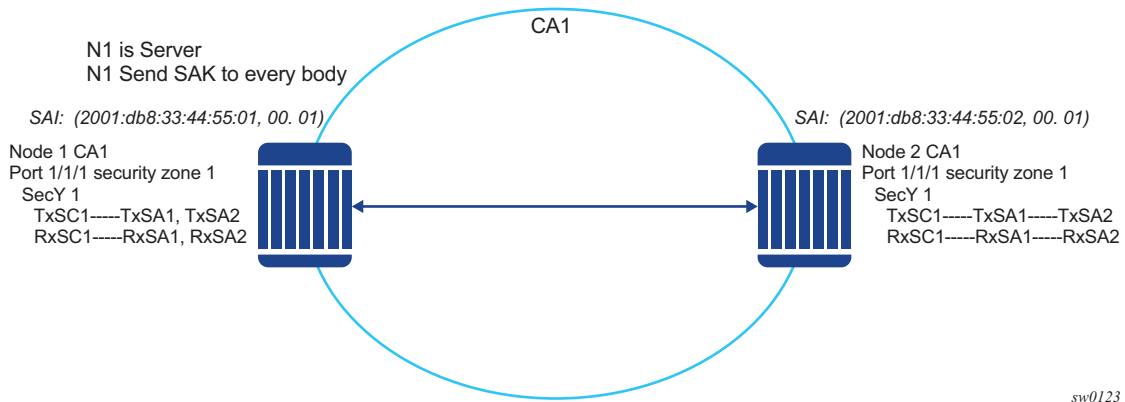
Platform	Ports in Security Zone 1	Ports in Security Zone 2	Ports in Security Zone 3	SA Limit per Security Zone
7210 SAS-K 3SFP+ 8C	Ports 1, 2, 3, 4 (1, 2, and 3 are 10GE ports)	Ports 5, 6, 7, 8	Ports 9, 10, 11	Rx-SA = 64 Tx-SA = 64

2.3.2.1.13 P2P (Switch-to-Switch) Topology

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

Figure 7 shows the P2P topology.

Figure 7 P2P (Switch-to-Switch) Topology

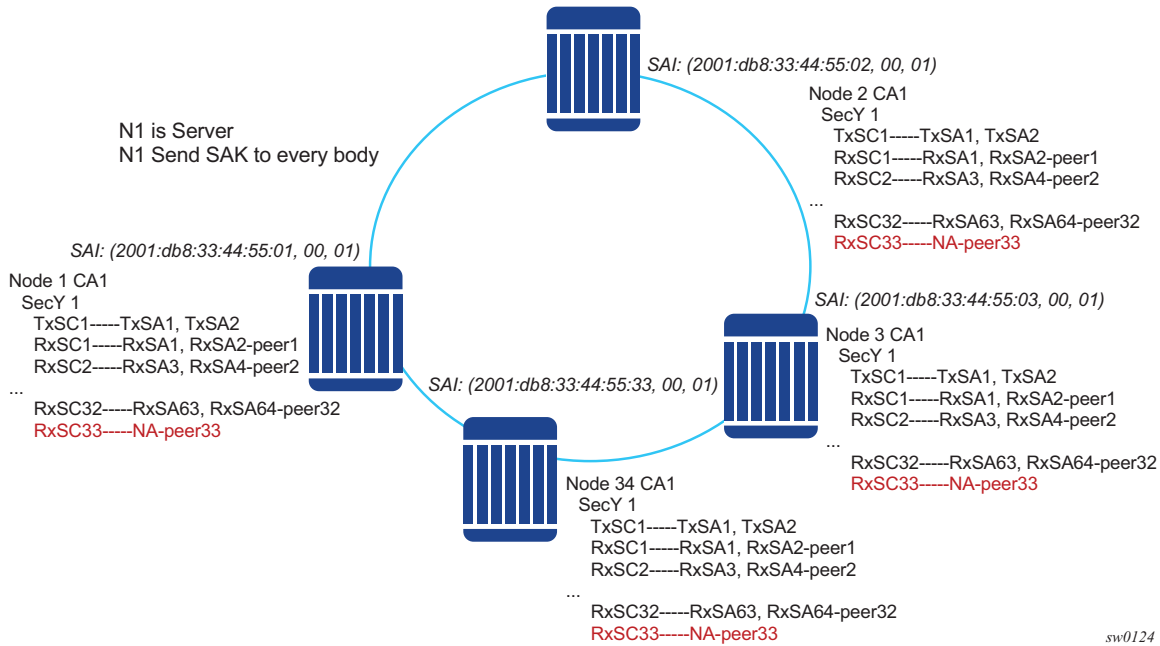


2.3.2.1.14 P2MP (Switch to Switch) Topology

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

As shown in [Figure 8](#), when the 34th node joins the multi-point topology, the other 33 nodes that are already part of this domain do not have SAs to create an Rx-SC for this 34th node; however, the 34th node has a Tx-SC and can accept 32 peers. The 34th node starts to transmit and encrypt the PDUs based on its Tx-SC. However, because all other nodes do not have as SC for this SAI, all Rx PDUs are dropped.

Figure 8 P2MP Topology



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

2.3.2.1.15 SA Exhaustion Behavior

A security zone has 64 Rx-SAs and 64 Tx-SAs, as described in [SA Limits and Network Design](#). Two Rx-SAs are used for each Rx-SC for rollover purposes, and two Tx-SAs are used for Tx-SC for rollover purposes. This translates to 32 peers for each security zone.

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



Note: You must ensure that the number of peers does not exceed the limit of maximum peers per security zone or maximum peers per port; for example, exceeds the **port max-peer** parameter.

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



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

2.3.2.1.16 Clear Tag Mode

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

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

Table 14 lists the MACsec encryption of 802.1Q tags when the clear-tag is configured.

Table 14 MACsec Encryption of 802.1Q Tags with Clear-tag Configured

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

2.3.2.1.17 802.1X Tunneling and Multihop MACsec

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

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

Check to see if tunneling is enabled using the following command:

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

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

2.3.2.1.18 EAPoL Destination Address

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

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

2.3.2.1.19 Mirroring Consideration

Mirroring is performed prior to MACsec encryption. Therefore, if a port is MACsec-enabled and is also being mirrored, all the mirror packets are in clear text.

2.3.3 Ethernet Combo Ports on 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

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

2.4 Link Layer Discovery Protocol (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.

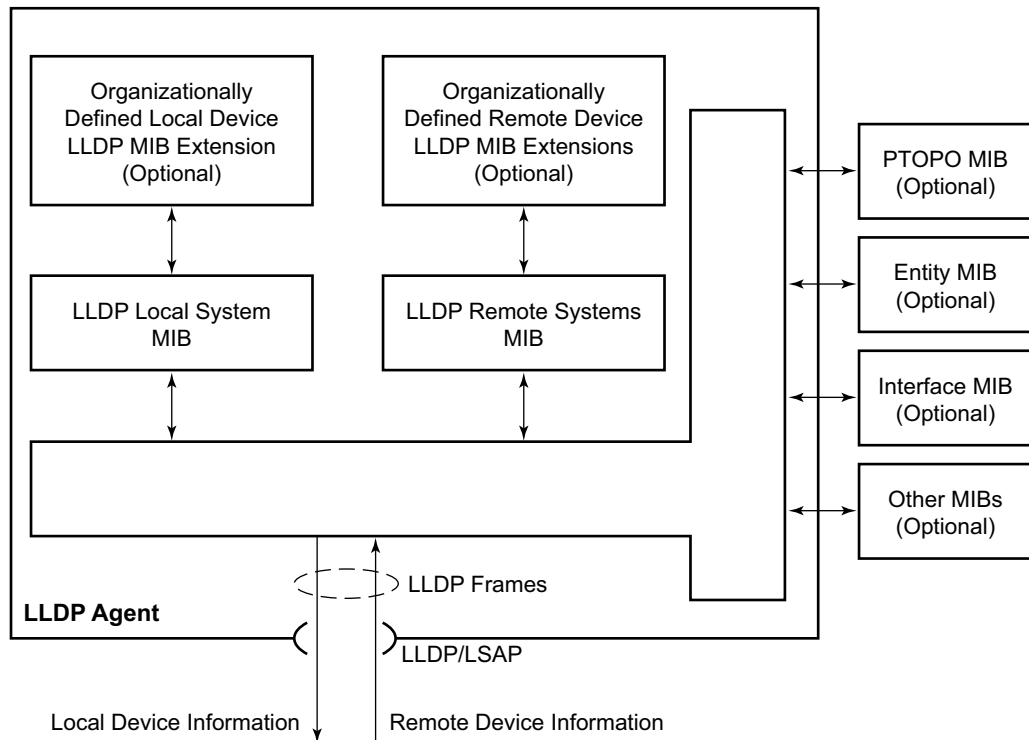
The following list is the information included in the protocol defined by the IEEE 802.1ab standard:

- 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 that suitable for storing connection information about adjacent stations is established.

- Provides compatibility with a number of MIBs. For more information, see [Figure 9](#).

[Figure 9](#) shows LLDP internal architecture for a network node.

Figure 9 LLDP Internal Architecture for a Network Node

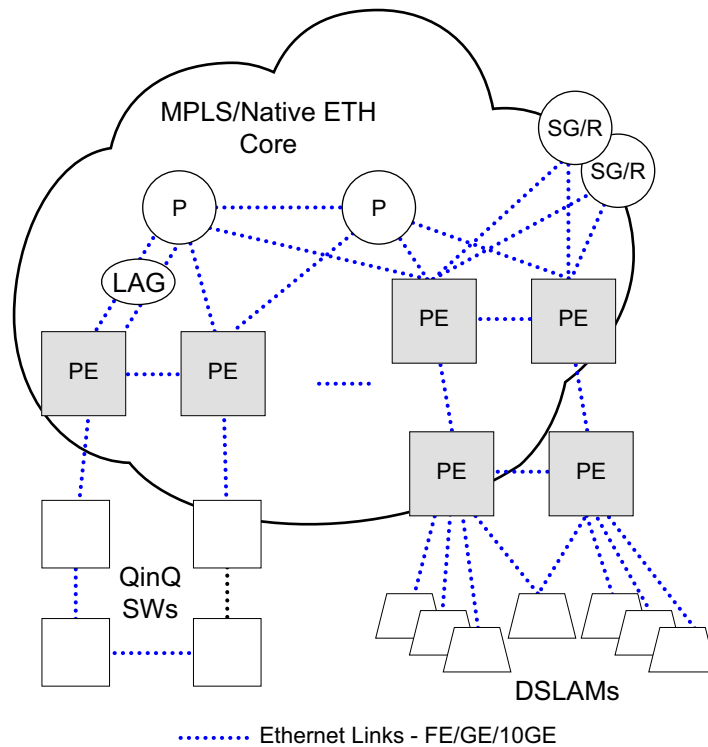


OSSG262

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 10](#) 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 10](#) can be discovered if, IEEE 802.1ab LLDP is running on each of the Ethernet interfaces in network.

Figure 10 Generic Customer Use Case For LLDP

OSSG263

2.4.1 LLDP Protocol Features

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

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

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

- Type identifies what kind of information is being sent.

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

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

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

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

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

A TTL value of 0 can be used, for example, to signal that the sending port has initiated a port shutdown procedure. The End Of LLDPDU TLV marks the end of the LLDPDU.

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

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

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

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

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

2.4.1.1 LLDP Tunneling for Epipe Service

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

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

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

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



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

2.5 Port Loopback for Ethernet Ports

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

The following sections describe the port loopback functionality.

2.5.1 Port Loopback without MAC Swap



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

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

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

2.5.2 Port Loopback with MAC Swap



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

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

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

2.5.3 Per-SAP Loopback with MAC Swap



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

The 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C provide per-SAP loopback support with MAC swap. When the SAP loopback command is enabled, all the packets that are sent out the SAP configured with loopback are looped back at the egress of the SAP back into the ingress of the SAP. The node swaps the MAC addresses before the packet hits the ingress of the SAP. After it is received back at SAP ingress, it processes these packets as per the service configuration for the SAP. Only traffic sent out of the test SAP is looped back. The loopback does not affect other SAPs and services configured on the same port. Per-SAP loopback is supported for use with both VPLS and Epipe services.

2.6 LAG

Based on the IEEE 802.3ax standard (formerly 802.3ad), Link Aggregation Groups (LAGs) can be configured to increase the bandwidth available between two network devices, depending on the number of links installed. LAG also provides redundancy 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 access uplink and access ports.

2.6.1 LAG Features

Hardware capabilities:

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

Software capabilities:

- Conforms to the IEEE LAG implementation.

2.6.2 Configuring LAGs

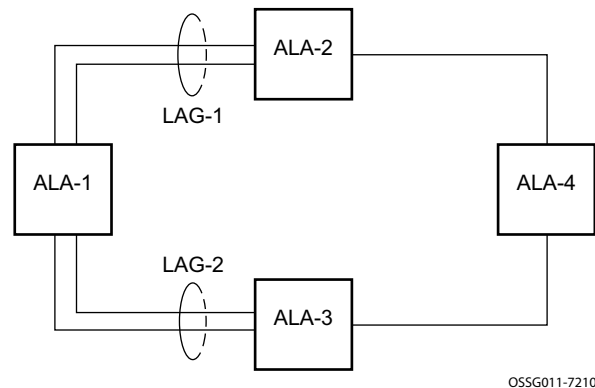
LAG configuration guidelines include:

- The 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E support up to four 1GE ports in a LAG. The 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T support up to three 1GE ports in a LAG. The 7210 SAS-K 3SFP+ 8C supports up to three 1GE ports or two 10GE ports in a LAG.
- Ports can be added or removed from the LAG while the LAG and its ports (other than the port being removed) remain operational. When ports to and/or from the LAG are added or removed, the hashing algorithm is adjusted for the new port count.

- The **show** commands display physical port statistics on a port-by-port basis or the entire LAG can be displayed.
- On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, a single set of counters is used to account for the traffic received on the LAG.
- LAG is supported on Ethernet ports.
- Ports of a particular LAG can be of different types but they must be the same speed and duplex. To guarantee the same port speed is used for all ports in a LAG, auto-negotiation must be disabled or in limited mode to ensure only a specific speed is advertised.

Figure 11 shows traffic routed between ALA-1 and ALA-2 as a LAG consisting of four ports.

Figure 11 LAG Configuration



2.6.3 LAG and QoS Policies on 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E

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

On the 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E, an egress QoS policy parameters are applied to all the ports that are members of the LAG (all ports get the full SLA). For example, if an egress policy is configured with a queue shaper rate of PIR 100Mbps, and applied to an access-uplink or access LAG configured with two port members, then each port would send out 100 Mbps of traffic for a total of 200Mbps of traffic out of the LAG. The advantage of this method over a scheme where the PIR is divided equally among all the member ports of the LAG is that, a single flow can use the entire SLA. The disadvantage is that, the overall SLA can be exceeded if the flows span multiple ports.

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

On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, an ingress QoS policy is applied to the aggregate traffic that is received through all the member ports of the LAG and mapped to that service entity (for example: access-uplink port). For example, if an ingress policy is configured with a queue shaper rate of PIR 100Mbps for an access-uplink LAG configured with two ports, then the queue shaper limits the traffic received through the two ports to a maximum of 100Mbps.

On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, egress QoS policy parameters are applied to all the ports that are members of the LAG (all ports get the full SLA). For example, if an egress policy is configured with a queue shaper rate of PIR 100Mbps, and applied to an access-uplink LAG configured with two port members, then each port can send out 100 Mbps of traffic for a total of 200Mbps of traffic out of the LAG (assuming flows are distributed among the 2 ports). The advantage of this method over a scheme where the PIR is divided equally among all the member ports of the LAG is that a single flow can use the entire SLA. The disadvantage is that the overall SLA can be exceeded if the flows span multiple ports.

2.6.5 Port Link Damping

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

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

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

2.6.6 LACP

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

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

2.6.7 LAG and ECMP Hashing



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

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

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

A 7210 SAS can deploy both methods at the same time, meaning it can use ECMP of two or more Link Aggregation Groups (LAG) or single links. The Nokia implementation supports per flow hashing used to achieve uniform loadspreading and per service hashing designed to provide consistent per service forwarding. Depending on the type of traffic that needs to be distributed into an ECMP or a LAG, different variables are used as input to the hashing algorithm.

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

2.6.7.1 LAG Hashing Algorithm for the 7210 SAS-D

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



Note: The following notes apply to Table 15:

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

Table 15 LAG Hashing Algorithm for Services Configured on 7210 SAS-D

Traffic Type	Packet Fields Used								
	BDA	BSA	EtherType	Ingress Port-ID	ISID	Source and Destination			VLAN
						MAC	IP	L4 Ports	
VPLS Service									
SAP to SAP									
IP traffic (learned)							✓	✓	
IP traffic (unlearned)				✓			✓	✓	
PBB traffic (learned)	✓	✓							✓
PBB traffic (unlearned)	✓	✓		✓	✓				
Non-IP traffic (learned)			✓			✓			✓
Non-IP traffic (unlearned)			✓	✓		✓			✓
Epipe Service									
SAP to SAP									
IP traffic				✓			✓	✓	
PBB traffic	✓	✓		✓	✓				

Table 15 LAG Hashing Algorithm for Services Configured on 7210 SAS-D

Traffic Type	Packet Fields Used								
	BDA	BSA	EtherType	Ingress Port-ID	ISID	Source and Destination			VLAN
						MAC	IP	L4 Ports	
Non-IP traffic			✓	✓		✓			✓
IES service (IPv4): IES SAP to IES SAP									
IPv4 unicast traffic							✓	✓	

2.6.7.2 LAG Hashing Algorithm for the 7210 SAS-Dxp

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



Note: The following notes apply to Table 16:

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

Table 16 LAG Hashing Algorithm for Services Configured on 7210 SAS-Dxp

Traffic Type	Packet Fields Used								
	BDA	BSA	EtherType	Ingress Port-ID	ISID	Source and Destination			VLAN
						MAC	IP	L4 Ports	
VPLS Service SAP to SAP									

Table 16 LAG Hashing Algorithm for Services Configured on 7210 SAS-Dxp (Continued)

Traffic Type	Packet Fields Used								
	BDA	BSA	EtherType	Ingress Port-ID	ISID	Source and Destination			VLAN
						MAC	IP	L4 Ports	
IP traffic (learned)							✓	✓	
IP traffic (unlearned)				✓					
PBB traffic (learned)	✓	✓							
PBB traffic (unlearned)	✓	✓		✓					
Non-IP traffic (learned)			✓			✓			
Non-IP traffic (unlearned)				✓		✓			
Epipe Service SAP to SAP									
IP traffic				✓					
PBB traffic	✓	✓		✓					
Non-IP traffic				✓		✓			
IES service (IPv4): IES SAP to IES SAP									
IPv4 unicast traffic							✓	✓	

2.6.7.3 LAG Hashing Algorithm for the 7210 SAS-E

Table 17 describes the packet fields used for hashing for services configured on the 7210 SAS-E.



Note: The following notes apply to [Table 17](#):

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

Table 17 LAG Hashing Algorithm for Services Configured on 7210 SAS-E

Traffic Type	Packet Fields Used							
	BDA	BSA	EtherType	MPLS Label Stack	Source and Destination			VLAN
					MAC	IP	L4 Ports	
VPLS Service SAP to SAP								
IP traffic (learned)						✓	✓	
IP traffic (unlearned)					✓			
PBB traffic (learned)	✓	✓						✓
PBB traffic (unlearned)	✓	✓						
MPLS traffic (learned)				✓ ²	✓ ¹			✓
MPLS traffic (unlearned)					✓ ¹			
Non-IP traffic (learned)			✓		✓			✓
Non-IP traffic (unlearned)					✓			
Epipe Service SAP to SAP								
IP traffic					✓			
PBB traffic	✓	✓						

Table 17 LAG Hashing Algorithm for Services Configured on 7210 SAS-E

Traffic Type	Packet Fields Used							
	BDA	BSA	EtherType	MPLS Label Stack	Source and Destination			VLAN
					MAC	IP	L4 Ports	
MPLS traffic					✓ ¹			
Non-IP traffic					✓			
IES service (IPv4): IES SAP to IES SAP								
IPv4 unicast traffic						✓	✓	

Notes:

1. The outer MAC of the Ethernet packet that encapsulates an MPLS packet
2. Two MPLS labels deep

2.6.7.4 LAG Hashing Algorithm for the 7210 SAS-K 2F1C2T

Table 18 describes the packet fields used for hashing for services configured on the 7210 SAS-K 2F1C2T.



Note: The following notes apply to Table 18:

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

**Table 18 LAG Hashing Algorithm for Services Configured on
7210 SAS-K 2F1C2T**

Traffic Type	Packet Fields Used								
	BDA	BSA	Ingress Port-ID	IP Protocol	Source and Destination			VLAN	
					MAC	IP	L4 Ports	Outer	Inner
VPLS Service SAP to SAP									
IP traffic (learned and unlearned)			✓	✓		✓	✓	✓	
PBB traffic (learned and unlearned)	✓	✓	✓					✓	✓
MPLS traffic (learned and unlearned)			✓		✓ ¹			✓	✓
Non-IP traffic (learned and unlearned)			✓		✓			✓	✓
Epipe Service SAP to SAP									
IP traffic			✓	✓		✓	✓	✓	
PBB traffic	✓	✓	✓					✓	✓
MPLS traffic			✓		✓ ¹			✓	✓
Non-IP traffic			✓		✓			✓	✓

Note:

1. The outer MAC of the Ethernet packet that encapsulates an MPLS packet

2.6.7.5 LAG Hashing Algorithm for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Table 19 describes the packet fields used for hashing for services configured on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.



Note: The following notes apply to [Table 19](#):

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

Table 19 LAG Hashing Algorithm for Services Configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Traffic Type	Packet Fields Used							
	Ingress Port-ID	IP Protocol	MPLS Label Stack	Source and Destination			VLAN	
				MAC	IP	L4 Ports	Outer	Inner
VPLS Service SAP to SAP								
IP traffic (learned and unlearned)	✓	✓			✓	✓	✓	
MPLS traffic (learned and unlearned)	✓			✓ ¹			✓	✓
Non-IP traffic (learned and unlearned)	✓			✓			✓	✓
VPLS Service SAP to SDP								
IP traffic (learned and unlearned)	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓ ¹			✓	✓
Non-IP traffic (learned and unlearned)	✓			✓			✓	✓

Table 19 LAG Hashing Algorithm for Services Configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C (Continued)

Traffic Type	Packet Fields Used							
	Ingress Port-ID	IP Protocol	MPLS Label Stack	Source and Destination			VLAN	
				MAC	IP	L4 Ports	Outer	Inner
VPLS Service SDP to SAP²								
IP traffic (learned and unlearned)	✓	✓			✓	✓		
Non-IP traffic (learned and unlearned)	✓			✓				
VPLS Service SDP to SDP²								
IP traffic (learned and unlearned)	✓	✓			✓	✓		
Non-IP traffic (learned and unlearned)	✓			✓				
Epipe Service SAP to SAP								
IP traffic	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓ ¹			✓	✓
Non-IP traffic	✓			✓			✓	✓
Epipe Service SAP to SDP								
IP traffic	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓ ¹			✓	✓
Non-IP traffic	✓			✓			✓	✓
Epipe Service SDP to SAP²								
IP traffic (learned and unlearned)	✓	✓			✓	✓		

Table 19 LAG Hashing Algorithm for Services Configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C (Continued)

Traffic Type	Packet Fields Used							
	Ingress Port-ID	IP Protocol	MPLS Label Stack	Source and Destination			VLAN	
				MAC	IP	L4 Ports	Outer	Inner
Non-IP traffic (learned and unlearned)	✓			✓				
MPLS - LSR								
All traffic	✓		✓ ³				✓	
IES Service (IPv4) IES SAP to IES SAP								
—	✓	✓			✓ ⁴	✓	✓	
IES Service (IPv6) IES SAP to IES SAP								
—	✓	✓			✓ ⁴	✓	✓	
IES Service (IPv4) IES SAP to IPv4 network port interface								
—	✓	✓			✓ ⁴	✓	✓	
IES Service (IPv6) IES SAP to IPv6 network port interface								
—	✓	✓			✓ ⁴	✓	✓	
IES Service (IPv4) interface IPv4 network port interface to IES SAP								
—	✓	✓			✓ ⁴	✓	✓	
IES Service (IPv6) IPv6 network port interface to IES SAP								
—	✓	✓			✓ ⁴	✓	✓	
Network port (IPv4) interface IPv4 network interface to IPv4 network interface								
—	✓	✓			✓ ⁴	✓	✓	

Table 19 LAG Hashing Algorithm for Services Configured on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C (Continued)

Traffic Type	Packet Fields Used							
	Ingress Port-ID	IP Protocol	MPLS Label Stack	Source and Destination			VLAN	
				MAC	IP	L4 Ports	Outer	Inner
Network port (IPv6) interface IPv6 network interface to IPv6 network interface								
—	✓	✓			✓ ⁴	✓	✓	
VPRN SAP to SAP, SDP to SAP, SAP to SDP								
—	✓	✓			✓ ⁴	✓	✓	

Notes:

1. The outer MAC of the Ethernet packet that encapsulates an MPLS packet
2. Traffic in the payload
3. Four MPLS labels deep
4. IPv4 and IPv6

2.6.7.6 Packet Fields Used for Pseudowire Hash-label Generation on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Table 20 describes the packet fields used by different services and traffic types to generate the PW hash label.

Table 20 Packet Fields Used for PW Hash-Label Generation on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Traffic Type	Packet Fields Used						
	Ingress Port-ID	IP Protocol	Source and Destination			VLAN	
			MAC	IP	L4 Ports	Outer	Inner
VPLS and Epipe Services SAP to SDP							
IP traffic (learned and unlearned)	✓	✓		✓	✓	✓	
MPLS traffic (learned and unlearned)	✓		✓ ¹			✓	✓
Non-IP traffic (learned and unlearned)	✓		✓			✓	✓
VPLS Services SDP to SDP							
IP traffic (learned and unlearned)	✓	✓		✓	✓		
Non-IP traffic (learned and unlearned)	✓		✓				

Note:

1. The outer MAC of the Ethernet packet that encapsulates MPLS packets

2.6.7.7 LDP ECMP Hashing Algorithm for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

Table 21 describes the packet fields used for LDP ECMP hashing for label edge router (LER) and label switching router (LSR) devices on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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

Traffic Type	Packet Fields Used							
	Ingress Port-ID	IP Protocol	MPLS Label Stack	Source and Destination			VLAN	
				MAC	IP	L4 Ports	Outer	Inner
VPLS and Epipe Services SAP to SDP (iLER)								
IP traffic	✓	✓			✓	✓	✓	
MPLS traffic	✓			✓ ¹			✓	✓
Non-IP traffic	✓			✓			✓	✓
LSR								
MPLS traffic	✓		✓ ²				✓	

Notes:

1. The outer MAC of the Ethernet packet that encapsulates MPLS packets
2. Four MPLS labels deep

2.6.8 Multi-Chassis LAG

This section describes the Multi-Chassis LAG (MC-LAG) concept. MC-LAG is an extension of a LAG concept that provides node-level redundancy in addition to link-level redundancy provided by “regular LAG”.



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

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

2.6.8.1 Overview

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

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

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

MC-LAG has the following characteristics.

- Selection of the common system ID, system-priority, and administrative-key are used in LACP messages to ensure that partner systems consider all links part of the same LAG.
- The selection algorithm is extended to allow the selection of the active subgroup.
 - The subgroup definition in the LAG context is still local to the single box. Consequently, even when subgroups configured on two different systems have the same subgroup-id, they are still considered two separate subgroups within the specific LAG.
 - Multiple subgroups per PE in a MC-LAG is supported.
 - If there is a tie in the selection algorithm, for example, two subgroups with identical aggregate weight (or number of active links), the group that is local to the system with lower system LACP priority and LAG system ID is selected.
- Providing an inter-chassis communication channel allows the inter-chassis communication to support LACP on both systems. The communication channel enables the following functionality.
 - It supports connections at the IP level that do not require a direct link between two nodes. The IP address configured at the neighbor system is one of the addresses of the system (interface or loop-back IP address).

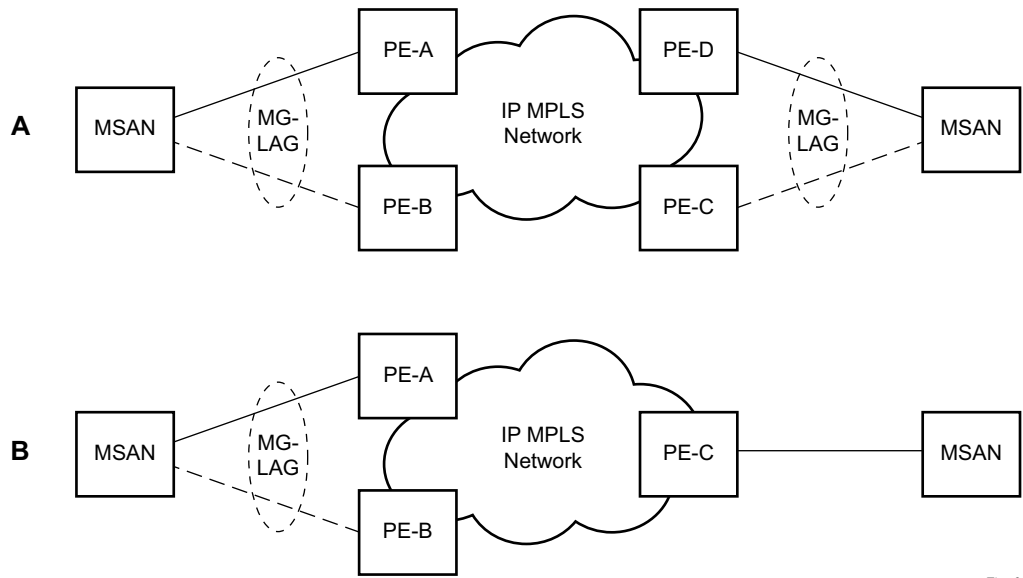
-
- The communication protocol provides heartbeat mechanism to enhance robustness of the MC-LAG operation and detect node failures.
 - It supports operator actions that force an operational change on nodes.
 - The LAG group-ids do not have to match between neighbor systems. At the same time, multiple LAG groups between the same pair of neighbors is also allowed.
 - It verifies that the physical characteristics, such as speed and auto-negotiation are configured and initiates operator notifications (traps) if errors exist. Consistency of MC-LAG configuration (system-id, administrative-key and system-priority) is provided. Load-balancing must be consistently configured on both nodes.
 - Traffic over the signaling link is encrypted using a user-configurable message digest key.
- The MC-LAG function provides active/standby status to other software applications to build reliable solutions.

Figure 12 and Figure 13 show different combinations of supported MC-LAG attachments. The supported configurations can be divided into the following subgroups:

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

Figure 12 shows dual homing to remote PE pairs.

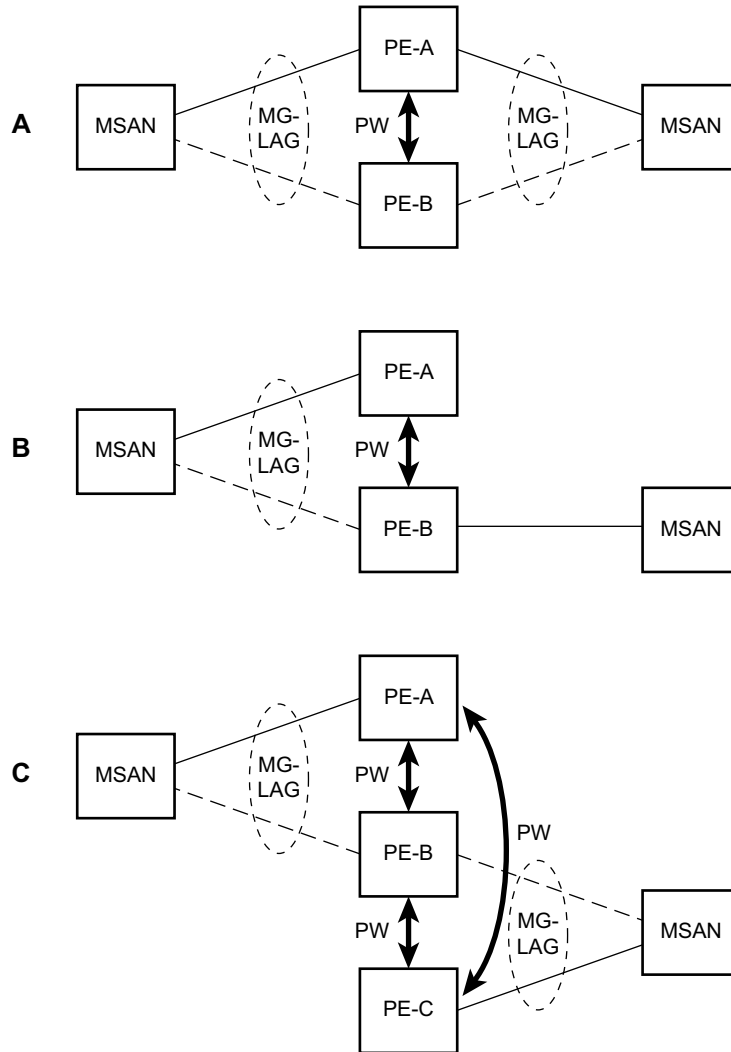
Figure 12 MC-LAG L2 Dual Homing to Remote PE Pairs



Fig_6

Figure 13 shows dual homing to local PE pairs.

Figure 13 MC-LAG L2 Dual Homing to Local PE-Pairs



Fig_7

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

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

- Packets received from the MC-LAG sap will be forwarded to the active destination pseudo-wire or active local links of destination-sap. If no such objects are available at the local node, the packets will be cross-connected to inter-chassis pseudowire.

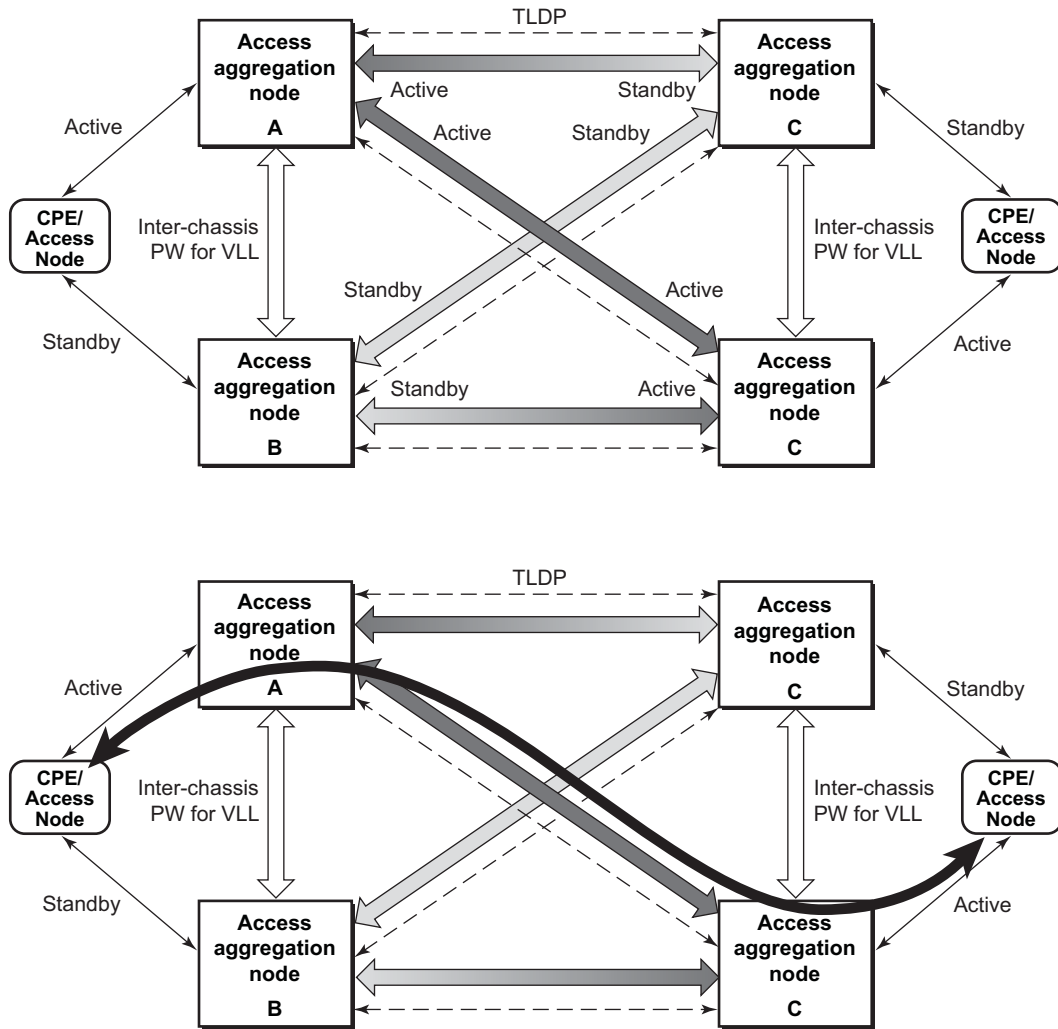
2.6.8.2 Point-to-Point Redundant Connection Across Layer 2/3 VPN Network

[Figure 14](#) shows the connection between two CPE/access nodes across network based on Layer 2/3 VPN pseudo-wires. The connection between a CPE/access node and a pair of access aggregation PE routers is realized by MC-LAG. From the CPE/access node perspective, a redundant pair of access aggregation PE routers acts as a single partner in LACP negotiation. At any point in time, only one of the routers has active links in a specific LAG. The status of LAG links is reflected in the status signaling of pseudowires set between all participating PEs. The combination of active and standby states across LAG links and pseudowires give only one unique path between a pair of MSANs.

Note that the configuration in [Figure 14](#) shows an example configuration of VLL connections based on MC-LAG. Specifically, it shows a VLL connection where the two ends (SAPs) are located on two different redundant-pairs. However, additional configurations are possible, for example:

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

Figure 14 P2P Redundant Connection Through a Layer 2 VPN Network



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2.6.8.3 Configuration Guidelines

The following guidelines apply to MC-LAG configurations.

- MC-LAG peer nodes must be of the same platform type. For example, 7210 SAS-K 2F6C4T can only peer with another 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C can only peer with another 7210 SAS-K 3SFP+ 8C. 7210 SAS-K 2F6C4T cannot be configured with 7210 SAS-K 3SFP+ 8C as its MC-LAG peer.

- MC-LAG is only supported when using MPLS uplinks with network ports. It is not supported with access-uplink ports.
- The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C can also be MC-LAG clients, with an active/standby LAG configuration used to dual-home to access-aggregation routers when using access-uplink ports. In this scenario the user has an option to provision the uplinks as access-uplink ports to dual-home into two aggregation PE routers that are configured as MC-LAG peers.

2.6.8.4 Configuring Multi-Chassis Redundancy



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

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

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

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

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
      exit
-----
*7210-SAS>config>redundancy#

```

2.6.8.5 MC-LAG Support on 7210 SAS-D, 7210 SAS-K 2F1C2T, and 7210 SAS-E (in client mode)

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

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

2.6.9 G.8032 Protected Ethernet Rings

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

Refer to “G.8032 Protected Ethernet Rings” in the 7210 SAS-D, E, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Services Guide for more information about Ethernet rings.

2.6.9.1 802.1x Network Access Control

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

2.6.9.1.1 802.1x 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 that is described as follows. The port will remain in an unauthorized state (no traffic except EAPOL frames is allowed) until the first client is authenticated successfully. After this, traffic is allowed on the port for all connected hosts.

2.6.9.2 802.1x Basics

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

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

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

2.6.9.3 802.1x Timers

The 802.1x authentication procedure is controlled by a number of configurable timers and scalars. There are two separate sets, one for the EAPOL message exchange and one for the RADIUS message exchange.

EAPOL timers:

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

RADIUS timer and scaler:

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

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

2.6.9.4 802.1x 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.

2.6.9.5 802.1x Tunneling for Epipe Service

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



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

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

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

2.7 802.3ah OAM

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

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

The following EFM OAM functions are supported:

- EFM OAM capability discovery.
- Active and passive modes.
- Remote failure indication — Handling of critical link events (for example, link fault, critical event, dying gasp)
- Loopback — A mechanism is provided to support a data link layer frame-level loopback mode. Both remote and local loopback modes are supported.
- Generation of dying gasp message on access uplink ports on power failure.
- EFM OAMPDU tunneling.
- Timer for EFM OAM in 500ms interval (minimum).

2.7.1 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.

2.7.2 Remote Loopback

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

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

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

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

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

2.7.3 802.3ah OAM PDU Tunneling for Epipe Service

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

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

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

Note that enabling 802.3ah for a port and enabling OAM PDU tunneling for the same port are mutually exclusive. That is, on a specific port either 802.3ah tunneling can be enabled or 802.3ah can be enabled, but both cannot be enabled together.

2.7.4 MTU Configuration Guidelines

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

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

- Identify the ports that are designated as access uplink ports as these are intended to carry service traffic.
- MTU values should not be modified frequently.
- MTU values must conform to the following conditions on the 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E:
 - The access uplink port MTU must be greater than or equal to the access port MTU plus the overhead added by the system (for example, typically 4 bytes of VLAN tag are added when a packet is transmitted using the QinQ access uplink).
- The 7210 SAS-K 2F1C2T supports service-mtu. The service MTU values must conform to the following conditions:
 - The service MTU must be less than or equal to the access-uplink port MTU.
 - The service MTU must be less than or equal to the access port (SAP) MTU.

- The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C support service-mtu. The service MTU values must conform to the following conditions:
 - The service MTU must be less than or equal to the access-uplink port MTU.
 - The service MTU must be less than or equal to the SDP path MTU when the service is configured to use MPLS SDPs.
 - The service MTU must be less than or equal to the access port (SAP) MTU.

2.7.4.1 Default MTU Values

Table 22 describes the default MTU values that are dependent upon the (sub-) port type, mode, and encapsulation.

Table 22 MTU Default Values

Port Type	Mode	Encap Type	Default (bytes)
Ethernet	access	null	1514
Ethernet	access	dot1q	1518
Port mode	access	qinq	1522
Fast Ethernet	uplink	—	1522
Other Ethernet	uplink	—	9212
Ethernet	hybrid	—	9212

2.7.4.2 Modifying MTU Defaults on 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E

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

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

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

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

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

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

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

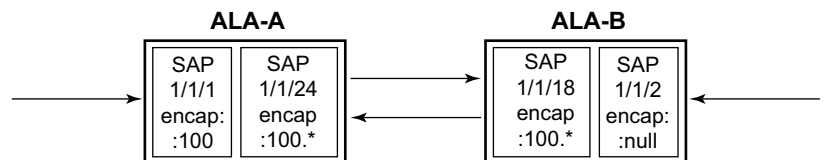
The service MTU must be less than or equal to both the access SAP port MTU and the access-uplink port MTU values. If the service from the 7210 SAS-K 2F1C2T is transported over an SDP in the IP/MPLS network (the SDP is not originating or terminating on the node), the operational path MTU can be less than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

2.7.4.4 Configuration Example for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C Using SAPs in the Service

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

Figure 15 shows an example of the targeted MTU values to configure for an Epipe service (ALA-A and ALA-B).

Figure 15 MTU Configuration Example



OSSG012-7210E

Since ALA-A uses Dot1q encapsulation, the port 1/1/1 MTU must be set to 1518 to be able to accept a 1514-byte service frame (see [Table 23](#) for MTU default values). Each of the access uplink port MTU must be set to at least 1518 as well. Finally, the MTU of ALA-B SAP (access port 1/1/2) must be at least 1514, as it uses null encapsulation.

[Table 23](#) describes sample MTU configuration values.

Table 23 MTU Configuration Example Values (ALA-A with Dot1q SAP Type, ALA-B with Null Encap)

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

Instead, if ALA-A uses a dot1q-preserve SAP on port 1/1/1, then port 1/1/1 MTU must be set to 1518 to be able to accept a 1514-byte service frame (see [Table 24](#) for MTU default values). Each of the access uplink port MTU must be set to at least 1522 as well. Finally, the MTU of ALA-B SAP (access port 1/1/2) must be at least 1518, as it uses Dot1q encapsulation.

[Table 24](#) describes sample MTU configuration values.

Table 24 MTU Configuration Example Values (ALA-A with Dot1q-preserve SAP Type, ALA-B with Dot1Q Encap)

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

2.7.5 Modifying MTU Defaults on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C when Using SDP in the Service

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

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

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

In a service configured to use access SAPs and access-uplinks SAPs, the service MTU must be less than or equal to both the access SAP port MTU and the access uplink port MTU values. If the service from the 7210 SAS-K 2F6C4T or 7210 SAS-K 3SFP+ 8C is transported over an SDP in the IP/MPLS network (the SDP is not originating or terminating on the node), the operational path MTU can be less than the service MTU. In this case, the user might need to modify the MTU value accordingly.

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

2.7.6 Deploying Preprovisioned Components

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

2.8 MAC Authentication



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

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

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

Layer 2 control protocols affect MAC authentication behavior differently depending on the protocol in use; see [Layer 2 Control Protocol Interaction with Authentication Methods](#) for more information.

2.8.1 MAC Authentication Basics

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

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



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

2. If the **mac-auth-wait** timer expires, and no EAPOL frames have been received, the 7210 SAS begins listening on the port for any Ethernet frames.

3. If the 7210 SAS receives an Ethernet frame, the 7210 SAS scans the client source MAC address in the frame and transmits the MAC address to the configured RADIUS server for comparison against the MAC addresses configured in its database.

The following attributes are contained in the RADIUS message:

- User-Name
This attribute specifies the source MAC address of the client device.
 - User-Password
This attribute specifies the source MAC address of the client device in an encrypted format.
 - Service-Type
This attribute specifies the type of service that the client has requested; the value is set to 10 (call-check) for MAC authentication requests.
 - Calling-Station-Id
This attribute specifies the source MAC address of the client device.
 - NAS-IP-Address
This attribute specifies the IP address of the device acting as the authenticator.
 - NAS-Port
This attribute specifies the physical port of the device acting as the authenticator.
 - Message-Authenticator
This attribute is used to authenticate and protect the integrity of Access Request messages in order to prevent spoofing attacks.
4. If the MAC address is approved by the RADIUS server, the 7210 SAS enables the port for traffic transmission by that particular MAC address, which is successfully authenticated.

If the MAC address is rejected by the RADIUS server, the 7210 SAS will not authenticate the port using either 802.1x or MAC authentication. If an Ethernet frame with the same MAC address is received, the 7210 SAS returns to step 3 and reattempts approval of the MAC address.
 5. If a port that was previously authenticated with MAC authentication receives an EAPOL-Start frame, the port will not reauthenticate using 802.1x EAPOL.

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

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

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

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

2.8.2 MAC Authentication Limitations

MAC authentication is subject to the following limitations.

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



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

2.9 VLAN Authentication



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

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

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

VLAN authentication and MAC authentication are mutually exclusive. MAC authentication cannot be configured on a port while VLAN authentication is already configured on the same port. See [MAC Authentication](#) for information about MAC authentication.

Layer 2 control protocols affect VLAN authentication behavior differently depending on the protocol in use; see [Layer 2 Control Protocol Interaction with Authentication Methods](#) for more information.

2.9.1 VLAN Authentication Basics

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

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

The User-Name attribute is contained in the RADIUS message. This attribute specifies the username received in the EAPOL frame from the client device.

3. If the VLAN is approved by the RADIUS server, the 7210 SAS maps all traffic received from the VLAN to a SAP and processes it in the context of the configured service.

If the VLAN is rejected by the RADIUS server, all traffic from the VLAN is dropped. The 7210 SAS enters a quiet period, configured using the **quiet-period** command, and will not authenticate the port using VLAN authentication. After the quiet period expires, the 7210 SAS returns to step 1.

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

2.9.2 VLAN Authentication Limitations

VLAN authentication is subject to the following limitations.

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

2.10 Layer 2 Control Protocol Interaction with Authentication Methods

[Table 25](#) describes the interactions of Layer 2 control protocols with 802.1x authentication, MAC authentication, and VLAN authentication.

Table 25 Layer 2 Control Protocol Interaction with Authentication Methods

Layer 2 Control Protocol	802.1x Port Authentication Enabled	MAC Authentication Enabled	VLAN Authentication Enabled	
			Dot1q Explicit Null SAP Not Configured	Dot1q Explicit Null SAP Configured
EFM OAM	Allow	Allow	Allow	Allow
LLDP	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	Allow	Allow

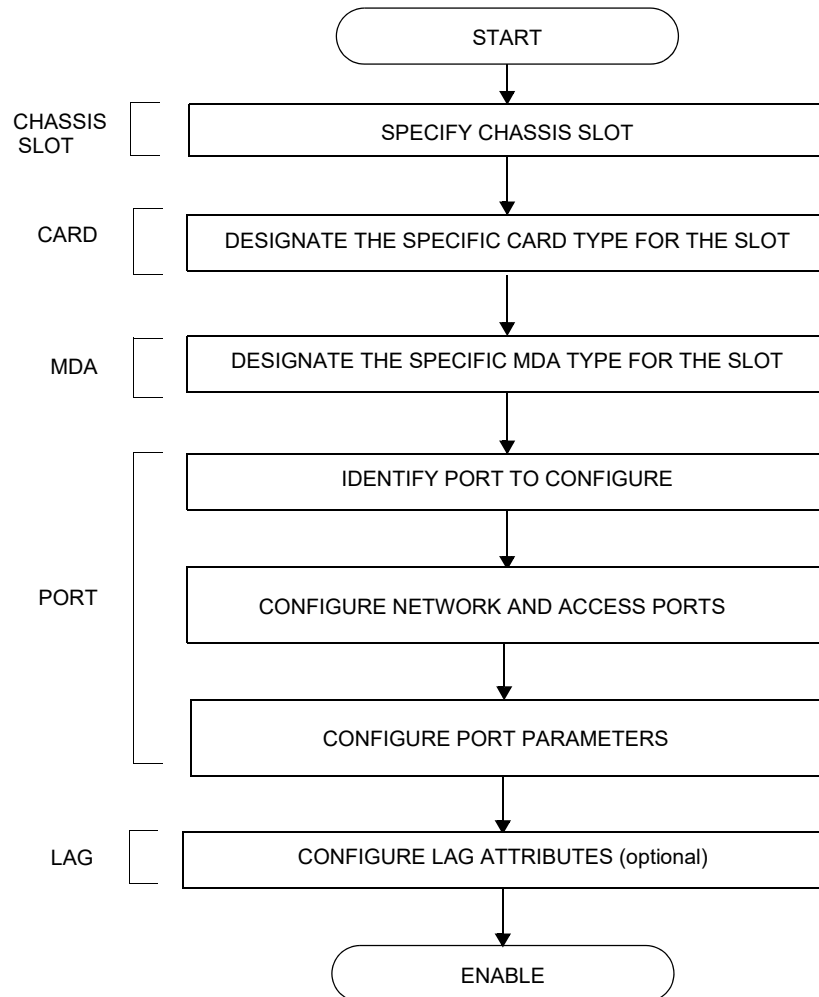
Table 25 Layer 2 Control Protocol Interaction with Authentication Methods (Continued)

Layer 2 Control Protocol	802.1x Port Authentication Enabled	MAC Authentication Enabled	VLAN Authentication Enabled	
			Dot1q Explicit Null SAP Not Configured	Dot1q Explicit Null SAP Configured
LACP	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	LAG and LACP are not supported on ports with VLAN authentication enabled	LAG and LACP are not supported on ports with VLAN authentication enabled
CFM	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	Block if VLAN (SAP) is unauthenticated Allow only if specific VLAN is authenticated	Block if null SAP is unauthenticated Allow if null SAP is authenticated
xSTP (STP/RSTP/MSTP)	Block if port is unauthenticated Allow if port is authenticated	Block if MAC is unauthenticated Allow if MAC is authenticated	Block if VLAN (SAP) is unauthenticated Allow if VLAN (SAP) is authenticated	Block if null SAP is unauthenticated Allow if null SAP is authenticated

2.11 Configuration Process Overview

Figure 16 shows the process to provision chassis slots, line cards, MDAs, and ports.

Figure 16 Slot, Card, MDA, and Port Configuration and Implementation Flow



2.12 Configuring Physical Ports with CLI

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

2.13 Preprovisioning Guidelines

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

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

2.13.1 Predefining Entities

The 7210 SAS auto-provisions card and MDA types.

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

You can:

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

2.13.2 Preprovisioning a Port

Some recommendations to configure a port include:

- Ethernet
 - Configure an access port for customer facing traffic on which services are configured.

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

To configure an Ethernet access port, refer to [Configuring Ethernet Port Parameters](#).

2.14 Basic Configuration

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

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

2.15 Common Configuration Tasks

2.15.1 Configuring Ethernet Port Parameters

2.15.1.1 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
exit
no shutdown
-----
A:ALA-B>config>port#
```

Ethernet network port configuration is supported only on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

2.15.1.2 Ethernet Access-Uplink Port

An access-uplink port is network facing and participates in the service provider transport or infrastructure network processes. This is similar to a network port concept, except that the 7210 SAS-E does not allow IP interfaces and does not run routing protocols.

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

The following is a sample network port configuration output.

```
A:ALA-B>config>port# info
-----
description "Ethernet Access Uplink port"
-----
ethernet
mode access uplink
exit
```

```

no shutdown
-----
A:ALA-B>config>port#

```

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

2.15.1.3 Ethernet Access Port

Services are configured on access ports used for customer-facing traffic. If a Service Access Port (SAP) is to be configured on a port, it must be configured as access mode or access uplink mode. When a port is configured for access mode, the appropriate encapsulation type can be specified to distinguish the services on the port. When a port has been configured for access mode, multiple services may be configured on the port.

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

```

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

```

```

*A:7210-SAS>

```

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

```

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

```

```
-----  
A:ALA-A>config>port#
```

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

2.15.1.4 Configuring 802.1x Authentication Port Parameters

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

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

2.15.1.5 Configuring MAC Authentication Port Parameters



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

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

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

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

```
CLI Syntax: port port-id ethernet  
dot1x  
mac-auth  
mac-auth-wait seconds
```

```
port-control auto
quiet-period seconds
radius-plcy name
```

The following example shows the command usage to configure MAC authentication for an Ethernet port.

Example:

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

Use the **info detail** command to display port configuration information. The following is a sample port configuration output.

```
SAS-T>config>port>ethernet>dot1x# info detail
-----
port-control auto
radius-plcy dot1xpolicy
re-authentication
re-auth-period 3600
max-auth-req 2
transmit-period 30
quiet-period 60
supplicant-timeout 30
server-timeout 30
mac-auth
mac-auth-wait 20
-----
SAS-T>config>port>ethernet>dot1x#
```

2.15.1.6 Configuring VLAN Authentication Port Parameters



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

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

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

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

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

The following example shows the command usage to configure VLAN authentication for an Ethernet port.

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

Use the **info detail** command to display port configuration information. The following is a sample port configuration output.

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

2.15.2 Configuring LAG Parameters

The following are general rules for configuring LAGs:

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

- Ports in a LAG must be configured as full duplex.

The following is a sample LAG configuration output.

```
A:ALA-A>config>lag# info detail
-----
      description "LAG2"
      mac 04:68:ff:00:00:01
      port 1/1/1
      port 1/3/1
-----
A:ALA-A>config>lag#
A:ALA-A>config>lag# info detail
-----
description "LAG2"
mac 04:68:ff:00:00:01
port 1/1/1
port 1/1/2
port 1/1/3
dynamic-cost
port-threshold 2 action down
-----
A:ALA-A>config>lag#
```

2.16 CRC Error Monitoring



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

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

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

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

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

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

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

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

2.17 Service Management Tasks

This section describes basic procedures of the service management tasks:

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

Use the following syntax to modify an MDA.

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

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

2.17.1 Modifying a Card Type

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

2.17.2 Deleting a Card

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

2.17.3 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

- [Configuration Commands](#)
- [Show Commands](#)
- [Monitor Commands](#)
- [Clear Commands](#)
- [Debug Commands](#)

2.18.1.1 Configuration Commands

- [Hardware Commands](#)
- [Port Buffer Pool Configuration Commands for 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E](#)
- [Port Configuration Commands](#)
- [Port-based Split Horizon Group Configuration Commands for 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E](#)
- [Port Commands for Reserving Resources of Ports on 7210 SAS-Dxp and 7210 SAS-E](#)
- [MACsec Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C](#)
- [Ethernet Commands](#)
- [LAG Commands for 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E](#)
- [LAG Commands for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C](#)
- [Multi-chassis Redundancy Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C](#)
- [Ethernet Ring Commands](#)

2.18.1.1.1 Hardware Commands

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

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

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

- ```

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

```

### 2.18.1.1.3 Port Configuration Commands

- ```

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

```

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

Port Configuration Commands

- ```

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

```

LAG Commands

- ```

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

```

2.18.1.1.5 Port Commands for Reserving Resources of Ports on 7210 SAS-Dxp and 7210 SAS-E

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

2.18.1.1.6 MACsec Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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

2.18.1.1.7 Ethernet Commands

Port Ethernet QoS commands

```
config
```

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

Port Ethernet Commands

- ```
config
— [no] port {port-id}
 — ethernet
 — autonegotiate [limited]
 — [no] autonegotiate
 — connection-type connection-type
 — down-on-internal-error
 — no down-on-internal-error
 — duplex {full | half}
 — dot1q-etype value
 — no dot1q-etype
 — encap-type {dot1q | null | qinq}
```

- **no encap-type**
- **frame-based-accounting**
- **no frame-based-accounting**
- **hold-time** {[**up** *hold-time up*] [**down** *hold-time down*] [**seconds** | **centiseconds**]}
- **no hold-time**
- **no ip-mtu** *mtu-bytes*
- [**no**] **lACP-tunnel**
- [**no**] **loopback** {**internal**} [**service** *svc-id sap sap-id src-mac SA dst-mac DA*]
- **mac** *ieee-address*
- **no mac**
- **mode** **access** [**uplink**]
- **mode** **hybrid**
- **mode** **network**
- **no mode**
- **monitor-oper-group** *name*
- **no monitor-oper-group**
- **mtu** *mtu-bytes*
- **no mtu**
- **no oper-group**
- **oper-group** *name*
- **qinq-etype** *value*
- **no qinq-etype**
- **speed** {**10** | **100** | **1000**}
- [**no**] **shutdown**

### Port Ethernet CRC Monitoring Commands for 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

Port Ethernet 802.1x Commands

- ```
config
 — [no] port {port-id}
 — ethernet
 — dot1x
 — [no] mac-auth
 — mac-auth-wait seconds
 — no mac-auth-wait
 — max-auth-req max-auth-request
 — port-control {auto | force-auth | force-unauth}
 — quiet-period seconds
```

- [no] **radius-plcy** *name*
- **re-auth-period** *seconds*
- [no] **re-authentication**
- **server-timeout** *seconds*
- no **server-timeout**
- **supplicant-timeout** *seconds*
- no **supplicant-timeout**
- **transmit-period** *seconds*
- no **transmit-period**
- [no] **tunneling**
- [no] **vlan-auth**

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

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

Port Ethernet Down-when-Looped Commands

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

## Port Ethernet EFM OAM Commands

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

## Port Ethernet LLDP Commands

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

## Port Ethernet Sync Commands for 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

### 2.18.1.1.8 LAG Commands for 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E

```
config
 — [no] lag [lag-id]
```

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

### 2.18.1.1.9 LAG Commands for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

config

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

- **selection-criteria** [{highest-count| highest-weight | best-port}] [slave-to-partner]
- **no selection-criteria**
- **standby-signalling** {lACP | power-off}
- **no standby-signalling**
- [no] **shutdown**

### 2.18.1.1.10 Multi-chassis Redundancy Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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

2.18.1.1.11 Ethernet Ring Commands

- ```
config
— eth-ring ring-id
— no eth-ring
 — [no] ccm-hold-time {down down-timeout | up up-timeout}
 — [no] compatible-version version
 — description description-string
 — no description
```

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

## 2.18.1.2 Show Commands

### show

- **chassis** [*environment*] [*power-supply*]
- **card** [*slot-number*] [*detail*]
- **card** **state**
- **pools** *mda-id* [*port*] [**access-app** [*pool-name*]]
- **pools** *mda-id* [*port*] [**network-app** [*pool-name*]]
- **lag** [*lag-id*] [*detail*] [*statistics*]
- **lag** *lag-id* **associations**
- **lag** [*lag-id*] **description**
- **lag** [*lag-id*] **port**
- **port** *port-id* [*count*] [*statistics*] [*detail*]
- **port** *port-id* **description**
- **port** *port-id* **associations**
- **port** *port-id* **dot1x** [*detail*]
- **port** *port-id* **ethernet** [*efm-oam* | *detail*]
- **port** *port-id* **optical**
- **port** [*A1*] [*detail*] [*statistics*] [*description*]
  - **ethernet**
    - **lldp** [*nearest-bridge* | *nearest-non-tpmr* | *nearest-customer*] [*remote-info*] [*detail*]
- **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**

### 2.18.1.2.1 MACsec Show Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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

### 2.18.1.3 Monitor Commands

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

### 2.18.1.4 Clear Commands

- clear
- **lag** lag-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]no **lag** [lag-id lag-id]

## 2.18.2 Command Descriptions

- [Configuration Commands](#)
- [Show Commands](#)
- [Port Monitor Commands](#)

- [Clear Commands](#)
- [Debug Commands](#)

## 2.18.2.1 Configuration Commands

- [Generic Commands](#)
- [Card Commands](#)
- [MDA Commands](#)
- [Interface QoS Commands](#)
- [General Port Commands](#)
- [Port Loopback Commands](#)
- [MACsec Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C](#)
- [Ethernet Port Commands](#)
- [802.1x Port Commands](#)
- [LLDP Port Commands](#)
- [Access-Uplink Port Commands](#)
- [LAG Commands](#)
- [Ethernet Ring Commands](#)

### 2.18.2.1.1 Generic Commands

#### description

|                            |                                                                                                                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>description</b> <i>long description-string</i><br><b>no description</b>                                                                                                                                             |
| <b>Context</b>             | config>port<br>config>lag<br>config>split-horizon-group<br>config>macsec>connectivity-association                                                                                                                      |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                      |
| <b>Description</b>         | This command creates a text description for a configuration context to help identify the content in the configuration file.<br><br>The <b>no</b> 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>ssm`  
`config>redundancy>multi-chassis>peer`  
`config>redundancy>multi-chassis>peer>mc-lag`  
`config>redundancy>multi-chassis>peer>sync`

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

**Description** This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics. The operational state of the entity is disabled as well as the operational state of any entities contained within.

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

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

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

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

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

### 2.18.2.1.2 Card Commands

## card

**Syntax** `card slot-number`

**Context** `config`

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

---

|                    |                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This mandatory command enables the context to access the chassis card Input/Output Module (IOM), slot, and MDA CLI context.<br><br>The <b>no</b> form of this command cannot be used on fixed IOM and MDA cards that are auto equipped and auto provisioned. The IOM card is equipped and provisioned for slot 1. |
| <b>Parameters</b>  | <i>slot-number</i> — Specifies the slot number of the card in the chassis.                                                                                                                                                                                                                                        |

## card-type

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>card-type</b> <i>card-type</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>             | config>card                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>         | <p>This mandatory command adds a card type to the device configuration for the slot. The card type can be preprovisioned, meaning that the card does not need to be installed in the chassis.</p> <p>A card must be provisioned before an MDA or port can be configured.</p> <p>A card can only be provisioned in a slot that is vacant, meaning no other card can be provisioned (configured) for that particular slot.</p> <p>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.</p> <p>A high severity alarm is raised if an administratively enabled card is removed from the chassis. The alarm is cleared when the proper card type is installed or the configuration is modified. A low severity trap is issued when a card is removed that is administratively disabled.</p> <p>An appropriate alarm is raised if a partial or complete card failure is detected. The alarm is cleared when the error condition ceases.</p> <p>The <b>no</b> form of this command cannot be used as the card is fixed.</p> |
| <b>Default</b>             | the card is equipped and preprovisioned for slot 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>          | <i>card-type</i> — Specifies the type of card to be configured and installed in that slot.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

---

### 2.18.2.1.3 MDA Commands

#### mda

|                            |                                                                                                                            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mda</b> <i>mda-slot</i><br><b>no mda</b> <i>mda-slot</i>                                                                |
| <b>Context</b>             | config>card                                                                                                                |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                          |
| <b>Description</b>         | This mandatory command enables the MDA CLI context to configure MDAs.                                                      |
| <b>Default</b>             | 1                                                                                                                          |
| <b>Parameters</b>          | <i>mda-slot</i> — Specifies the MDA slot number to be configured. Fixed ports on the panel of the chassis belong to MDA 1. |

#### mda-type

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mda-type</b> <i>mda-type</i><br><b>no mda-type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>             | config>card>mda                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>         | <p>This mandatory command provisions a specific MDA type to the device configuration for the slot. The MDA can be preprovisioned but an MDA must be provisioned before ports can be configured. Ports can be configured when the MDA is properly provisioned.</p> <p>7210 SAS-E, 7210 SAS-D, and 7210 SAS-Dxp (all platform variants) support only a fixed MDA. These platforms do not support an expansion slot. The fixed MDA (addressed as mda 1) is auto-equipped and auto-provisioned on bootup. It cannot be deleted.</p> <p>The <b>no</b> form of this command displays an error message if performed on fixed MDAs.</p> |
| <b>Default</b>             | MDA 1 is auto-equipped and auto-provisioned by default during bootup.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>          | <i>mda-type</i> — Specifies the type of MDA selected for the slot position.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Values</b>              | m4-tx+6-sfp (7210 SAS-D)<br>m6-tx+4-sfp+2-sfpp (7210 SAS-Dxp)<br>m12-tx+12-sfp (7210 SAS-E)<br>m2-tx+2-sfp+1-combo (7210 SAS-K 2F1C2T)<br>m4-tx+2-sfp+6-combo (7210 SAS-K 2F6C4T)                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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m3-10gb-sfp+8-combo (7210 SAS-K 3SFP+ 8C)

## sync-e

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] sync-e</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>             | config>card>mda                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>         | <p>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.</p> <p>Synchronous Ethernet is supported for both Ethernet SFP ports and fixed copper ports.</p> <p>Refer to the <i>7210 SAS-D, Dxp, E, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide</i> for more information about Synchronous Ethernet.</p> <p>The <b>no</b> form of this command disables Synchronous Ethernet on the MDA.</p> |
| <b>Default</b>             | no sync-e                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 2.18.2.1.4 Interface QoS Commands

## access

|                            |                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>access</b>                                                                          |
| <b>Context</b>             | config>port                                                                            |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                      |
| <b>Description</b>         | This command enables the context to configure QoS policy parameters on an access port. |

## uplink

|                            |                                                                   |
|----------------------------|-------------------------------------------------------------------|
| <b>Syntax</b>              | <b>uplink</b>                                                     |
| <b>Context</b>             | config>port>access                                                |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document |

---

**Description** This command enables the context to configure QoS policy parameters on an access-uplink port.

## egress

**Syntax** **egress**

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

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

**Description** This command enables the context to configure QoS egress policy parameters for the access port on 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E, and for the access-uplink port on 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-E, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C respectively.

## pool

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

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

**Supported Platforms** 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E

**Description** This command configures pool policies.



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

**Default** default

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

## slope-policy

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

---

|                            |                                                                                                                                                                                      |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>port>access>egress>pool<br>config>port>access>uplink>egress>pool                                                                                                              |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E                                                                                                                                             |
| <b>Description</b>         | This command specifies an existing slope policy which defines high and low priority RED slope parameters. The policy is defined in the <b>config&gt;qos&gt;slope-policy</b> context. |
| <b>Parameters</b>          | <i>name</i> — Specifies the policy name, a string up to 32 characters.                                                                                                               |

## qos

|                            |                                                                                                                                                                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>qos</b> <i>policy-id</i><br><b>no qos</b>                                                                                                                                                                                        |
| <b>Context</b>             | config>port>ethernet>access>egress                                                                                                                                                                                                  |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E                                                                                                                                                                                            |
| <b>Description</b>         | This command associates a access-egress QoS policy to the access port.<br><br>The <b>no</b> form of this policy removes the explicit association of a user configured QoS policy and associates a default QoS policy with the port. |
| <b>Parameters</b>          | <i>policy-id</i> — Specifies an existing QoS policy to be assigned to the port.<br><br><b>Values</b> 1 to 65535                                                                                                                     |

## qos

|                            |                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>qos</b> <i>policy-id</i><br><b>no qos</b>                                                                    |
| <b>Context</b>             | config>port>ethernet>access>uplink                                                                              |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                               |
| <b>Description</b>         | This command associates a network QoS policy with the access-uplink port.                                       |
| <b>Parameters</b>          | <i>policy-id</i> — Specifies an existing QoS policy to be assigned to the port.<br><br><b>Values</b> 1 to 65535 |

---

## nw-egr-agg-shaper-rate

|                            |                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>nw-egr-agg-shaper-rate</b> <i>rate</i><br><b>no nw-egr-agg-shaper-rate</b>                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>             | config>port>ethernet>network                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b>         | <p>This command specifies the network egress aggregate shaper rate for port queues. The shaper value limits the maximum bandwidth that port queues can receive from the total port bandwidth, with remaining port bandwidth shared by SAPs on the port. This command is only supported on hybrid ports.</p> <p>The <b>no</b> form of this command removes the configured egress aggregate shaper rate.</p> |
| <b>Default</b>             | no nw-egr-agg-shaper-rate                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>          | <i>rate</i> — Specifies the egress aggregate shaper rate in kb/s.<br><b>Values</b> 64 to 1000000 (7210 SAS-K 2F6C4T)<br>64 to 10000000 (7210 SAS-K 3SFP+ 8C)                                                                                                                                                                                                                                               |

## qos

|                            |                                                                                                                |
|----------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>qos</b> <i>policy-id</i><br><b>no qos</b>                                                                   |
| <b>Context</b>             | config>port>ethernet>network                                                                                   |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                      |
| <b>Description</b>         | This command associates a network QoS policy to a network port.                                                |
| <b>Parameters</b>          | <i>policy-id</i> — Specifies an existing QoS policy to be assigned to the port.<br><b>Values</b> 1, 3 to 65535 |

### 2.18.2.1.5 General Port Commands

## port

|               |                                              |
|---------------|----------------------------------------------|
| <b>Syntax</b> | <b>port</b> <i>port-id</i><br><b>no port</b> |
|---------------|----------------------------------------------|

---

|                            |                                                                                                                                                                                                                                                                                                                   |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config                                                                                                                                                                                                                                                                                                            |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                 |
| <b>Description</b>         | 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 <b>card</b> and <b>mda</b> commands.) All ports must be explicitly configured and enabled |
| <b>Parameters</b>          | <i>port-id</i> — Specifies the physical port ID in the <i>slot/mda/port</i> format.                                                                                                                                                                                                                               |

## enable-dei

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] enable-dei</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>             | config>port>ethernet<br>config>lag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Supported Platforms</b> | 7210 SAS-D and 7210 SAS-Dxp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>         | <p>This command enables DEI-based classification on access ports, network ports, access-uplink or hybrid ports.</p> <p>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:</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> </ul> <p>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.</p> <p>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.</p> <p>See the <i>7210 SAS-D, Dxp, E Quality of Service Guide</i> for more information.</p> |
| <b>Default</b>             | no enable-dei                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

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## egress-scheduler-policy

|                            |                                                                                                                                                                                                                                                                         |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>egress-scheduler-policy</b> <i>port-scheduler-policy-name</i><br><b>no egress-scheduler-policy</b>                                                                                                                                                                   |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                    |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E                                                                                                                                                                                                                                |
| <b>Description</b>         | <p>This command configures the scheduling behavior to the one specified in the policy (Strict, RR, WRR, WDRR, WRR/WDRR + Strict).</p> <p>The <b>no</b> form of this command removes the policy from the port and makes the scheduling scheme of the port to strict.</p> |
| <b>Parameters</b>          | <i>port-scheduler-policy-name</i> — Specifies a port scheduler policy for the port.                                                                                                                                                                                     |

## mode

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mode access</b> [uplink]<br><b>mode hybrid</b><br><b>mode network</b><br><b>no mode</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>             | config>port>ethernet<br>config>lag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>         | <p>This command configures an Ethernet port for access mode, access-uplink mode, hybrid mode, or network mode of operation.</p> <p>The following modes are supported on the 7210 SAS platforms:</p> <ul style="list-style-type: none"><li>• The 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-E, and 7210 SAS-K 2F1C2T support only access and access-uplink mode.</li><li>• The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C support access, access-uplink, hybrid, and network mode.</li></ul> <p>The functionality of the different modes is as follows:</p> <ul style="list-style-type: none"><li>• Access — An access port is used for customer facing traffic on which services are configured. A Service Access Point (SAP) can only be configured on an access port. When a port is configured for access mode, the appropriate encap-type must be specified to distinguish the services on the port. When an Ethernet port has been configured for access mode, multiple services can be configured on the Ethernet port.</li></ul> |

- **Access-uplink** — Access-uplink ports are used to provide native Ethernet connectivity in service provider transport or infrastructure network. This can be achieved by configuring port mode as access uplink. With this option, the `encap-type` can be configured to only `qinq`. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access uplink port to allow the operator to differentiate multiple services being carried over a single access uplink port.
- **Network** — A network port participates in the service provider transport or infrastructure network when a network mode is selected. When the network option is configured, the `encap-type` can be configured to either `null` or `dot1q`.
- **Hybrid** — A hybrid Ethernet port allows the combination of network and access modes of operation on a per-VLAN basis and must be configured as either `dot1q` or `QinQ` encapsulation. When the hybrid port is configured with `dot1q` encapsulation, SAPs are configured in a service by providing the SAP ID, which must include the `port-id` value of the hybrid port and an unused VLAN tag value in the format `port-id:qtag1`. A SAP with the format `port-id:*` is also supported. Network IP interfaces are configured in the **config>router>interface>port** context by providing the port name, which consists of the `port-id` value of the hybrid port and an unused VLAN tag value in the format `port-id:qtag1`.

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

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

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

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

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

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

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

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

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

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## monitor-oper-group

|                            |                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>monitor-oper-group</b> <i>name</i><br><b>no monitor-oper-group</b>                                                                                                                                                                                                                                                                             |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                              |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                           |
| <b>Description</b>         | <p>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 <i>config&gt;system</i> context before its name is referenced in this command.</p> <p>The <b>no</b> form of this command removes the association from the configuration.</p> |
| <b>Default</b>             | no monitor-oper-group                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>          | <i>name</i> — Specifies a character string of maximum 32 ASCII characters identifying the group instance.<br><b>Values</b> 32 chars maximum                                                                                                                                                                                                       |

## mac

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mac</b> <i>ieee-address</i><br><b>no mac</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>             | config>port>ethernet<br>config>lag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | <p>This command assigns a specific MAC address to an Ethernet port, Link Aggregation Group (LAG).</p> <p>Only one MAC address can be assigned to a port. When multiple <b>mac</b> commands are entered, the last command overwrites the previous command. When the command is issued while the port is operational, IP will issue an ARP, if appropriate, and BPDUs are sent with the new MAC address. A default MAC address is assigned by the system from the chassis MAC address pool.</p> <p>The <b>no</b> form of this command reverts the MAC address to the default value.</p> |
| <b>Parameters</b>          | <i>ieee-address</i> — 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.                                                                                                                                                                                                                                                                                                                       |

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**mtu**

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mtu</b> <i>mtu-bytes</i><br><b>no mtu</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>         | <p>This command configures the maximum transmission unit (MTU) size for an Ethernet port. The Ethernet port level MTU parameter indirectly defines the largest physical packet the port can transmit or the far-end Ethernet port can receive. Packets received that are larger than the MTU value are discarded. Packets that cannot be fragmented at egress and exceed the MTU are discarded.</p> <p>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.</p> <p>The <b>no</b> form of this command reverts to the default values.</p> |
| <b>Default</b>             | Table 26 describes the default MTU values that are dependent on the (sub-)port type, mode, and encapsulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**Table 26** Default MTU Values


| Type        | Mode   | Encap Type | Default (Bytes) |
|-------------|--------|------------|-----------------|
| 10/100, Gig | Access | null       | 1514            |
| 10/100, Gig | Access | dot1q      | 1518            |
| 10/100, Gig | Access | q-in-q     | 1522            |

|                   |                                                                                              |
|-------------------|----------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>mtu-bytes</i> — Specifies the maximum allowable size of the MTU, expressed as an integer. |
| <b>Values</b>     | 512 to 9212                                                                                  |

**2.18.2.1.6 Port Loopback Commands****loopback-no-svc-port**

|               |                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>[no] loopback-no-svc-port</b> [ <b>mirror</b>   <b>mac-swap</b>   <b>testhead</b> ] <i>port-id</i> |
|---------------|-------------------------------------------------------------------------------------------------------|

---

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>                                                                    | config>system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Supported Platforms</b>                                                        | 7210 SAS-Dxp, 7210 SAS-E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>                                                                | <p>This command specifies the port to assign for system use when using port loopback or for the mac-swap, mirroring, or testhead OAM tools. The system utilizes the resources of the port and the port is not available for configuring services.</p> <p>The user cannot share a single port between multiple tools or applications if they intend to use the tools simultaneously. The system displays an error if the user tries to configure the same port for use with multiple OAM tools or if the user tries to use the tool without first configuring the port resources to be used by the tool.</p> <p>The system verifies if any services are configured on the port specified with this command and if services are configured the command fails.</p> <p>The <b>no</b> form of this command disables the use of this port by the specified OAM tool.</p>                                                                                                                                                                                                                                                                                                                                                                                   |
|  | <p><b>Note:</b></p> <ul style="list-style-type: none"><li>• On 7210 SAS-E and 7210 SAS-Dxp, this command must be used and the user needs to dedicate one front-panel port for use with the mirroring applications. Port loopback with mac-swap is not supported on 7210 SAS-E.</li><li>• On 7210 SAS-D (ETR and non-ETR variants), the user can use the 3 available internal ports (that is, port 1/1/11, 1/1/12, and 1/1/13) for use with either mac-swap or mirroring or testhead OAM tool. The user does not need to use this command and the internal port resources are automatically allocated to the ports by software to different OAM tools.</li><li>• On 7210 SAS-Dxp, the three internal ports (ports 1/1/13, 1/1/14, and 1/1/15) can be used for mac-swap, mirroring, or testhead OAM tools. Port 1/1/13 is a 1GE port and is recommended for applications with traffic up to 1Gbps. Ports 1/1/14 and 1/1/15 are 10GE ports and are recommended for applications with traffic greater than 1Gbps but less than 10Gbps. The <b>loopback-no-svc-port</b> command must be used to associate the port resources with the applications. A port can be used with a single application and cannot be shared by multiple applications.</li></ul> |
| <b>Parameters</b>                                                                 | <p><b>mac-swap</b> — Specifies that the port is dedicated for use by the mac-swap application/OAM tool.</p> <p><b>mirror</b> — Specifies that the port is dedicated for use by the mirroring application/OAM tool.</p> <p><b>testhead</b> — Specifies that the port is dedicated for use by the testhead application/OAM tool.</p> <p><i>port-id</i> — Specifies the physical port ID in the <i>slot/mdal/port</i> format.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

### 2.18.2.1.7 MACsec Commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

#### macsec

|                            |                                                                                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>macsec</b>                                                                                                        |
| <b>Context</b>             | config                                                                                                               |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                            |
| <b>Description</b>         | This command enables the context for MACsec configuration. The MACsec MKA profile can be configured in this context. |

#### connectivity-association

|                            |                                                                                                                                                                                                        |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>connectivity-association</b> <i>ca-name</i> [ <b>create</b> ]<br><b>no connectivity-association</b> <i>ca-name</i>                                                                                  |
| <b>Context</b>             | config>macsec                                                                                                                                                                                          |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                              |
| <b>Description</b>         | This command configures a connectivity association (CA). MACsec CAs are applied to a port dot1x configuration to enable MACsec on that port.<br><br>The <b>no</b> form of this command removes the CA. |
| <b>Parameters</b>          | <i>ca-name</i> — Specifies the name of the CA using a string of up to 32 characters.<br><b>create</b> — Specifies a mandatory keyword when creating an entry.                                          |

#### cipher-suite

|                            |                                                                                                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>cipher-suite</b> <i>cipher-suite</i><br><b>no cipher-suite</b>                                                                                                                                  |
| <b>Context</b>             | config>macsec>connectivity-association                                                                                                                                                             |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                          |
| <b>Description</b>         | This command configures encryption of datapath PDUs. When all parties in the CA have the SAK, they use the <i>cipher-suite</i> algorithm in conjunction with the SAK to encrypt the datapath PDUs. |

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

**Default** cipher-suite gcm-aes-128

**Parameters** *cipher-suite* — Specifies the algorithm to use for control plane encryption.

**Values** gcm-aes-128  
gcm-aes-256

## clear-tag-mode

**Syntax** **clear-tag-mode** *clear-tag-mode*  
**no clear-tag-mode**

**Context** config>macsec>connectivity-association

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

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

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

[Table 27](#) describes the encrypted dot1q and QinQ packet format when clear-tag-mode (single-tag or dual-tag) is configured.

**Table 27 Encrypted Dot1q and QinQ Packet Format**

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

**Default** no clear-tag-mode

**Parameters** *clear-tag-mode* — Specifies the clear tag mode.

**Values** single-tag, dual-tag

## description

|                            |                                                                                                                     |
|----------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>description</b> <i>description</i><br><b>no description</b>                                                      |
| <b>Context</b>             | config>macsec>connectivity-association                                                                              |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                           |
| <b>Description</b>         | This command enters a description for the CA.<br><br>The <b>no</b> form of this command removes the CA description. |
| <b>Parameters</b>          | <i>description</i> — Specifies a brief description of the CA using a string of up to 80 characters.                 |

## encryption-offset

|                            |                                                                                                                                                                                                                                                 |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>encryption-offset</b> <i>encryption-offset</i><br><b>no encryption-offset</b>                                                                                                                                                                |
| <b>Context</b>             | config>macsec>connectivity-association                                                                                                                                                                                                          |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                       |
| <b>Description</b>         | This command specifies the offset of the encryption in MACsec packets.<br><br>The encryption-offset is distributed by MKA to all parties and is signaled via MACsec capabilities.<br><br><a href="#">Table 28</a> describes the basic settings. |

**Table 28** MACsec Basic Settings

| Setting        | Description                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0              | MACsec is not implemented                                                                                                                                                                                 |
| 1              | Integrity without confidentiality                                                                                                                                                                         |
| 2              | The following are supported: <ul style="list-style-type: none"> <li>• Integrity without confidentiality</li> <li>• Integrity and confidentiality with a confidentiality offset of 0</li> </ul>            |
| 3 <sup>1</sup> | The following are supported: <ul style="list-style-type: none"> <li>• Integrity without confidentiality</li> <li>• Integrity and confidentiality with a confidentiality offset of 0, 30, or 50</li> </ul> |

**Note:**

1. 7210 SAS supports setting 3: Integrity without confidentiality and Integrity and confidentiality with a confidentiality offset of 0, 30, or 50.

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

|                   |                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | encryption-offset 0                                                                                             |
| <b>Parameters</b> | <i>encryption-offset</i> — Specifies the encryption offset.                                                     |
| <b>Values</b>     | 0 — encrypts the entire payload<br>30 — leaves the IPv4 header in clear<br>50 — leaves the IPv6 header in clear |

## macsec-encrypt

|                            |                                                                                                                                                                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] macsec-encrypt</b>                                                                                                                                                                                                          |
| <b>Context</b>             | config>macsec>connectivity-association                                                                                                                                                                                              |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                           |
| <b>Description</b>         | This command enables encryption and authentication (ICV payload) for all PDUs.<br><br>The <b>no</b> form of this command specifies that all PDUs are transmitted with clear text but still authenticated and have the trailing ICV. |
| <b>Default</b>             | macsec-encrypt                                                                                                                                                                                                                      |

## replay-protection

|                            |                                                                                                                                                                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] replay-protection</b>                                                                                                                                                                                                                        |
| <b>Context</b>             | config>macsec>connectivity-association                                                                                                                                                                                                               |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                            |
| <b>Description</b>         | Specifies the size of the replay protection window.<br><br>This command must be configured to force packet discard when the system detects a packet that is not within the parameters configured for the <a href="#">replay-window-size</a> command. |

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

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



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

**Default**    replay-protection

## replay-window-size

|                            |                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>replay-window-size</b> <i>number-of-packets</i><br><b>no replay-window-size</b>                                                                                                                                                                                                                                                                         |
| <b>Context</b>             | config>macsec>connectivity-association                                                                                                                                                                                                                                                                                                                     |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b>         | This command specifies the size of the replay protection window.<br><br>This command must be configured to enable the <a href="#">replay-protection</a> command.<br><br>When the <i>number-of-packets</i> parameter is set to 0, all packets that arrive out of order are dropped.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>             | replay-window-size 0                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>          | <i>number-of-packets</i> — Specifies the window that the packets can arrive out of order.<br><br><b>Values</b> 0 to 4294967294                                                                                                                                                                                                                             |

## shutdown

**Syntax**    [no] shutdown

---

|                            |                                                                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>macsec>connectivity-association                                                                                                                                                                                |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                             |
| <b>Description</b>         | This command shuts down the CA profile. All ports using this profile do not transmit PDUs, because this command shuts down MACsec for this profile.<br><br>The <b>no</b> form of this command enables the CA profile. |
| <b>Default</b>             | shutdown                                                                                                                                                                                                              |

## static-cak

|                            |                                                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] static-cak</b>                                                                                                         |
| <b>Context</b>             | config>macsec>connectivity-association                                                                                         |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                      |
| <b>Description</b>         | This command enables the context to configure a Connectivity Association Key (CAK). A CAK is responsible for managing the MKA. |

## active-psk

|                            |                                                                                                                                                                                                                                                                                      |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>active-psk</b> <i>active-pre-shared-key</i><br><b>no active-psk</b>                                                                                                                                                                                                               |
| <b>Context</b>             | config>macsec>conn-assoc>static-cak                                                                                                                                                                                                                                                  |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                            |
| <b>Description</b>         | This command specifies which pre-shared key is the active transmitting pre-shared key. If there are two pre-shared keys configured, the arriving MACsec MKA can be decrypted using CAKs of both pre-shared keys; however, only the active PSK is used for Tx encryption of MKA PDUs. |
| <b>Default</b>             | active-psk 1                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>          | <i>active-pre-shared-key</i> — Specifies the value of the pre-shared key.<br><b>Values</b> 1 or 2                                                                                                                                                                                    |

## mka-key-server-priority

|                            |                                                                                                                                                                                                                          |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mka-key-server-priority</b> <i>priority</i><br><b>no mka-key-server-priority</b>                                                                                                                                      |
| <b>Context</b>             | config>macsec>conn-associ>static-cak                                                                                                                                                                                     |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                |
| <b>Description</b>         | This command specifies the key server priority used by the MKA protocol to select the key server when MACsec is enabled using static CAK security mode.<br><br>The <b>no</b> form of this command disables this command. |
| <b>Default</b>             | mka-key-server-priority 16                                                                                                                                                                                               |
| <b>Parameters</b>          | <i>priority</i> — Specifies the priority of the server.<br><br><b>Values</b> 0 to 255                                                                                                                                    |

## pre-shared-key

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>pre-shared-key</b> <i>pre-shared-key-index</i> [ <b>encryption-type</b> <i>encryption-type</i> ] [ <b>create</b> ]<br><b>no pre-shared-key</b> <i>pre-shared-key-index</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>             | config>macsec>conn-assoc>static-cak                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | This command specifies the pre-shared key used to enable MACsec using static CAK security mode. This command also specifies the encryption algorithm used for encrypting the SAK.<br><br>A pre-shared key includes a connectivity association key name (CKN) and a CAK. The pre-shared key (the CKN and CAK) must match on both ends of a link.<br><br>A pre-shared key is configured on both devices at each end of a point-to-point link to enable MACsec using static CAK security mode. The MKA protocol is enabled after the successful MKA liveness negotiation.<br><br>The <i>encryption-type</i> parameter is used for encrypting SAK and authentication of the MKA packet. The symmetric encryption key SAK needs to be encrypted (wrapped) using the above protocols. The AES key is derived using the pre-shared key.<br><br>The <b>no</b> form of this command removes the index. |
| <b>Parameters</b>          | <i>pre-shared-key-index</i> — Specifies the index of this pre-shared key.<br><br><b>Values</b> 1, 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

---

*encryption-type* — Specifies the type of encryption.

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

**create** — Specifies a mandatory keyword when creating an entry.

## cak

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>cak</b> <i>hex-string</i> [ <b>hash</b>   <b>hash2</b> ]<br><b>no cak</b>                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>             | config>macsec>conn-assoc>static-cak>pre-shared-key                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>         | Specifies the CAK for a pre-shared key. The following values are derived from CAK: <ul style="list-style-type: none"><li>• KEK (Key Encryption Key)<br/>KEK is used to encrypt the MKA and SAK (symmetric key used for datapath PDUs) to be distributed between all members.</li><li>• ICK (Integrity Check Value)<br/>ICK is used to authenticate the MKA and SAK PDUs to be distributed between all members.</li></ul> The <b>no</b> form of this command removes the value. |
| <b>Parameters</b>          | <i>hex-string</i> — Specifies the value of the CAK using up to 64 hexadecimal characters, 32 hexadecimal characters for a 128-bit key and 64 hexadecimal characters for a 256-bit key<br><b>hash</b> — Specifies the hash scheme.<br><b>hash2</b> — Specifies the hash scheme.                                                                                                                                                                                                 |

## ckn

|                            |                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>ckn</b> <i>hex-string</i><br><b>no ckn</b>                                                                                 |
| <b>Context</b>             | config>macsec>conn-assoc>static-cak>pre-shared-key                                                                            |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                     |
| <b>Description</b>         | This command specifies the CKN for a pre-shared key.<br>CKN is appended to the MKA for identification of the CAK by the peer. |

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

**Parameters** *hex-string* — Specifies the value of the CKN.

**Values** 32 octets char (64 hex)

### 2.18.2.1.8 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 access parameters.

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

#### autonegotiate

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

**Context** config>port>ethernet

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

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

There are three possible settings for autonegotiation:

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

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

When autonegotiation is disabled on a port, the port does not attempt to autonegotiate and will only operate at the **speed** and **duplex** settings configured for the port. Note that disabling autonegotiation on gigabit ports is not allowed as the IEEE 802.3 specification for gigabit Ethernet requires autonegotiation be enabled for far end fault indication.

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

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

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

**Default** autonegotiate

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

## connection-type

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

**Context** config>port>ethernet

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

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

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

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

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

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

---

|                   |                                                                             |
|-------------------|-----------------------------------------------------------------------------|
| <b>Default</b>    | sfp (7210 SAS-K 2F1C2T)<br>auto (7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C) |
| <b>Parameters</b> | <i>connection-type</i> — Specifies the type of Ethernet combo port.         |
| <b>Values</b>     | sfp, copper, auto                                                           |

## crc-monitor

|                            |                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>crc-monitor</b>                                                                  |
| <b>Context</b>             | config>port>ethernet                                                                |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C |
| <b>Description</b>         | This command configures Ethernet CRC Monitoring parameters.                         |

## sd-threshold

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | [no] <b>sd-threshold</b> <i>threshold</i> [ <b>multiplier</b> <i>multiplier</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>             | config>port>ethernet>crc-monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | <p>This command specifies the error rate at which to declare the Signal Failure condition on an Ethernet interface.</p> <p>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.</p> <p>The <b>no</b> form of this command reverts to the default value of 1. If the multiplier keyword is omitted, the multiplier will return to the default value of 1.</p> |
| <b>Default</b>             | no sd-threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>          | <p><i>threshold</i> — Specifies the rate of CRC errored Ethernet frames.</p> <p><b>Values</b> 1 to 9</p> <p><i>multiplier</i> — Specifies the multiplier used to scale the CRC error ratio.</p> <p><b>Values</b> 1 to 9</p>                                                                                                                                                                                                                                                                                                                                                                                |

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## sf-threshold

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] sf-threshold</b> <i>threshold</i> [ <b>multiplier</b> <i>multiplier</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>             | config>port>ethernet>crc-monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>         | <p>This command specifies the error rate at which to declare the Signal Degrade condition on an Ethernet interface.</p> <p>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.</p> <p>The <b>no</b> form of this command reverts to the default value of 1. If the multiplier keyword is omitted, the multiplier will return to the default value of 1.</p> |
| <b>Default</b>             | no sf-threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>          | <p><i>threshold</i> — Specifies the rate of CRC errored Ethernet frames.</p> <p><b>Values</b> 1 to 9</p> <p><i>multiplier</i> — Specifies the multiplier used to scale the CRC error ratio.</p> <p><b>Values</b> 1 to 9</p>                                                                                                                                                                                                                                                                                                                                            |

## window-size

|                            |                                                                                                                                                                                                                                                        |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] window-size</b> <i>seconds</i>                                                                                                                                                                                                                 |
| <b>Context</b>             | config>port>ethernet>crc-monitor                                                                                                                                                                                                                       |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                    |
| <b>Description</b>         | 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. |
| <b>Default</b>             | 10                                                                                                                                                                                                                                                     |
| <b>Parameters</b>          | <p><i>seconds</i> — Specifies the size of the sliding window in seconds over which the errors are measured.</p> <p><b>Values</b> 5 to 60</p>                                                                                                           |

---

## down-on-internal-error

|                            |                                                                                                                                         |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] down-on-internal-error</b>                                                                                                      |
| <b>Context</b>             | config>port>ethernet                                                                                                                    |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                     |
| <b>Description</b>         | This command enables the context to bring a port operationally down in the event the systems has detected internal max transmit errors. |
| <b>Default</b>             | no down-on-internal-error                                                                                                               |

## dot1q-etype

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>dot1q-etype</b> <i>value</i><br><b>no dot1q-etype</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>         | <p>This command specifies the Ethertype expected when the port's encapsulation type is dot1q. Dot1q encapsulation is supported only on Ethernet interfaces.</p> <p>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.</p> |



**Note:**

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

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

**Parameters** *value* — Specifies the Ethertype to expect, in decimal or hexadecimal format.

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

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

## duplex

|                            |                                                                                                                                                                           |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>duplex</b> {full   half}                                                                                                                                               |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                      |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                         |
| <b>Description</b>         | This command enables the context for the configuration of the duplex mode of a Fast Ethernet port. If the port is configured to autonegotiate, this parameter is ignored. |
| <b>Default</b>             | full                                                                                                                                                                      |

**Parameters** **full** — Sets the link to full duplex mode.  
**half** — Sets the link to half duplex mode.

## egress-rate

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

**Context** config>port>ethernet

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

**Description** This command configures the rate of traffic leaving the network.  
The **no** form of this command reverts to the default value.



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

**Default** no egress-rate

**Parameters** *sub-rate* — The egress rate in Kbps.  
**Values** 1 to 10000000

**max-burst** *size-in-kbits* — Specifies the maximum egress burst in kilobits. This parameter is configurable only on 7210 SAS-E, 7210 SAS-D, and 7210 SAS-Dxp.  
**Values** 32 to 16384, default

## efm-oam

**Syntax** **efm-oam**

**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 EFM-OAM attributes.

## accept-remote-loopback

|                            |                                                                                                                                                                |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] accept-remote-loopback</b>                                                                                                                             |
| <b>Context</b>             | config>port>ethernet>efm-oam                                                                                                                                   |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                              |
| <b>Description</b>         | This command enables reactions to loopback control OAM PDUs from peers.<br>The <b>no</b> form of this command disables reactions to loopback control OAM PDUs. |
| <b>Default</b>             | no accept-remote-loopback                                                                                                                                      |

## mode

|                            |                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>mode {active   passive}</b>                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>             | config>port>ethernet>efm-oam                                                                                                                                                                                                                                                                                                                          |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | 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. |
| <b>Default</b>             | active                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>          | <b>active</b> — Specifies that the port has the capability to initiate negotiation and monitoring activities.<br><b>passive</b> — Specifies that the port relies on peer to initiate negotiation and monitoring activities.                                                                                                                           |

## transmit-interval

|                            |                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] transmit-interval <i>interval</i> [<b>multiplier</b> <i>multiplier</i>]</b> |
| <b>Context</b>             | config>port>ethernet>efm-oam                                                        |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                   |
| <b>Description</b>         | This command configures the transmit interval of OAM PDUs.                          |

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

**Default** transmit-interval 10 multiplier 5

**Parameters** *interval* — Specifies the transmit interval, in 100 milliseconds.

**Values** 1 to 600

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

**Values** 2 to 5

## tunneling

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

**Context** config>port>ethernet>efm-oam

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

**Description** This command enables EFM OAM PDU tunneling. Enabling tunneling will allow a port mode Epipe SAP to pass OAM frames through the pipe to the far end.

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

**Default** no tunneling

## encap-type

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

**Context** config>port>ethernet

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

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



**Note:**

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

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

|                   |                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | null                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b> | <b>dot1q</b> — Specifies that the ingress frames carry 802.1Q tags where each tag signifies a different service.<br><b>null</b> — Specifies that the ingress frames will not use any tags to delineate a service. As a result, only one service can be configured on a port with a null encapsulation type.<br><b>qinq</b> — Specifies QinQ encapsulation for QinQ access SAPs. |

## frame-based-accounting

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>frame-based-accounting</b><br><b>no frame-based-accounting</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Supported Platforms</b> | 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>         | This command configures per port frame-based accounting. It can be enabled or disabled on each port. When enabled, all the shapers rates and queues statistics on that port also account for the Ethernet Layer 1 overhead (of 20 bytes) in both ingress and egress direction. That is all ingress queue shaper rates, egress queue shaper rates and aggregate SAP shaper rate account for the ethernet overhead.<br><br>The <b>no</b> form of this command disables frame-based-accounting. |
| <b>Default</b>             | no frame-based-accounting                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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## hold-time

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>hold-time</b> {[ <i>up hold-time up</i> ] [ <i>down hold-time down</i> ] [ <b>seconds</b>   <b>centiseconds</b> ]}<br><b>no hold-time</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>         | <p>This command configures port link dampening timers which reduce the number of link transitions reported to upper layer protocols. The <b>hold-time</b> value is used to dampen interface transitions.</p> <p>When an interface transitions from an up state to a down state, it is immediately advertised to the rest of the system if the hold-time down interval is zero, but if the hold-time down interval is greater than zero, interface down transitions are not advertised to upper layers until the hold-time down interval has expired. Likewise, an interface is immediately advertised as up to the rest of the system if the hold-time up interval is zero, but if the hold-time up interval is greater than zero, up transitions are not advertised until the hold-time up interval has expired.</p> <p>The <b>no</b> form of this command reverts to the default values.</p> |
| <b>Default</b>             | <p>down 0 seconds — No port link down dampening is enabled; link down transitions are immediately reported to upper layer protocols</p> <p>up 0 seconds — No port link up dampening is enabled; link up transitions are immediately reported to upper layer protocols</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>          | <p><b>up</b> <i>hold-time up</i> — Specifies the delay, in seconds or centiseconds, to notify the upper layers after an interface transitions from a down state to an up state.</p> <p><b>Values</b> 0 to 900 (seconds)<br/>0, 10 to 90000 (centiseconds in 5-centisecond increments)</p> <p><b>Values</b> 0 to 900</p> <p><b>down</b> <i>hold-time down</i> — Specifies the delay, in seconds or centiseconds, to notify the upper layers after an interface transitions from an up state to a down state.</p> <p><b>Values</b> 0 to 900 (seconds)<br/>0, 10 to 90000 (centiseconds in 5-centisecond increments)</p> <p><b>seconds</b>   <b>centiseconds</b> — Specifies the units of the hold time in seconds or centiseconds.</p> <p><b>Values</b> 0 to 900</p>                                                                                                                             |

## ip-mtu

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>[no] ip-mtu mtu-bytes</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>             | <code>config&gt;port&gt;ethernet</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Supported Platforms</b> | 7210 SAS-E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>         | <p>This command enables the context to configure the IP MTU value. This value is used by all IP interfaces created on the port. The IP MTU value specified must be smaller than the configured port MTU value. If the configured IP MTU value is greater than the port MTU value, the IP MTU is set equal to the port MTU value and the port MTU value is set to default. The MTU check is enforced on self-generated and forwarded packets. The system uses the configured IP MTU value to ensure that packets sent out of the IP interfaces configured on the port are lesser than or equal to the specified value. The IP packets which need to be forwarded but are greater than the configured IP MTU size are dropped. It is supported only on Ethernet ports.</p> <p>On 7210 SAS-E devices the IES IP interfaces are created on access-uplink ports for In-band management. The IP MTU command allows the operator to specify the IP MTU size to be used for CPU generated IP packets (for example SNMP, FTP and so on). Additionally, it also allows the operators to specify different MTU sizes for service traffic and management traffic (a smaller MTU size value allowed) that share the same port.</p> |



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

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

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

|                   |                                                         |
|-------------------|---------------------------------------------------------|
| <b>Default</b>    | the IP MTU value is set to the port MTU value           |
| <b>Parameters</b> | <i>mtu-bytes</i> — Specifies the IP MTU value in bytes. |
| <b>Values</b>     | 512 to 9000                                             |

## lACP-tunnel

|                            |                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>[no] lACP-tunnel</code>                                                       |
| <b>Context</b>             | <code>config&gt;port&gt;ethernet</code>                                             |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C |

---

|                    |                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | 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.<br><br>The <b>no</b> form of this command disables LACP packet tunneling for the Ethernet port. |
| <b>Default</b>     | no lacp-tunnel                                                                                                                                                                                                                                                                                                             |

## oper-group

|                            |                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>no oper-group</b><br><b>oper-group</b> <i>name</i>                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                                   |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                    |
| <b>Description</b>         | This command associates the context to which it is configured to the operational group specified in the <i>group-name</i> . The <b>oper-group</b> <i>group-name</i> must be already configured under <b>config&gt;system</b> context before its name is referenced in this command.<br><br>The <b>no</b> form of this command removes the association. |
| <b>Parameters</b>          | <i>name</i> — Specifies a character string of maximum 32 ASCII characters identifying the group instance.<br><br><b>Values</b> 32 chars maximum                                                                                                                                                                                                        |

## qinq-etype

|                            |                                                                      |
|----------------------------|----------------------------------------------------------------------|
| <b>Syntax</b>              | <b>qinq-etype</b> <i>value</i><br><b>no qinq-etype</b>               |
| <b>Context</b>             | config>port>ethernet                                                 |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document    |
| <b>Description</b>         | This command configures the Ethertype used for Q-in-Q encapsulation. |

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



**Note:**

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

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

**Default** 0x8100

**Parameters** *value* — Specifies the qinq-etype to expect, in hexadecimal or decimal notation.

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

## statistics

**Syntax** **statistics**

**Context** config>port>ethernet

**Supported Platforms** 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

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

## egress

|                            |                                                                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>egress</b>                                                                                                                          |
| <b>Context</b>             | config>port>ethernet>statistics                                                                                                        |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-E, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C                                                  |
| <b>Description</b>         | This command enables the context to configure egress per queue statistics counter, which counts the total number of packets forwarded. |

## queue

|                            |                                                                                                                   |
|----------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>queue</b> <i>queue-id</i>                                                                                      |
| <b>Context</b>             | config>port>ethernet>statistics>egress                                                                            |
| <b>Supported Platforms</b> | 7210 SAS-E                                                                                                        |
| <b>Description</b>         | This command enables the context to associate a counter with the egress queue identified by the <i>queue-id</i> . |
| <b>Parameters</b>          | <i>queue-id</i> — Specifies the queue with which the counter must be associated.                                  |
|                            | <b>Values</b> 1 to 8                                                                                              |


## packets-forwarded-count

|                            |                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] packets-forwarded-count</b>                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>             | config>port>ethernet>statistics>egress                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Supported Platforms</b> | 7210 SAS-E                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>         | This command associates a counter with the specified queue and counts the number of packets forwarded through the queue.<br><br>The <b>no</b> form of this command stops the counter and disassociates the counter from the queue. Before issuing the <b>no</b> form of this command, ensure all accounting policies using the counter and associated with the port are removed from the configuration. |

## port-clock

|               |                                                |
|---------------|------------------------------------------------|
| <b>Syntax</b> | <b>port-clock {master   slave   automatic}</b> |
|---------------|------------------------------------------------|

---

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Supported Platforms</b> | 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>         | <p>This command enables the context to force the copper port to be a master or slave or set it for automatic detection. Using a value of master ensures that the local node is the SyncE master. A SyncE master port distributes the system timing over the copper port to the remote peer node. Using a value of slave ensures that the local node is a SyncE slave. A SyncE slave port uses the incoming timing information.</p> <p>With copper ports using 1G speed, the nodes need to determine who will be the master and slave with respect to clock used for transmission and reception. The master-slave relationship between the two ports of the nodes is determined during autonegotiation of the link parameters and is automated; there is no management intervention in this process. When this process is complete, the master port transmit clock will be used for receiving the packets on the slave port. However, when SyncE is in use, to maintain clock distribution hierarchy (for example, master will be synchronized to a stable reference and will distribute this clock to the slave) one needs to make sure that one of the ports behave as a master while the remote port of the link in question behaves as a slave.</p> <p>For copper ports, when port-clock is set to <b>automatic</b>, the Ethernet interface will automatically negotiate clock mastership along with other link parameters with the far end. Depending upon the capabilities of the two ends, one will be master the other will be slave for clocking.</p> |
|                            | <p> <b>Note:</b> This command is ignored for all ports, other than copper ports that support SyncE.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                            | <p>The <b>no</b> form of this command allows the node to automatically determine the master or slave status for the copper port based on the nodes capabilities exchanged during auto-negotiation. That is, depending on the peer setting, the local end could end up as either a master or a slave when the no form of this command is used.</p> <p>The following conditions must be met before using SyncE on the fixed port copper ports:</p> <ul style="list-style-type: none"><li>• Autonegotiation (or autonegotiation limited) must be turned on. This command is required only when the copper port speed is set to 1Gbps. This CLI command is not supported for fiber ports or for fiber ports that use copper SFPs.</li><li>• The port clock must be set to slave, if the port is used as a source-port for any reference. On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C platform, when using combo ports, the connection-type must be set to <b>copper</b>. The port-clock parameter is ignored if the connection-type is set to <b>sfp</b> or <b>auto</b>.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Default</b>             | automatic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

- Parameters**
- master** — Specifies that the local node is the synchronous Ethernet master. A synchronous Ethernet master port distributes the system timing over the copper port to the remote peer node.
  - slave** — Specifies that the local node is a synchronous Ethernet slave. A synchronous Ethernet slave port uses the incoming timing information.
  - automatic** — Specifies that the Ethernet interface will automatically negotiate clock mastership along with other link parameters with the far end. Depending upon the capabilities of the two ends, one will be master the other will be slave for clocking.

## speed

- Syntax** `speed {10 | 100 | 1000}`
- Context** `config>port>ethernet`
- Supported Platforms** Supported on all 7210 SAS platforms as described in this document
- Description** This command configures the port speed of a Fast Ethernet port when autonegotiation is disabled. If the port is configured to autonegotiate this parameter is ignored. Speed cannot be configured for ports that are part of a Link Aggregation Group (LAG).
- Default** 100
- Parameters**
- 10** — Sets the link to 10 Mb/s.
  - 100** — Sets the link to 100 Mb/s.
  - 1000** — Sets the link to 1000 Mb/s.

## loopback

- Syntax** `[no] loopback {internal} [service svc-id sap sap-id src-mac SA dst-mac DA]`
- Context** `config>port>ethernet`
- Supported Platforms** Supported on all 7210 SAS platforms as described in this document
- Description** This command enables the context to configure simple port loopback and port loopback with MAC swap. When the optional parameter **internal** is specified, it provides the port loopback without the mac-swap functionality. It enables physical layer loopback of the packets that egress on the SAPs created on an Ethernet port. The packets that egress are looped back into the node instead of being transmitted on to the line. After loopback, the packets ingress the system and are mapped to the same SAP from which they were egressed. The packets that are looped back are processed as per the service configuration of the SAP.



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

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

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



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

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

The following information describes guidelines for port loopback without mac-swap.

- Use this command for testing VLL services.
- Enabling this command for testing VPLS services leads to rapid MAC address movement to another port, as source or destination MAC address swap is not performed.
- This command affects all services provisioned on the port.
- Before enabling this command, turn off all Layer 2 and IP control protocols (such as LACP, EFM, 802.1x and so on) on the device and its peer to prevent errors such as protocol flaps 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 loopback to be functional, the following are not required:
  - SFP or XFPs need not be inserted into the device.
  - Ethernet cables need not be plugged in for copper ports.

- When the loopback command is enabled, ensure that Ethernet parameters such as speed, duplex, autonegotiation and so on are not modified.

The following information describes guidelines for port loopback with mac-swap.

- This command is available for testing VLL services and VPLS services only.
- When enabled, the command affects all services provisioned on the port.
- Before enabling this command, turn off all Layer 2 and IP control protocols (such as LACP, EFM, 802.1x and so on) on the device and its peer to prevent errors such as protocol flaps 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 using port loopback with mac-swap enabled, for unicast and unknown-unicast packets, if the packet matches the configured source and destination MAC address it will be swapped and looped back in the service. For broadcast and multicast packets, if the packet matches the configured source MAC address, its source MAC address will be used as the destination MAC address and the system MAC address will be the source MAC address. The packet is looped back in the service as a unicast packet. All other packets sent to the loopback port will be dropped. Since forwarding of these packets after loopback can potentially cause network wide problems.
- For loopback to be functional, the following are not required:
  - SFP or XFPs need not be inserted into the device.
  - Ethernet cables need not be plugged in for copper ports.
- When the loopback is enabled, ensure that Ethernet parameters such as, speed, duplex, autonegotiation and so on are not modified.
- When the loopback is enabled, ensure that service parameter and attributes such as ingress qos policy, accounting records, ingress/egress ACLs, and so on are not modified.
  - With port loopback in use, the SAP ingress ACLs with IP-criteria is not recommended for use, 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. When the loopback configuration is removed for the port, then the software enables learning and aging for specified SAP. Therefore, port loopback with mac-swap cannot be used for learning or aging.
- It is not recommend to change the service parameters for the SAP and the service when loopback is active. Additionally use of commands which clears the FDB, and so on is highly discouraged.
- Remove the loopback on the SAP port to bring the sap out of MAC swap with loopback mode.

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



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

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

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

Enable the port, execute the command **config>port> no shutdown**. Enable the required services. The following list is the recommended sequence of commands to be executed to perform loopback when SFP or XFPs are inserted into the device:

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

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

1. Disable the port, execute the **config>port>shutdown** command.
2. Insert the new SFP or XFP.

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

**Parameters**

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

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

**Values** 1 to 2147483648

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

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

|                            |                                                                                                                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>ssm</b>                                                                                                                                                                                                                      |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                            |
| <b>Supported Platforms</b> | 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                         |
| <b>Description</b>         | This command enables Ethernet Synchronous Status Message (SSM) capability on a synchronous Ethernet port. Synchronous Ethernet must be enabled on the MDA (using the <a href="#">sync-e</a> command) before SSM can be enabled. |

## code-type

|                            |                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>code-type [sonet   sdh]</b>                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>             | config>port>ethernet>ssm                                                                                                                                                                                                                                                                                                                                                       |
| <b>Supported Platforms</b> | 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | 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). |
| <b>Default</b>             | sdh                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>          | <b>sdh</b> — Specifies the values used on a G.781 Option 1 compliant network.<br><b>sonet</b> — Specifies the values used on a G.781 Option 2 compliant network.                                                                                                                                                                                                               |

## tx-dus

|                            |                                                                                                                                                                                                                                                           |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] tx-dus</b>                                                                                                                                                                                                                                        |
| <b>Context</b>             | config>port>ethernet>ssm<br>config>port>sonet-sdh (not supported on 7210 SAS-Dxp)                                                                                                                                                                         |
| <b>Supported Platforms</b> | 7210 SAS-D ETR, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                   |
| <b>Description</b>         | This command forces the QL value transmitted from the SSM channel of the SONET/SDH port or the Synchronous Ethernet port to be set to QL-DUS/QL-DNU. This capability is provided to block the use of the interface for timing purposes from the 7210 SAS. |
| <b>Default</b>             | no tx-dus                                                                                                                                                                                                                                                 |

### 2.18.2.1.9 802.1x Port Commands

#### dot1x

|                            |                                                                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>dot1x</b>                                                                                                                                                                                                                          |
| <b>Context</b>             | config>port>ethernet                                                                                                                                                                                                                  |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                     |
| <b>Description</b>         | This command enables the context to configure port-specific 802.1x authentication attributes. This context can only be used when configuring Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet LAN ports on an appropriate MDA. |

#### mac-auth

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] mac-auth</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Supported Platforms</b> | 7210 SAS-Dxp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>         | <p>This command enables MAC-based authentication. To use MAC-based authentication, 802.1x authentication must first be enabled using the <b>port-control auto</b> command.</p> <p>When MAC-based authentication is enabled, and the <b>mac-auth-wait</b> timer expires, the 7210 SAS begins listening on the port for valid Ethernet frames. The source MAC address of a received frame is used for MAC-based authentication.</p> <p>MAC authentication and Dot1x authentication or VLAN authentication are mutually exclusive and cannot be configured on the same port.</p> <p>The <b>no</b> form of this command disables MAC-based authentication.</p> |
| <b>Default</b>             | no mac-auth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

#### mac-auth-wait

|                            |                                                                |
|----------------------------|----------------------------------------------------------------|
| <b>Syntax</b>              | <b>mac-auth-wait</b> <i>seconds</i><br><b>no mac-auth-wait</b> |
| <b>Context</b>             | config>port>ethernet>dot1x                                     |
| <b>Supported Platforms</b> | 7210 SAS-Dxp                                                   |

---

|                    |                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the delay period before MAC authentication is activated.<br><br>The <b>no</b> form of this command disables the delay and allows MAC authentication to be used immediately. |
| <b>Default</b>     | no mac-auth-wait                                                                                                                                                                                    |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the MAC authentication delay period, in seconds.<br><b>Values</b> 1 to 3600                                                                                              |

## max-auth-req

|                            |                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>max-auth-req</b> <i>max-auth-request</i>                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                                                                                                                                                                                                                                                                     |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>         | 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 <i>number</i> attempts, the 802.1x authentication procedure is considered to have failed.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>             | 2                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>          | <i>max-auth-request</i> — Specifies the maximum number of RADIUS retries.<br><b>Values</b> 1 to 10                                                                                                                                                                                                                                                                             |

## port-control

|                            |                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>port-control</b> [auto   force-auth   force-unauth]                                                                          |
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                      |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                               |
| <b>Description</b>         | This command configures the 802.1x authentication mode.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>             | force-auth                                                                                                                      |

- Parameters**
- force-auth** — Specifies that 802.1x authentication will be disabled and causes the port to transition to the authorized state without requiring any authentication exchange. The port transmits and receives normal traffic without requiring 802.1x-based host authentication.
  - force-unauth** — Specifies that the port will remain in the unauthorized state, ignoring all attempts by the hosts to authenticate. The switch cannot provide authentication services to the host through the interface.
  - auto** — Specifies that 802.1x authentication will be enabled. The port starts in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. Both the 7210 SAS and the host can initiate an authentication procedure. The port will remain in an unauthorized state (no traffic except EAPOL frames is allowed) until the first client is authenticated successfully. After this, traffic is allowed on the port for all connected hosts.

## quiet-period

- Syntax** **quiet-period** *seconds*  
**no quiet-period**
- Context** config>port>ethernet>dot1x
- Supported Platforms** Supported on all 7210 SAS platforms as described in this document
- Description** This command configures the period between two authentication sessions during which no EAPOL frames are sent by the 7210 SAS.
- The **no** form of this command reverts to the default value.
- Default** 30
- Parameters** *seconds* — Specifies the quiet period in seconds.
- Values** 1 to 3600

## radius-plcy

- Syntax** **radius-plcy** *name*  
**no radius-plcy**
- Context** config>port>ethernet>dot1x
- Supported Platforms** Supported on all 7210 SAS platforms as described in this document

---

**Description** This command configures the RADIUS policy to be used for 802.1x authentication. An 802.1x RADIUS policy must be configured (under `config>security>dot1x`) before it can be associated 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

**Description** This command configures the period after which re-authentication is performed. This value is only relevant if re-authentication is enabled.

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

**Default** 3600

**Parameters** *seconds* — Specifies the re-authentication delay period in seconds.

**Values** 1 to 9000

## re-authentication

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

**Context** config>port>ethernet>dot1x

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

**Description** This command enables or disables periodic 802.1x re-authentication.

When re-authentication is enabled, the 7210 SAS will re-authenticate clients on the port every re-auth-period seconds.

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

**Default** re-authentication

---

## server-timeout

|                            |                                                                                                                                                                                                                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>server-timeout</b> <i>seconds</i><br><b>no server-timeout</b>                                                                                                                                                                                                                                                            |
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                                                                                                                                                                                                                  |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                           |
| <b>Description</b>         | This command configures the period during which the 7210 SAS waits for the RADIUS server to respond to its access request message. When this timer expires, the 7210 SAS will re-send the access request message, up to the specified number times.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>             | 30                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>          | <i>seconds</i> — Specifies the server timeout period in seconds.<br><b>Values</b> 1 to 300                                                                                                                                                                                                                                  |

## supplicant-timeout

|                            |                                                                                                                                                                                                                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>supplicant-timeout</b> <i>seconds</i><br><b>no supplicant-timeout</b>                                                                                                                                                                                                                       |
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                                                                                                                                                                                     |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                              |
| <b>Description</b>         | 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.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>             | 30                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>          | <i>seconds</i> — Specifies the server timeout period in seconds.<br><b>Values</b> 1 to 300                                                                                                                                                                                                     |

## transmit-period

|               |                                                                    |
|---------------|--------------------------------------------------------------------|
| <b>Syntax</b> | <b>transmit-period</b> <i>seconds</i><br><b>no transmit-period</b> |
|---------------|--------------------------------------------------------------------|

---

|                            |                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                                                                    |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                             |
| <b>Description</b>         | <p>This command configures the period after which the 7210 SAS sends a new EAPOL request message.</p> <p>The <b>no</b> form of this command reverts to the default value.</p> |
| <b>Default</b>             | 30                                                                                                                                                                            |
| <b>Parameters</b>          | <i>seconds</i> — Specifies the server transmit period in seconds.                                                                                                             |
| <b>Values</b>              | 1 to 3600                                                                                                                                                                     |

## tunneling

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] tunneling</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>             | config>port>ethernet>dot1x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | <p>This command enables tunneling of dot1x frames. With dot1x tunneling enabled, dot1x frames received on the port are transparently forwarded to the remote end of the service. To forwards dot1x frames transparently the port on which tunneling is enabled must be configured with NULL SAP and the NULL SAP must be configured in an Epipe service. Tunneling is not supported for any other port encapsulation or when using any other service.</p> <p>Additionally, dot1x protocol must be disabled on the port (using the command <b>configure&gt; port&gt; ethernet&gt; dot1x&gt; port-control force-auth</b>) before dot1x tunneling can be enabled using this command. If dot1x is configured to use either force-unauth or auto, then dot1x tunneling cannot be enabled. If dot1x tunneling is enabled, then the user cannot configure either force-unauth or auto.</p> <p>The <b>no</b> form of this command disables dot1x tunneling.</p> |
| <b>Default</b>             | no tunneling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## vlan-auth

|                            |                            |
|----------------------------|----------------------------|
| <b>Syntax</b>              | <b>[no] vlan-auth</b>      |
| <b>Context</b>             | config>port>ethernet>dot1x |
| <b>Supported Platforms</b> | 7210 SAS-Dxp               |

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command enables VLAN-based authentication. To use VLAN-based authentication, 802.1x authentication must first be enabled using the <b>port-control auto</b> command.</p> <p>When VLAN-based authentication is enabled, all traffic for all VLANs on the port is blocked. VLAN-tagged EAPOL messages are forwarded to the RADIUS server for authentication. If authentication is successful, the VLAN corresponding to the successfully authenticated VLAN-tagged EAPOL message is unblocked and traffic is processed for the configured service. If authentication fails, the VLAN continues to be blocked.</p> <p>VLAN authentication and MAC authentication are mutually exclusive and cannot be configured on the same port.</p> <p>The <b>no</b> form of this command disables VLAN-based authentication.</p> |
| <b>Default</b>     | no vlan-auth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## down-when-looped

|                            |                                                                   |
|----------------------------|-------------------------------------------------------------------|
| <b>Syntax</b>              | <b>down-when-looped</b>                                           |
| <b>Context</b>             | config>port>ethernet                                              |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document |
| <b>Description</b>         | This command configures Ethernet loop detection attributes.       |

## keep-alive

|                            |                                                                                  |
|----------------------------|----------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>keep-alive timer</b><br><b>no keep-alive</b>                                  |
| <b>Context</b>             | config>port>ethernet>dwl                                                         |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                |
| <b>Description</b>         | This command configures the time interval between keep-alive PDUs.               |
| <b>Default</b>             | no keep-alive                                                                    |
| <b>Parameters</b>          | <i>timer</i> — Specifies the time interval, in seconds, between keep-alive PDUs. |
| <b>Values</b>              | 1 to 120                                                                         |

## retry-timeout

|                            |                                                                                                                            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>retry-timeout</b> <i>timer</i><br><b>no retry-timeout</b>                                                               |
| <b>Context</b>             | config>port>ethernet>dwl                                                                                                   |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                          |
| <b>Description</b>         | This command configures the minimum wait time before re-enabling the port after loop detection.                            |
| <b>Default</b>             | no retry-timeout                                                                                                           |
| <b>Parameters</b>          | <i>timer</i> — Specifies the minimum wait time before re-enabling port after loop detection.<br><b>Values</b> 0, 10 to 160 |

### 2.18.2.1.10 802.1x Port MACsec Commands

## macsec

|                            |                                                            |
|----------------------------|------------------------------------------------------------|
| <b>Syntax</b>              | [no] <b>macsec</b>                                         |
| <b>Context</b>             | config>port>ethernet>dot1x                                 |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                  |
| <b>Description</b>         | This command configures MACsec functionality for the port. |



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

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

## ca-name

|               |                                                    |
|---------------|----------------------------------------------------|
| <b>Syntax</b> | <b>ca-name</b> <i>ca-name</i><br><b>no ca-name</b> |
|---------------|----------------------------------------------------|

---

|                            |                                                                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>port>ethernet>dot1x>macsec                                                                                                                                                                                             |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                     |
| <b>Description</b>         | This command configures the CA linked to the MACsec port. The CA provides the MACsec parameter that is used or is negotiated with other peers.<br><br>The <b>no</b> form of this command removes the CA from the MACsec port. |
| <b>Parameters</b>          | <i>ca-name</i> — Specifies the CA to use for the MACsec port, up to 32 characters.                                                                                                                                            |

## eapol-destination-address

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>eapol-destination-address</b> <i>mac</i><br><b>no eapol-destination-address</b>                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>             | config>port>ethernet>dot1x>macsec                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b>         | This command configures the destination MAC address of the EAPoL to the unicast address of the MACsec peer, so that the EAPoL and MKA signaling is unicast between two peers.<br><br>The EAPoL destination MAC address uses a destination multicast MAC address of 01:80:C2:00:00:03. Some networks cannot tunnel these packets over the network or consume them, causing the MKA session to fail.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>             | no eapol-destination-address                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>          | <i>mac</i> — Specifies the destination MAC address used by the EAPoL MKA packets of the specified port. The 48-bit MAC address is in the form aa:bb:cc:dd:ee:ff or aa-bb-cc-dd-ee-ff, where aa, bb, cc, dd, ee, and ff are hexadecimal numbers.                                                                                                                                                                                                                            |


## exclude-protocol

|                            |                                                       |
|----------------------------|-------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] exclude-protocol</b> { <i>protocol-name</i> } |
| <b>Context</b>             | config>port>ethernet>dot1x>macsec                     |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C             |

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures the protocols for which packets are not secured with MACsec when MACsec is enabled on a port. When this command is enabled in a CA that is attached to an interface, MACsec is not enabled for all packets of the specified protocols that are sent and received on the link.</p> <p>When this command is enabled on a port where MACsec is configured, packets of the specified protocols are sent and received in clear text.</p> |
| <b>Default</b>     | no exclude-protocol                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <i>protocol-name</i> — Specifies the protocol name.                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Values</b>      | cdp, lacp, lldp, eapol-start                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## max-peer

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>max-peer</b> <i>max-peer</i><br><b>no max-peer</b>                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>             | config>port>ethernet>dot1x>macsec                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>         | <p>This command configures the maximum number of peers allowed for the specified MACsec instance.</p> <p> <b>Note:</b> The peer establishment is a race condition and operates on a first-come-first-served basis. For a security zone, only 32 peers are supported.</p> <p>The <b>no</b> form of this command reverts to the default value.</p> |
| <b>Default</b>             | no max-peer                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>          | <i>max-peer</i> — Specifies the maximum number of peers supported on this port.                                                                                                                                                                                                                                                                                                                                                     |
| <b>Values</b>              | 0 to 32                                                                                                                                                                                                                                                                                                                                                                                                                             |

## rx-must-be-encrypted

|                            |                                           |
|----------------------------|-------------------------------------------|
| <b>Syntax</b>              | <b>[no] rx-must-be-encrypted</b>          |
| <b>Context</b>             | config>port>ethernet>dot1x>macsec         |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C |

**Description** This command specifies that all non-MACsec-secured traffic that is received on the port is dropped.

When this command is disabled, all arriving traffic is accepted, regardless of whether traffic is MACsec-secured.



**Note:** This command is available only at the NULL port level and does not have per-VLAN granularity.

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

**Default** rx-must-be-encrypted

## shutdown

**Syntax** [no] shutdown

**Context** config>port>ethernet>dot1x>macsec

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

**Description** This command shuts down MACsec functionality, including MKA negotiation, for the port. In the shutdown state, the port is not MACsec capable and all PDUs are transmitted and expected without encryption and authentication.

A valid CA that is different from another CA configured on a sub-port of this port, and also a *max-peer* value larger than 0, must be configured. In MACsec-enabled mode, packets are sent in clear text until the MKA session is up, and if the **rx-must-be-encrypted** command is configured on the port, all incoming packets without MACsec are dropped.

The **no** form of this command sets the port to MACsec-enabled mode.

**Default** shutdown

### 2.18.2.1.11 LLDP Port Commands

## lldp

**Syntax** lldp

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

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

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

[Table 29](#) describes the behavior for LLDP with different values set in use for admin-status and when tunneling is enabled or disabled:

**Table 29 LLDP Behavior**

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



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

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

**Default** no tunnel-nearest-bridge-dest-mac

## dest-mac

|                            |                                                                                                                                                                                                                                         |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>dest-mac</b> { <b>nearest-bridge</b>   <b>nearest-non-tmpr</b>   <b>nearest-customer</b> }                                                                                                                                           |
| <b>Context</b>             | config>port>ethernet>lldp                                                                                                                                                                                                               |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                       |
| <b>Description</b>         | This command configures destination MAC address parameters to use by LLDP.                                                                                                                                                              |
| <b>Parameters</b>          | <p><b>nearest-bridge</b> — Specifies to use the nearest bridge</p> <p><b>nearest-non-tmpr</b> — Specifies to use the nearest non-Two-Port MAC Relay (TPMR).</p> <p><b>nearest-customer</b> — Specifies to use the nearest customer.</p> |

## admin-status

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>admin-status</b> { <b>rx</b>   <b>tx</b>   <b>tx-rx</b>   <b>disabled</b> }                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>             | config>port>ethernet>lldp>dstmac                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | This command specifies the desired administrative status of the local LLDP agent.                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>          | <p><b>rx</b> — Specifies that the LLDP agent receives LLDP frames on this port, also indicates that the LLDP agent does not transmit LLDP frames.</p> <p><b>tx</b> — Specifies that the LLDP agent transmits LLDP frames on this port and does not store any information about the remote systems connected.</p> <p><b>tx-rx</b> — Specifies that the LLDP agent transmits and receives LLDP frames on this port.</p> |

**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

|                            |                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] notification</b>                                                                                        |
| <b>Context</b>             | config>port>ethernet>lldp>dstmac                                                                                |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                               |
| <b>Description</b>         | This command enables LLDP notifications.<br><br>The <b>no</b> form of this command disables LLDP notifications. |

## port-id-subtype

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>port-id-subtype {tx-if-alias   tx-if-name   tx-local}</b>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>             | config>port>ethernet>lldp>dstmac                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | This command specifies how to encode the PortID TLV transmit to the peer. Some releases of the NSP NFM-P require the PortID value require the default if-Alias to properly build the Layer Two topology map using LLDP. Selecting a different option will impact the ability of the NSP NFM-P to build those Layer 2 topologies.                                                                                                                           |
| <b>Default</b>             | portid-subtype tx-local                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>          | <b>tx-if-alias</b> — Specifies that the ifAlias String (subtype 1) that describes the port as stored in the IF-MIB, either user configured or the default entry (10/100/GigE SFP), will be transmitted.<br><br><b>tx-if-name</b> — Specifies that the ifName String (subtype 5) that describes the port as stored in the IF-MIB ifName info will be transmitted.<br><br><b>tx-local</b> — Specifies the interface ifIndex value (subtype 7) as the PortID. |

## tx-mgmt-address

|               |                                                                      |
|---------------|----------------------------------------------------------------------|
| <b>Syntax</b> | <b>tx-mgmt-address [system] [system-ipv6]<br/>no tx-mgmt-address</b> |
|---------------|----------------------------------------------------------------------|

---

|                            |                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>port>ethernet>lldp>dstmac                                                                                                                                                                                                                                                                                                                                                          |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>         | 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 send the management address. |
| <b>Default</b>             | no tx-mgmt-address                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>          | <b>system</b> — Specifies that the system IPv4 address will be transmitted.<br><b>system-ipv6</b> — Specifies that the system IPv6 address will be transmitted.                                                                                                                                                                                                                           |



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

## tx-tlvs

|                            |                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>tx-tlvs [port-desc] [sys-name] [sys-desc] [sys-cap]</b><br><b>no tx-tlvs</b>                                                                                                                                                                                                                                                                                     |
| <b>Context</b>             | config>port>ethernet>lldp>dstmac                                                                                                                                                                                                                                                                                                                                    |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>         | This command specifies which LLDP TLVs to transmit.<br><br>The <b>no</b> form of this command reverts to the default value.                                                                                                                                                                                                                                         |
| <b>Default</b>             | no tx-tlvs                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>          | <b>port-desc</b> — Specifies that the LLDP agent should transmit port description TLVs.<br><b>sys-name</b> — Specifies that the LLDP agent should transmit system name TLVs.<br><b>sys-desc</b> — Specifies that the LLDP agent should transmit system description TLVs.<br><b>sys-cap</b> — Specifie that the LLDP agent should transmit system capabilities TLVs. |

---

### 2.18.2.1.12 Access-Uplink Port Commands

#### network

|                            |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>network</b>                                                         |
| <b>Context</b>             | config>port>ethernet                                                   |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                              |
| <b>Description</b>         | This command enables the context to configure network port parameters. |

#### uplink

|                            |                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>uplink</b>                                                                       |
| <b>Context</b>             | config>port>access                                                                  |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C |
| <b>Description</b>         | This command enables the context to configure access uplink egress port parameters. |

#### accounting-policy

|                            |                                                                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>accounting-policy</b> <i>policy-id</i><br><b>no accounting-policy</b>                                                                                               |
| <b>Context</b>             | config>port>ethernet>network<br>config>port>ethernet>access>uplink<br>config>port>ethernet>access                                                                      |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; the network context applies only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C |
| <b>Description</b>         | 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. No accounting policies are specified by default. You must explicitly specify a policy. If configured, the accounting policy configured as the default is used.

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

**Values** 1 to 99

## collect-stats

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

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

**Supported Platforms** 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; the network context applies only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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

The **no** form of this command ensures that the statistics are still accumulated by the IOM cards, however, the CPU does not obtain the results and write them to the billing file.

If the **collect-stats** command is issued again (enabled), then the counters written to the billing file will include the traffic collected while the **no collect-stats** command was in effect.

**Default** no collect-stats

## queue-policy

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

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

**Supported Platforms** 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; the network context applies only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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|                    |                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | 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 <b>config&gt;qos&gt;network-queue</b> context.<br><br>A default CBS is defined for the queues and this is not configurable. |
| <b>Default</b>     | default                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>name</i> — Specifies an existing network-queue policy name.                                                                                                                                                                                                                                                                           |

### 2.18.2.1.13 LAG Commands

#### lag

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] lag</b> [ <i>lag-id</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>             | config                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>         | <p>This command enables the context for configuring Link Aggregation Group (LAG) attributes.</p> <p>A LAG can be used to group multiple ports into one logical link. The aggregation of multiple physical links allows for load sharing and provides seamless redundancy. If one of the links fails, traffic will be redistributed over the remaining links.</p> <p>There are three possible settings for autonegotiation:</p> <ul style="list-style-type: none"><li>• “on” or enabled with full port capabilities advertised</li><li>• “off” or disabled where there is no autonegotiation advertisements</li><li>• “limited” where a single speed/duplex is advertised.</li></ul> <p>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.</p> <p>When autonegotiation is disabled on a port, the port does not attempt to autonegotiate and will only operate at the <b>speed</b> and <b>duplex</b> 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.</p> <p>If the <a href="#">autonegotiate limited</a> keyword option is specified the port will autonegotiate but will only advertise a specific speed and duplex. The speed and duplex advertised are the <b>speed</b> and <b>duplex</b> settings configured for the port. One use for limited mode is for multispeed gigabit ports to force gigabit operation while keeping autonegotiation is enabled for compliance with IEEE 801.3.</p> |

The system requires that autonegotiation be disabled or limited for ports in a LAG to guarantee a specific port speed.

The **no** form of this command deletes the LAG from the configuration. Deleting a LAG can only be performed while the LAG is administratively shut down. Any dependencies such as IP-Interfaces configurations must be removed from the configuration before issuing the **no lag** command.

|                   |                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>lag-id</i> — The LAG identifier, expressed as a decimal integer.                                                               |
| <b>Values</b>     | 1 to 3 (7210 SAS-K 2F1C2T)<br>1 to 5 (7210 SAS-D)<br>1 to 6 (7210 SAS-Dxp, 7210 SAS-E,<br>7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C) |

## dynamic-cost

|                            |                                                                                                                              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] dynamic-cost</b>                                                                                                     |
| <b>Context</b>             | config>lag                                                                                                                   |
| <b>Supported Platforms</b> | Supported on 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                       |
| <b>Description</b>         | 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

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

If the encapsulation type of the LAG port is changed, the encapsulation type on all the port members will also change. The encapsulation type can be changed on the LAG port only if there is no interface associated with it. If the MTU is set to a non default value, it will be reset to the default value when the encap type is changed. All traffic on the port belongs to a single service or VLAN.



**Note:**

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

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

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | null                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b> | <p><b>dot1q</b> — Specifies that the ingress frames will carry 802.1Q tags where each tag signifies a different service.</p> <p><b>null</b> — Specifies that the ingress frames will not use any tags to delineate a service. As a result, only one service can be configured on a port with a null encapsulation type.</p> <p><b>qinq</b> — Specifies QinQ encapsulation. This value is not supported on access Port/LAG of 7210 SAS-E platform.</p> |

## hold-time

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <p><b>hold-time down</b> <i>hold-down-time</i></p> <p><b>no hold-time</b></p>                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>             | config>lag                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>         | <p>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.</p> <p>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.</p> |
| <b>Default</b>             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>          | <p><b>down</b> <i>hold-down-time</i> — Specifies the hold-time for event reporting.</p> <p><b>Values</b> 0 to 2000</p>                                                                                                                                                                                                                                                                                                                                                  |

## lACP

|                            |                                                                                                                                                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>lACP</b> [ <i>mode</i> ] [ <b>administrative-key</b> <i>admin-key</i> ] [ <b>system-id</b> <i>system-id</i> ] [ <b>system-priority</b> <i>priority</i> ] |
| <b>Context</b>             | config>lag                                                                                                                                                  |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                           |

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|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command enables the Link Aggregation Control Protocol (LACP) mode for aggregated Ethernet interfaces only. Per the IEEE 802.3ax standard (formerly 802.3ad), the LACP provides a standardized means for exchanging information between Partner Systems on a link. This allow their Link Aggregation Control instances to reach agreement on the identity of the Link Aggregation Group to which the link belongs, move the link to that Link Aggregation Group, and enable its transmission and reception functions in an orderly manner. LACP can be enabled on a maximum of 256 ports.                                                                                                                                                                                                                                                              |
| <b>Default</b>     | no lacp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <i>mode</i> — Specifies the mode in which LACP will operate.<br><b>Values</b> <b>passive</b> — Starts transmitting LACP packets only after receiving packets.<br><b>active</b> — Initiates the transmission of LACP packets.<br><b>power-off</b> — Disables transmitter of standby ports.<br><i>admin-key</i> — 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.<br><b>Values</b> 1 to 65535<br><i>system-id</i> — Specifies a 6 byte value expressed in the same notation as MAC address<br><b>Values</b> xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx<br><i>priority</i> — Specifies the system priority to be used for the LAG in the context of the MC-LAG.<br><b>Values</b> 0 to 65535 |

## lacp-xmit-interval

|                            |                                                                                                                                          |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] lacp-xmit-interval {slow   fast}</b>                                                                                             |
| <b>Context</b>             | config>lag                                                                                                                               |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                        |
| <b>Description</b>         | This command specifies the interval signaled to the peer and tells the peer at which rate it should transmit.                            |
| <b>Default</b>             | fast                                                                                                                                     |
| <b>Parameters</b>          | <b>slow</b> — Specifies that packets will transmit every 30 seconds.<br><b>fast</b> — Specifies that packets will transmit every second. |

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## lacp-xmit-stdby

|                            |                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] lacp-xmit-stdby</b>                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>             | config>lag                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | <p>This command enables LACP message transmission on standby links.</p> <p>The <b>no</b> 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 <b>no</b> form if the peer does not implement the proper behavior regarding the lacp sync bit.</p> |
| <b>Default</b>             | lacp-xmit-stdby                                                                                                                                                                                                                                                                                                                                                                                          |

## port

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>port</b> <i>port-id</i> [ <i>port-id ...up to n total</i> ] [ <b>priority</b> <i>priority</i> ] [ <b>subgroup</b> <i>sub-group-id</i> ]<br><b>no port</b> <i>port-id</i> [ <i>port-id ...up to n total</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>             | config>lag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | <p>This command adds ports to a Link Aggregation Group (LAG).</p> <p>The port configuration of the first port added to the LAG is used as a basis to compare to subsequently added ports. If a discrepancy is found with a newly added port, that port will be not added to the LAG.</p> <p>The maximum number of ports allowed in a LAG depends on the platform. The limits per platforms is as follows:</p> <ul style="list-style-type: none"> <li>• On the 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E, a maximum of four 1GE ports can be added to or removed from the LAG as long as the maximum of four ports is not exceeded.</li> <li>• On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, a maximum of three 1GE ports can be added or removed from the LAG as long as the maximum of three ports is not exceeded.</li> <li>• On the 7210 SAS-K 3SFP+ 8C, a maximum of two 10GE ports can be added or removed from the LAG as long as the maximum of three ports is not exceeded.</li> </ul> |

All ports, when added to a LAG, must share the same characteristics (speed, duplex, and so on). An error message will be displayed when adding ports that do not share the same characteristics. Hold-timers down must be 0. Ports that are part of a LAG must be configured with autonegotiate limited or disabled. No ports are defined as members of a LAG.

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

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

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

**Values** 1 to 65535

**subgroup** *sub-group-id* — Specifies a LAG subgroup. 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 in case a subgroup consists of one member.

**Values** 1 to 2

## port-threshold

**Syntax** **port-threshold** *value* [**action** **{down}**]  
**no port-threshold**

**Context** config>lag

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

**Description** This command configures the behavior for the Link Aggregation Group (LAG) if the number of operational links is equal to or below a threshold level.

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

**Default** “0” action down

**Parameters** *value* — Specifies the decimal integer threshold number of operational links for the LAG at or below which the configured action will be invoked. If the number of operational links exceeds the port-threshold value, any action taken for being below the threshold value will cease.

**Values** 0 to 3

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

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

## selection-criteria

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>selection-criteria</b> [{ <b>highest-count</b>   <b>highest-weight</b>   <b>best-port</b> }] [ <b>slave-to-partner</b> ]<br><b>no selection-criteria</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>             | config>lag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>         | This command specifies which selection criteria should be used to select the active sub-group.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Default</b>             | highest-count                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>          | <p><b>highest-count</b> — Specifies sub-group with the highest number of eligible members.</p> <p><b>highest-weight</b> — Specifies sub-group with the highest aggregate weight.</p> <p><b>best-port</b> — Specifies the selection criteria used with “power-off” mode of operation. The sub-group containing the port with highest priority port. In case of equal port priorities the sub-group containing the port with the lowest port-id is taken</p> <p><b>slave-to-partner</b> — Specifies that, together with the selection criteria, the slave-to-partner keyword should be used to select the active sub-group. An eligible member is a lag-member link which can potentially become active. This means it is operationally up (not disabled) for use by the remote side. The <b>slave-to-partner</b> parameter can be used to control whether or not this latter condition is taken into account.</p> |

## standby-signalling

|                            |                                                                                                                                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>standby-signalling</b> { <b>lACP</b>   <b>power-off</b> }<br><b>no standby-signalling</b>                                                                         |
| <b>Context</b>             | config>lag                                                                                                                                                           |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document, except 7210 SAS-E                                                                                 |
| <b>Description</b>         | 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 <b>standby</b> value. |
| <b>Default</b>             | lACP                                                                                                                                                                 |

- 
- Parameters** *lacp* — Specifies that LACP protocol is used to signal standby links of the LAG.
- power-off* — The laser of the standby links in the LAG are shutoff to indicate standby status. It allows user to use LAG standby link feature without LACP, if the peer node does not support LACP.

### 2.18.2.1.14 Multi-Chassis Redundancy Commands

#### redundancy

- Syntax** **redundancy**
- Context** config
- Supported Platforms** Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
- Description** This command enables the context to configure redundancy operations.

#### multi-chassis

- Syntax** **multi-chassis**
- Context** config>redundancy
- Supported Platforms** Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
- 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 the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
- Description** This command configures the MC-LAG peer.
- Parameters** *ip-address* — Specifies the IP address.
- Values** ipv4-address: a.b.c.d
- create** — Specifies to create the peer.

## authentication-key

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>authentication-key</b> [ <i>authentication-key</i>   <i>hash-key</i> ] [ <b>hash</b>   <b>hash2</b> ]<br><b>no authentication-key</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>             | config>redundancy>multi-chassis>peer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b>         | 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>          | <p><i>authentication-key</i> — 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.</p> <p><i>hash-key</i> — Specifies the hash key. The key can be any combination of ASCII characters up to 33 (<i>hash1-key</i>) or 55 (<i>hash2-key</i>) characters (encrypted). If spaces are used in the string, enclose the entire string in quotation marks.</p> <p><b>hash</b> — Specifies that the key is entered in an encrypted form. If the hash or hash2 parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the hash or hash2 parameter specified.</p> <p><b>hash2</b> — Specifies that the key is entered in a more complex encrypted form that involves more variables than 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.</p> |

## description

|                            |                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>description</b> <i>long-description-string</i><br><b>no description</b>                                                      |
| <b>Context</b>             | config>redundancy>multi-chassis>peer                                                                                            |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                      |
| <b>Description</b>         | This command adds a text description for the ring path.<br><br>The <b>no</b> form of this command removes the text description. |
| <b>Default</b>             | ""                                                                                                                              |
| <b>Parameters</b>          | <i>string</i> — Specifies the text description up to 160 characters.                                                            |

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## MC Endpoint Commands

### hold-on-neighbor-failure

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>hold-on-neighbor-failure</b> <i>multiplier</i><br><b>no hold-on-neighbor-failure</b>                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>             | config>redundancy>multi-chassis>peer>mc-ep                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>         | <p>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.</p> <p>The <b>no</b> form of this command reverts the multiplier to the default value.</p> |
| <b>Default</b>             | 3                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>          | <i>multiplier</i> — Specifies the hold time applied on neighbor failure.<br><b>Values</b> 2 to 25                                                                                                                                                                                                                                                                                                               |

## MC LAG Commands

### mc-lag

|                            |                                                                                                                                                                                                                                                     |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] mc-lag</b>                                                                                                                                                                                                                                  |
| <b>Context</b>             | config>redundancy>multi-chassis>peer>mc-lag                                                                                                                                                                                                         |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                          |
| <b>Description</b>         | <p>This command enables the context to configure multi-chassis LAG operations and related parameters.</p> <p>The <b>no</b> form of this command administratively disables multi-chassis LAG. MC-LAG can be issued only when MC-LAG is shutdown.</p> |

### hold-on-neighbor-failure

**Syntax** **hold-on-neighbor-failure** *multiplier*

---

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | <b>no hold-on-neighbor-failure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>             | config>redundancy>multi-chassis>peer>mc-lag                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | This command specifies the interval that the standby node waits 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.<br><br>The <b>no</b> form of this command reverts the multiplier to the default value. |
| <b>Default</b>             | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>          | <i>multiplier</i> — Specifies the time interval that the standby node waits for packets from the active node before assuming a redundant-neighbor node failure.<br><br><b>Values</b> 2 to 25                                                                                                                                                                                                                                                                                      |


## keep-alive-interval

|                            |                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>keep-alive-interval</b> <i>interval</i><br><b>no keep-alive-interval</b>                                                                                                                                                                                                                                             |
| <b>Context</b>             | config>redundancy>multi-chassis>peer>mc-lag                                                                                                                                                                                                                                                                             |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                              |
| <b>Description</b>         | This command sets the interval at which keep-alive messages are exchanged between two systems participating in MC-LAG. These keep-alive messages are used to determine remote-node failure and the interval is set in deciseconds.<br><br>The <b>no</b> form of this command reverts the interval to the default value. |
| <b>Default</b>             | 10                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>          | <i>interval</i> — Specifies the time interval expressed, in deciseconds.<br><br><b>Values</b> 5 to 500                                                                                                                                                                                                                  |

## lag

|               |                                                                                                                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>lag</b> <i>lag-id</i> <b>lacp-key</b> <i>admin-key</i> <b>system-id</b> <i>system-id</i> [ <b>remote-lag</b> <i>remote-lag-id</i> ] <b>system-priority</b> <i>system-priority</i><br><b>lag</b> [ <b>remote-lag</b> <i>remote-lag-id</i> ] |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                   | <b>no lag</b> <i>lag-id</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>                                                                    | config>redundancy>multi-chassis>peer>mc-lag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Supported Platforms</b>                                                        | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>                                                                | <p>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 for MC-LAG to become operational, all parameters (<b>lACP-key</b>, <b>system-id</b>, <b>system-priority</b>) must be configured the same on both nodes of the same redundant pair.</p> <p>The partner system (the system connected to all links forming MC-LAG) considers all ports using the same <b>lACP-key</b>, <b>system-id</b>, <b>system-priority</b> 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.</p> <p>The <b>no</b> form of this command disables MC LAG for the specific LAG (regardless of the mode).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  | <p><b>Note:</b> The correct CLI command to enable MC LAG for a LAG in <b>standby-signaling power-off mode</b> is <b>lag lag-id [remote-lag remote-lag-id]</b>. In the CLI help output, the first three forms are used to enable MC LAG for a LAG in LACP mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>                                                                 | <p><i>lag-id</i> — Specifies the LAG identifier, expressed as a decimal integer. Specifying the <i>lag-id</i> allows the mismatch between lag-id on redundant-pair. If no <b>lag-id</b> is specified it is assumed that neighbor system uses the same <i>lag-id</i> 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).</p> <p><b>Values</b> 1 to 6 (for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C)</p> <p><b>lACP-key</b> <i>admin-key</i> — 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.</p> <p><b>Values</b> 1 to 65535</p> <p><b>system-id</b> <i>system-id</i> — Specifies a 6-byte value expressed in the same notation as MAC address</p> <p><b>Values</b> xx:xx:xx:xx:xx:xx — xx (00 to FF)</p> <p><b>remote-lag</b> <i>lag-id</i> — Specifies the LAG ID on the remote system.</p> <p><b>Values</b> 1 to 6</p> <p><b>system-priority</b> <i>system-priority</i> — Specifies the system priority to be used in the context of the MC-LAG. The partner system will consider all ports using the same <b>lACP-key</b>, <b>system-id</b>, and <b>system-priority</b> as part of the same LAG.</p> <p><b>Values</b> 1 to 65535</p> |

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## source-address

|                            |                                                                                                   |
|----------------------------|---------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>source-address</b> <i>ip-address</i><br><b>no source-address</b>                               |
| <b>Context</b>             | config>redundancy>multi-chassis>peer                                                              |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                        |
| <b>Description</b>         | This command specifies the source address used to communicate with the multi-chassis peer.        |
| <b>Parameters</b>          | <i>ip-address</i> — Specifies the source address used to communicate with the multi-chassis peer. |

## peer-name

|                            |                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>peer-name</b> <i>name</i><br><b>no peer-name</b>                                   |
| <b>Context</b>             | config>redundancy>multi-chassis>peer                                                  |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                            |
| <b>Description</b>         | This command specifies the peer name used to communicate with the multi-chassis peer. |
| <b>Parameters</b>          | <i>name</i> — Specifies the name used to communicate with the multi-chassis peer.     |

## sync

|                            |                                                                           |
|----------------------------|---------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] sync</b>                                                          |
| <b>Context</b>             | config>redundancy>multi-chassis>peer                                      |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                |
| <b>Description</b>         | This command enables the context to configure synchronization parameters. |

## igmp-snooping

|                |                                           |
|----------------|-------------------------------------------|
| <b>Syntax</b>  | <b>[no] igmp-snooping</b>                 |
| <b>Context</b> | config>redundancy>multi-chassis>peer>sync |

---

|                            |                                                                                                              |
|----------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                   |
| <b>Description</b>         | This command specifies whether IGMP snooping information should be synchronized with the multi-chassis peer. |
| <b>Default</b>             | no igmp-snooping                                                                                             |

## port

|                            |                                                                                                                                                                                                                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>port</b> [ <i>port-id</i>   <i>lag-id</i> ] [ <b>sync-tag</b> <i>sync-tag</i> ]<br><b>no port</b> [ <i>port-id</i>   <i>lag-id</i> ]                                                                                                                                                                                |
| <b>Context</b>             | config>redundancy>multi-chassis>peer>sync                                                                                                                                                                                                                                                                              |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                                                                                                                                                                                             |
| <b>Description</b>         | 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.                                                                                                                                         |
| <b>Parameters</b>          | <i>port-id</i> — Specifies the port to be synchronized with the multi-chassis peer.<br><i>lag-id</i> — Specifies the LAG ID to be synchronized with the multi-chassis peer.<br><b>sync-tag</b> <i>sync-tag</i> — Specifies a synchronization tag to be used while synchronizing this port with the multi-chassis peer. |

## range

|                            |                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>range</b> <i>encap-range</i> <b>sync-tag</b> <i>sync-tag</i><br><b>no range</b> <i>encap-range</i>                  |
| <b>Context</b>             | config>redundancy>multi-chassis>peer>sync>port                                                                         |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                             |
| <b>Description</b>         | This command configures a range of encapsulation values.                                                               |
| <b>Parameters</b>          | <i>encap-range</i> — Specifies a range of encapsulation values on a port to be synchronized with a multi-chassis peer. |

### Values

|                   |                                             |
|-------------------|---------------------------------------------|
| Dot1Q             | <i>start-qtag-end-qtag</i>                  |
| <i>start-qtag</i> | <i>0 to 4094</i>                            |
| <i>end-qtag</i>   | <i>0 to 4094</i>                            |
| 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.

### 2.18.2.1.15 Ethernet Ring Commands

#### eth-ring

|                            |                                                                                                                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>eth-ring</b> <i>ring-id</i><br><b>no eth-ring</b>                                                                                                                                                                        |
| <b>Context</b>             | config                                                                                                                                                                                                                      |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                           |
| <b>Description</b>         | This command configures a G.8032 protected Ethernet ring. G.8032 Rings may be configured as major rings with two paths (a&b).<br><br>The <b>no</b> form of this command deletes the Ethernet ring specified by the ring-id. |
| <b>Default</b>             | no eth-ring                                                                                                                                                                                                                 |
| <b>Parameters</b>          | <i>ring-id</i> — Specifies the ring ID.<br><b>Values</b> 1 to 128                                                                                                                                                           |

#### guard-time

|                            |                                                                   |
|----------------------------|-------------------------------------------------------------------|
| <b>Syntax</b>              | <b>guard-time</b> <i>time</i><br><b>no guard-time</b>             |
| <b>Context</b>             | config>eth-ring                                                   |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document |

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|                    |                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the guard time for an Eth-Ring. The guard timer is standard and is configurable from 100 ms to 2 seconds<br><br>The <b>no</b> form of this command reverts to the default guard-time. |
| <b>Default</b>     | 5 deciseconds                                                                                                                                                                                                 |
| <b>Parameters</b>  | <i>value</i> — Specifies the guard-time.<br><b>Values</b> 1 to 20 deciseconds                                                                                                                                 |

## revert-time

|                            |                                                                                                                                                                                                                                                                    |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>revert-time</b> <i>time</i><br><b>no revert-time</b>                                                                                                                                                                                                            |
| <b>Context</b>             | config>eth-ring                                                                                                                                                                                                                                                    |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                  |
| <b>Description</b>         | This command configures the revert time for an Eth-Ring. It ranges from 60 seconds to 720 second by 1 second intervals.<br><br>The <b>no</b> form of this command means non-revertive mode and revert time essentially is 0 meaning the revert timers are not set. |
| <b>Default</b>             | 300 seconds                                                                                                                                                                                                                                                        |
| <b>Parameters</b>          | <i>value</i> — Specifies the guard-time, in seconds.<br><b>Values</b> 60 to 720                                                                                                                                                                                    |

## ccm-hold-time

|                            |                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>ccm-hold-time</b> { <b>down</b> <i>down-timeout</i>   <b>up</b> <i>up-timeout</i> }<br><b>no ccm-hold-time</b>                                                                                                                                                                                                                                                       |
| <b>Context</b>             | config>eth-ring                                                                                                                                                                                                                                                                                                                                                         |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>         | This command configures eth-ring dampening timers.<br><br>This command specifies the timer, which controls the delay between detecting that ring path is down and reporting it to the G.8032 protection module. If a non-zero value is configured, the CPM will wait for the time specified in the value parameter before reporting it to the G.8032 protection module. |



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

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



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

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

**Parameters**

*down-timeout* — Specifies the down timeout, in deciseconds.

**Values** 0 to 5000

*up-timeout* — Specifies the hold-time for reporting the recovery, in deciseconds.

**Values** 0 to 5000

## rpl-node

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>rpl-node</b> <owner   nbr><br><b>no rpl-node</b>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>             | config>eth-ring                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | This command configures the G.8032 Ring Protection Link (RPL) type as owner or neighbor. When RPL owner or neighbor is specified, either the a or b path must be configured with the RPL end command. An owner is responsible for operation of the RPL link. Configuring the RPL as neighbor is optional (can be left as no rpl-node) but if the command is used the nbr is mandatory.<br><br>The <b>no</b> form of this command removes the connection to the RPL link. |
| <b>Default</b>             | no rpl-node                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>          | <b>owner</b> — Specifies a G.8032 RPL type of owner.<br><b>nbr</b> — Specifies a G.8032 RPL type of neighbor.                                                                                                                                                                                                                                                                                                                                                            |

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## node-id

|                            |                                                                                                                                                                                                                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>node-id</b> <i>mac</i><br><b>no node-id</b>                                                                                                                                                                                                                                         |
| <b>Context</b>             | config>eth-ring                                                                                                                                                                                                                                                                        |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                      |
| <b>Description</b>         | <p>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.</p> <p>The <b>no</b> form of this command removes the RPL link.</p> |
| <b>Default</b>             | no node-id                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>          | <i>mac</i> — Specifies a MAC address in the format xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx                                                                                                                                                                                              |

## sub-ring

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>sub-ring</b> { <b>virtual-link</b>   <b>non-virtual-link</b> }<br><b>[no] sub-ring</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>             | config>eth-ring>sub-ring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>         | <p>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.</p> <p>The <b>no</b> form of this command deletes the sub-ring and its virtual channel associations.</p> |
| <b>Default</b>             | no sub-ring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>          | <b>virtual-link</b> — Specifies the interconnection is to a ring and a virtual link will be used.<br><b>non-virtual-link</b> — Specifies the interconnection is to a ring or a VPLS instance and a virtual link will not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## compatible-version

|                            |                                                                                  |
|----------------------------|----------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>compatible-version</b> <i>version</i><br>[no] <b>compatible-version</b>       |
| <b>Context</b>             | config>eth-ring                                                                  |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                |
| <b>Description</b>         | This command configures the backward compatibility logic for the Ethernet rings. |
| <b>Default</b>             | 2                                                                                |
| <b>Parameters</b>          | <i>version</i> — Specifies the Ethernet ring version.<br><b>Values</b> 1 to 2    |

## path

|                            |                                                                                                                                                                                                                                                           |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>path</b> {a   b} [{ <i>port-id</i>   <i>lag-id</i> } <b>raps-tag</b> <i>qtag</i> [ <i>qtag</i> ]]<br>[no] <b>path</b> {a   b}                                                                                                                          |
| <b>Context</b>             | config>eth-ring                                                                                                                                                                                                                                           |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                         |
| <b>Description</b>         | 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.<br><br>The <b>no</b> form of this command removes the path a or b.                                                 |
| <b>Default</b>             | no path                                                                                                                                                                                                                                                   |
| <b>Parameters</b>          | <b>path</b> — Specifies the path.<br><b>Values</b> a, b<br><i>lag-id</i> — Specifies the LAG ID<br><i>qtag</i> [ <i>qtag</i> ] — Specifies the qtag. For Dot1q, only the first qtag is used. For QinQ, both qtags can be used.<br><b>Values</b> 1 to 4094 |

## description

|               |                                                                            |
|---------------|----------------------------------------------------------------------------|
| <b>Syntax</b> | <b>description</b> <i>long-description-string</i><br><b>no description</b> |
|---------------|----------------------------------------------------------------------------|

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|                            |                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>             | config>eth-ring>path                                                                                                        |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                           |
| <b>Description</b>         | This command adds a text description for the ring path.<br>The <b>no</b> form of this command removes the text description. |
| <b>Default</b>             | ""                                                                                                                          |
| <b>Parameters</b>          | <i>string</i> — Specifies the text description up to 160 characters.                                                        |

## rpl-end

|                            |                                                                                                                                                                                                                                                                                                          |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>rpl-end</b><br><b>no rpl-end</b>                                                                                                                                                                                                                                                                      |
| <b>Context</b>             | config>eth-ring>path                                                                                                                                                                                                                                                                                     |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                        |
| <b>Description</b>         | 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.<br>The <b>no</b> form of this command sets the rpl-end to default no rpl-end. |
| <b>Default</b>             | no rpl-end                                                                                                                                                                                                                                                                                               |

## eth-cfm

|                            |                                                                   |
|----------------------------|-------------------------------------------------------------------|
| <b>Syntax</b>              | <b>eth-cfm</b>                                                    |
| <b>Context</b>             | config>eth-ring>path                                              |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document |
| <b>Description</b>         | This command enables the context to configure ETH-CFM parameters. |

## mep

|                |                                                                                                |
|----------------|------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>[no] mep</b> <i>mep-id</i> <b>domain</b> <i>md-index</i> <b>association</b> <i>ma-index</i> |
| <b>Context</b> | config>eth-ring>path>eth-cfm                                                                   |

---

|                            |                                                                                                                                                                                                                                                                                                           |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                         |
| <b>Description</b>         | This command provisions an 802.1ag maintenance endpoint (MEP).<br>The <b>no</b> form of this command reverts to the default values.                                                                                                                                                                       |
| <b>Parameters</b>          | <i>mep-id</i> — Specifies the maintenance association (MA) end point identifier.<br><b>Values</b> 1 to 81921<br><i>md-index</i> — Specifies the maintenance domain (MD) index value.<br><b>Values</b> 1 to 4294967295<br><i>ma-index</i> — Specifies the MA index value.<br><b>Values</b> 1 to 4294967295 |

## ccm-enable

|                            |                                                                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] ccm-enable</b>                                                                                                              |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                                                    |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                   |
| <b>Description</b>         | This command enables the generation of CCM messages.<br>The <b>no</b> form of this command disables the generation of CCM messages. |

## ccm-ltm-priority

|                            |                                                                                                                                                                              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>ccm-ltm-priority</b> <i>priority</i><br><b>no ccm-ltm-priority</b>                                                                                                        |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                                                                                             |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                            |
| <b>Description</b>         | This command specifies the priority value for CCMs and LTMs transmitted by the MEP.<br>The <b>no</b> form of this command removes the priority value from the configuration. |
| <b>Default</b>             | the highest priority on the bridge-port                                                                                                                                      |
| <b>Parameters</b>          | <i>priority</i> — Specifies the priority of CCM and LTM messages.<br><b>Values</b> 0 to 7                                                                                    |

---

## control-mep

|                            |                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>no control-mep</b>                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                                                                                                                                                                                                                                                                                                               |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>         | <p>This command enables the context of the CC state by the Ethernet ring for consideration in the protection algorithm. The use of control-mep command is recommended if fast failure detection is required, especially when Link Layer OAM does not provide the required detection time.</p> <p>The <b>no</b> form of this command disables the use of the CC state by the Ethernet ring.</p> |
| <b>Default</b>             | no control-mep                                                                                                                                                                                                                                                                                                                                                                                 |

## eth-test-enable

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] eth-test-enable</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>         | <p>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:</p> <pre>oam eth-cfm eth-test <i>mac-address</i> mep <i>mep-id</i> domain <i>md-index</i> association <i>ma-index</i> [priority <i>priority</i>] [data-length <i>data-length</i>]</pre> <p>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.</p> |

## test-pattern

|                            |                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>test-pattern {all-zeros   all-ones} [crc-enable]</b><br><b>no test-pattern</b> |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep>eth-test-enable                                  |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                 |
| <b>Description</b>         | This command configures the test pattern for eth-test frames.                     |

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

|                   |                                                                                                                                                                                                                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | all-zeros                                                                                                                                                                                                                     |
| <b>Parameters</b> | <p><b>all-zeros</b> — Specifies to use all zeros in the test pattern.</p> <p><b>all-ones</b> — Specifies to use all ones in the test pattern.</p> <p><b>crc-enable</b> — Specifies that a CRC checksum will be generated.</p> |

## bit-error-threshold

|                            |                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>bit-error-threshold</b> <i>bit-errors</i>                                                     |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                 |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                |
| <b>Description</b>         | This command specifies the lowest priority defect that is allowed to generate a fault alarm.     |
| <b>Default</b>             | 1                                                                                                |
| <b>Parameters</b>          | <p><i>bit-errors</i> — Specifies the lowest priority defect.</p> <p><b>Values</b> 0 to 11840</p> |

## mac-address

|                            |                                                                                                                                                                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <p><b>mac-address</b> <i>mac-address</i></p> <p><b>no mac-address</b></p>                                                                                                                                                                        |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                                                                                                                                                                 |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                |
| <b>Description</b>         | <p>This command specifies the MAC address of the MEP.</p> <p>The <b>no</b> 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).</p>           |
| <b>Parameters</b>          | <p><i>mac-address</i> — Specifies the MAC address of the MEP.</p> <p><b>Values</b> 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.</p> |

## one-way-delay-threshold

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>one-way-delay-threshold</b> <i>seconds</i>                                                  |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                               |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                              |
| <b>Description</b>         | This command enables one way delay threshold time limit.                                       |
| <b>Default</b>             | 3 seconds                                                                                      |
| <b>Parameters</b>          | <i>priority</i> — Specifies the value for the threshold, in seconds.<br><b>Values</b> 0 to 600 |

## shutdown

|                            |                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] shutdown</b>                                                                                                          |
| <b>Context</b>             | config>eth-ring>path>eth-cfm>mep                                                                                              |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                             |
| <b>Description</b>         | This command administratively enables or disables the MEP.<br>The <b>no</b> form of this command disables or enables the MEP. |
| <b>Default</b>             | shutdown                                                                                                                      |

## shutdown

|                            |                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] shutdown</b>                                                                                                            |
| <b>Context</b>             | config>eth-ring>path                                                                                                            |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                               |
| <b>Description</b>         | This command administratively enables or disables the path.<br>The <b>no</b> form of this command disables or enables the path. |
| <b>Default</b>             | shutdown                                                                                                                        |

---

## shutdown

|                            |                                                                                                                                    |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>[no] shutdown</b>                                                                                                               |
| <b>Context</b>             | config>eth-ring                                                                                                                    |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                  |
| <b>Description</b>         | This command administratively enables/disables the Ethernet ring.<br>The <b>no</b> form of this command disables/enables the ring. |
| <b>Default</b>             | shutdown                                                                                                                           |

## description

|                            |                                                                                                                              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>description</b> <i>long-description-string</i><br><b>no description</b>                                                   |
| <b>Context</b>             | config>eth-tunnel                                                                                                            |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                            |
| <b>Description</b>         | This command adds a text description for the eth-tunnel.<br>The <b>no</b> form of this command removes the text description. |
| <b>Default</b>             | “Eth-tunnel”                                                                                                                 |
| <b>Parameters</b>          | <i>string</i> — Specifies the text description up to 160 characters.                                                         |

## split-horizon-group

|                            |                                                                                                                                                                                                                                           |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>split-horizon-group</b> <i>group-name</i><br><b>no split-horizon-group</b>                                                                                                                                                             |
| <b>Context</b>             | config>lag<br>config>port                                                                                                                                                                                                                 |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E                                                                                                                                                                                                  |
| <b>Description</b>         | 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 <b>config</b> 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.

## 2.18.2.2 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

#### Description



**Note:** The environment option is not supported on the 7210 SAS-D.

This command displays general chassis status information.

**Parameters** **environment** — Displays chassis environmental status information.  
**power-supply** — Displays chassis power supply status information.

**Output** The following output is an example of chassis information, and [Table 30](#) describes the output fields.

**Sample Output**

This CLI output is obtained only if the hardware supports “DC source failure detection”.

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

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

Environment Information
 Number of fan trays : 1
 Number of fans : 3

 Fan tray number : 1
 Status : up
 Speed : half speed

Power Supply Information

 Number of power supplies : 2

 Power supply number : 1
 Configured power supply type : dc
 Status : failed
 DC power : out of range
 Input power : out of range
 Output power : within range

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

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

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

Environment Information
 Number of fan trays : 1
 Number of fans : 3

 Fan tray number : 1
 Status : up
 Speed : half speed

Power Supply Information
 Number of power supplies : 2

 Power supply number : 1
 Configured power supply type : dc
 Status : up
 DC power : within range
 Input power : within range
 Output power : within range

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

*A:SAS-D>show# chassis

=====
Chassis Information
=====
```

```

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

Hardware Data
Part number :
CLEI code :
Serial number : NS1050C0071
Manufacture date :
Manufacturing string :
Manufacturing deviations :
Time of last boot : 1970/01/01 00:00:03
Current alarm state : alarm cleared

Power Supply Information
Number of power supplies : 1

Power supply number : 1
Configured power supply type : ac single
Status : up
AC power : within range
=====
*A:SAS-D>show#

```

**Table 30 Output Fields: Chassis**

| Label       | Description                                                                                                                                                                                                                                    |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name        | The system name for the router.                                                                                                                                                                                                                |
| Type        | The device model number.                                                                                                                                                                                                                       |
| Location    | The system location for the device.                                                                                                                                                                                                            |
| Coordinates | A user-configurable string that indicates the Global Positioning System (GPS) coordinates for the location of the chassis.<br>For example:<br>N 45 58 23, W 34 56 12<br>N37 37' 00 latitude, W122 22' 00 longitude<br>N36*39.246' W121*40.121' |

**Table 30 Output Fields: Chassis (Continued)**

| Label                | Description                                                                                                                                                                                         |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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<br>The card is administratively up.                                                                                                                                                              |
|                      | Down<br>The card is administratively down.                                                                                                                                                          |
| Operational state    | Up<br>The card is operationally up.                                                                                                                                                                 |
|                      | Down<br>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.                                                                                                                                               |

**Table 30 Output Fields: Chassis (Continued)**

| Label                    | Description                                                             |
|--------------------------|-------------------------------------------------------------------------|
| 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<br>The fans are operating at half speed.                     |
|                          | Full speed<br>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<br>AC voltage is within range.                             |
|                          | Out of range<br>AC voltage is out of range.                             |
| DC power                 | Within range<br>DC voltage is within range.                             |
|                          | Out of range<br>DC voltage is out of range.                             |
| Over temp                | Within range<br>The current temperature is within the acceptable range. |
|                          | Out of range<br>The current temperature is above the acceptable range.  |
| Status                   | Up<br>The specified power supply is up.                                 |
|                          | Down<br>The specified power supply is down                              |

card

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

- Context** show
- Supported Platforms** Supported on all 7210 SAS platforms as described in this document
- Description** This command displays card information.  
  
If no command line parameters are specified, a card summary for all cards is displayed.
- Parameters**
  - slot-number* — Displays information for the specified card slot.
    - Default** Displays all cards.
    - Values** state
  - detail* — Displays detailed card information.
    - Default** displays summary information only
- Output** The following outputs are examples of card information, and the associated tables describe the output fields.
  - [Sample Output for 7210 SAS-K 2F1C2T, Table 31](#)
  - [Output Sample for 7210 SAS-K 2F1C2T Card Detail, Table 32](#)
  - [Sample Output for CPM Card, Table 33](#)
  - [Output Fields for Card State, Table 34](#)

**Sample Output for 7210 SAS-K 2F1C2T**

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

=====
Card Summary
=====
Slot Provisioned Type Admin Operational Comments
 Equipped Type (if different) State State

1 iom-sas up up
A sfm-sas up up/active
=====
*A:SAH01-051>show#
```

**Table 31 Output Fields: Card**

| Label                 | Description                                           |
|-----------------------|-------------------------------------------------------|
| Slot                  | The slot number of the card in the chassis.           |
| Provisioned Card-type | The card type that is configured for the slot.        |
| Equipped Card-type    | The card type that is actually populated in the slot. |

**Table 31 Output Fields: Card (Continued)**

| Label             | Description                                |
|-------------------|--------------------------------------------|
| Admin State       | Up<br>The card is administratively up.     |
|                   | Down<br>The card is administratively down. |
| Operational State | Up<br>The card is operationally up.        |
|                   | Down<br>The card is operationally down.    |

**Output Sample for 7210 SAS-K 2F1C2T Card Detail**

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

```

=====
Card 1
=====
Slot Provisioned Type Admin Operational Comments
 Equipped Type (if different) State State

1 iom-sas up up

```

IOM Card Specific Data

```

Clock source : none
Named Pool Mode : Disabled
Available MDA slots : 2
Installed MDAs : 1

```

Hardware Data

```

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

```

```

Memory capacity : 1,024 MB
* indicates that the corresponding row element may have been truncated.

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

A sfm-sas up up/active

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

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

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

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

```

**Table 32 Output Fields: Card Detail**

| Label                    | Description                                                                                                                         |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Clock source             | Source of clock for the IOM. Note: Currently this parameter always displays 'none'                                                  |
| Available MDA slots      | The number of MDA slots available on the IOM.                                                                                       |
| Installed MDAs           | The number of MDAs installed on the IOM                                                                                             |
| Part number              | The IOM part number.                                                                                                                |
| CLEI code                | The Common Language Location Identifier (CLLI) code string for the router.                                                          |
| Serial number            | The serial number. Not user modifiable.                                                                                             |
| Manufacture date         | The chassis manufacture date. Not user modifiable.                                                                                  |
| Manufacturing string     | Factory-inputted manufacturing text string. Not user modifiable.                                                                    |
| Manufacturing deviations | Displays a record of changes by manufacturing to the hardware or software and which is outside the normal revision control process. |
| Administrative state     | Up<br>The card is administratively up.                                                                                              |
|                          | Down<br>The card is administratively down.                                                                                          |
| Operational state        | Up<br>The card is operationally up.                                                                                                 |
|                          | Down<br>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 for CPM Card**

The following outputs are examples of CPM card information, and [Table 33](#) describes the output fields.

Sample output for 7210 SAS-E:

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

=====
Card Summary
=====
Slot Provisioned Equipped Admin Operational
 Card-type Card-type State State

1 iom-sas iom-sas up up
A sfm-sas sfm-sas up up/active
=====
*A:SAS-E>bof#
```

Sample output for 7210 SAS D:

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

=====
Card Summary
=====
Slot Provisioned Equipped Admin Operational
 Card-type Card-type State State

1 iom-sas iom-sas up up
A sfm-sas sfm-sas up up/active
=====
*A:SAS-D>show#
```

**Table 33 Output Fields: CPM Card**

| Label            | Description                                             |
|------------------|---------------------------------------------------------|
| Slot             | The slot of the card in the chassis.                    |
| Card Provisioned | The SF/CPM type that is configured for the slot.        |
| Card Equipped    | The SF/CPM type that is actually populated in the slot. |
| Admin State      | Up<br>The SF/CPM is administratively up.                |
|                  | Down<br>The SF/CPM is administratively down.            |

**Table 33 Output Fields: CPM Card (Continued)**

| Label                     | Description                                                                         |
|---------------------------|-------------------------------------------------------------------------------------|
| Operational State         | Up<br>The SF/CPM is operationally up.                                               |
|                           | Down<br>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<br>The card is acting as the primary (active) CPM in a redundant system.     |
|                           | standby<br>The card is acting as the standby (secondary) CPM in a redundant system. |
| Administrative state      | Up<br>The CPM is administratively up.                                               |
|                           | Down<br>The CPM is administratively down.                                           |
| Operational state         | Up<br>The CPM is operationally up.                                                  |
|                           | Down<br>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.                                                             |

**Table 33 Output Fields: CPM Card (Continued)**

| Label                 | Description                                                                                            |
|-----------------------|--------------------------------------------------------------------------------------------------------|
| 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<br>The card is administratively up.<br>Down<br>The card is administratively down.                   |
| Operational state     | Up<br>The card is operationally up.                                                                    |
|                       | Down<br>The card is operationally down.                                                                |
| Time of last boot     | The date and time the most recent boot occurred.                                                       |
| Current alarm state   | Displays the alarm conditions for the specific board.                                                  |
| Status                | Displays the current status.                                                                           |
| Temperature           | Internal chassis temperature.                                                                          |
| Temperature threshold | The value above which the internal temperature must rise to indicate that the temperature is critical. |
| Software boot version | The version of the boot image.                                                                         |
| Memory capacity       | The total amount of memory.                                                                            |

**Output Fields for Card State**

[Table 34](#) describes the output fields.

**Table 34 Output Fields: Card State**

| Label            | Description                                           |
|------------------|-------------------------------------------------------|
| Slot/MDA         | The slot number of the card in the chassis.           |
| Provisioned Type | The card type that is configured for the slot.        |
| Equipped Type    | The card type that is actually populated in the slot. |

**Table 34 Output Fields: Card State (Continued)**

| Label             | Description                                                                |
|-------------------|----------------------------------------------------------------------------|
| Admin State       | Up<br>The card is administratively up.                                     |
|                   | Down<br>The card is administratively down.                                 |
| Operational State | Up<br>The card is operationally up.                                        |
|                   | provisioned<br>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.                     |

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* — Specifies the slot number for which to display MDA information.

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

**detail** — Displays detailed MDA information.

**Output** The following outputs are an example of MDA information, and [Table 35](#) and [Table 36](#) describe the output fields.

**Sample Output**

```
B:Dut-D# show mda 1/1 detail
=====
MDA 1/1 detail
=====
Slot Mda Provisioned Equipped Admin Operational
```

```

 Mda-type Mda-type State State

1 1 m10-1gb-sfp m10-1gb-sfp up up

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

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

```

**Sample Output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C**

```

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

=====
MDA 1/1 detail
=====
Slot Mda Provisioned Type Admin Operational
 Mda Equipped Type (if different) State State

1 1 m2-tx+2-sfp+1-combo up up

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

Hardware Data
 Platform type : N/A
 Part number :
 CLEI code :
 Serial number : SAH01-051
 Manufacture date :
 Manufacturing string : (Not Specified)
 Manufacturing deviations : (Not Specified)
 Manufacturing assembly number :

```

```

Administrative state : up
Operational state : up
Temperature : 49C
Temperature threshold : 58C
Software version : N/A
Time of last boot : 2014/01/14 05:14:03
Current alarm state : alarm cleared
Base MAC address : 00:03:fa:27:15:50
Firmware version : N/A

```

```

=====
*A:SAH01-051>show#

```

### Sample Output (for 7210 SAS-D)

```

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

```

```

=====
MDA 1/1 detail
=====

```

| Slot | Mda | Provisioned<br>Mda-type | Equipped<br>Mda-type | Admin<br>State | Operational<br>State |
|------|-----|-------------------------|----------------------|----------------|----------------------|
| 1    | 1   | m4-tx+6-sfp             | m4-tx+6-sfp          | up             | up                   |

#### MDA Specific Data

```

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

```

#### Hardware Data

```

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

```

#### QOS Settings

```

Ing. Named Pool Policy : None
Egr. Named Pool Policy : None
=====

```

```

*A:SAS-D>show#

```

**Table 35 Output Fields: MDA**

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

**Table 36 Output Fields: MDA Detail**

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

**Table 36 Output Fields: MDA Detail (Continued)**

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

## pools

- Syntax**     **pools** *mda-id* [*/port*] [**access-app** *pool-name*]  
**pools** *mda-id* [*/port*] [**network-app** *pool-name*]
- Context**     show
- Supported Platforms**     7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E
- Description**     This command displays pool information.
- Parameters**     *mda-id*[*/port*] — Displays the pool information of the specified MDA.  
**access-app** *pool-name* — Displays the pool information of the specified QoS policy.  
**Values**     access-ingress, access-egress  
**network-app** *pool-name* — Displays the pool information of the specified QoS policy.  
**Values**     network-egress
- Output**     The following outputs are examples of pool information, and [Table 37](#) describes show the output fields.

Dumping concise pool information for all ports in the MDA:

```
*A:card-1>config# show pools 1/1
=====
Type Id App. Pool Name Actual ResvCBS PoolSize
Admin ResvCBS

Port 1/1/1 Acc-Egr default 0 0
Sum
Port 1/1/1 AUp-Egr default 50 99
Sum
Port 1/1/2 Acc-Egr default 26 79
Sum
Port 1/1/2 AUp-Egr default 0 0
Sum
Port 1/1/3 Acc-Egr default 26 79
Sum
Port 1/1/3 AUp-Egr default 0 0
Sum
Port 1/1/4 Acc-Egr default 26 79
Sum
...
Sum
Port 1/1/24 AUp-Egr default 0 0
Sum
=====
*A:card-1>config#
```

### Sample Output (for 7210 SAS-D)

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

```

=====
Type Id App. Pool Name Actual ResvCBS PoolSize
Admin ResvCBS

Port 1/1/1 Acc-Egr default 68 186
Sum
Port 1/1/1 Net-Egr default 0 0
Sum
Port 1/1/2 Acc-Egr default 68 186
Sum
Port 1/1/2 Net-Egr default 0 0
Sum
Port 1/1/3 Acc-Egr default 68 186
Sum
Port 1/1/3 Net-Egr default 0 0
Sum
Port 1/1/4 Acc-Egr default 68 186
Sum
Port 1/1/4 Net-Egr default 0 0
Sum
Port 1/1/5 Acc-Egr default 68 186
Sum
Port 1/1/5 Net-Egr default 0 0
Sum
Port 1/1/6 Acc-Egr default 68 186
Sum
Port 1/1/6 Net-Egr default 0 0
Sum
Port 1/1/7 Acc-Egr default 68 186
Sum
Port 1/1/7 Net-Egr default 0 0
Sum
Port 1/1/8 Acc-Egr default 68 186
Sum
Port 1/1/8 Net-Egr default 0 0
Sum
Port 1/1/9 Acc-Egr default 68 186
Sum
Port 1/1/9 Net-Egr default 0 0
Sum
Port 1/1/10 Acc-Egr default 0 0
Sum
Port 1/1/10 Net-Egr default 68 186
Sum
=====
*A:SAS-D>show#

```

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

```

*A:card-1>config# show pools 1/1/5 access-egress
=====
Pool Information
=====
Port : 1/1/5
Application : Acc-Egr Pool Name : default

```

```

Resv CBS : Sum

Utilization State Start-Threshold

High-Slope Down 75%
Low-Slope Down 50%

Queue High Slope Drop Rate(%) Low Slope Drop Rate(%)

Queue 1 6.250000 100.000000
Queue 2 6.250000 100.000000
Queue 3 6.250000 100.000000
Queue 4 6.250000 100.000000
Queue 5 6.250000 100.000000
Queue 6 6.250000 100.000000
Queue 7 6.250000 100.000000
Queue 8 6.250000 100.000000

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

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

FC-Maps ID CBS Depth A.CIR A.PIR
 O.CIR O.PIR

be 1/1/5 3200 0 0 1000000
 0 Max
l2 1/1/5 3200 0 0 1000000
 0 Max
af 1/1/5 3200 0 0 1000000
 0 Max
l1 1/1/5 3200 0 0 1000000
 0 Max
h2 1/1/5 3200 0 0 1000000
 0 Max
ef 1/1/5 3200 0 0 1000000
 0 Max
h1 1/1/5 3200 0 0 1000000
 0 Max
nc 1/1/5 3200 0 0 1000000
 0 Max
=====
*A:card-1>config#

```

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

```

*A:SAS-D>show# pools 1/1/2 access-egress

=====
Pool Information
=====
Port : 1/1/2
Application : Acc-Egr Pool Name : default
Resv CBS : Sum

```

High Slope

```


QueueId State Start-Avg(%) Max-Avg(%) Max-Prob(%)

Queue1 Down 70 90 75
Queue2 Down 70 90 75
Queue3 Down 70 90 75
Queue4 Down 70 90 75
Queue5 Down 70 90 75
Queue6 Down 70 90 75
Queue7 Down 70 90 75
Queue8 Down 70 90 75

```

Low Slope

```


QueueId State Start-Avg(%) Max-Avg(%) Max-Prob(%)

Queue1 Down 50 75 75
Queue2 Down 50 75 75
Queue3 Down 50 75 75
Queue4 Down 50 75 75
Queue5 Down 50 75 75
Queue6 Down 50 75 75
Queue7 Down 50 75 75
Queue8 Down 50 75 75

```

Non Tcp Slope

```


QueueId State Start-Avg(%) Max-Avg(%) Max-Prob(%)

Queue1 Down 50 75 75
Queue2 Down 50 75 75
Queue3 Down 50 75 75
Queue4 Down 50 75 75
Queue5 Down 50 75 75
Queue6 Down 50 75 75
Queue7 Down 50 75 75
Queue8 Down 50 75 75

```

Time Avg Factor

```


Queue Id Time Avg Factor

Queue1 7
Queue2 7
Queue3 7
Queue4 7
Queue5 7
Queue6 7
Queue7 7
Queue8 7

```

MMU Pool Total In Use: 0 KB

MMU Pool Shared In\*: 0 KB

Pool Total : 186 KB

```
Pool Shared : 118 KB Pool Resv : 68 KB
Pool Total In Use : 0 KB
Pool Shared In Use : 0 KB Pool Resv In Use : 0 KB
```

```

```

| ID    | FC-MAPS | CBS (B) | Depth | A.CIR<br>O.CIR | A.PIR<br>O.PIR |
|-------|---------|---------|-------|----------------|----------------|
| 1/1/2 | be      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | l2      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | af      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | l1      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | h2      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | ef      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | h1      | 8698    | 0     | 0<br>0         | 1000000<br>Max |
| 1/1/2 | nc      | 8698    | 0     | 0<br>0         | 1000000<br>Max |

```

```

=====  
\* indicates that the corresponding row element may have been truncated.

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

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

Utilization State Start-Threshold

High-Slope Down 75%
Low-Slope Down 50%

Queue High Slope Drop Rate(%) Low Slope Drop Rate(%)

Queue 1 6.250000 100.000000
Queue 2 6.250000 100.000000
Queue 3 6.250000 100.000000
Queue 4 6.250000 100.000000
Queue 5 6.250000 100.000000
Queue 6 6.250000 100.000000
Queue 7 6.250000 100.000000
Queue 8 6.250000 100.000000

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

```

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

FC-Maps ID CBS Depth A.CIR A.PIR
 O.CIR O.PIR

be 1/1/1 3557 0 0 1000000
 0 Max
l2 1/1/1 3557 0 250000 1000000
 249984 Max
af 1/1/1 10671 0 250000 1000000
 249984 Max
l1 1/1/1 3557 0 250000 1000000
 249984 Max
h2 1/1/1 10671 0 1000000 1000000
 Max Max
ef 1/1/1 10671 0 1000000 1000000
 Max Max
h1 1/1/1 3557 0 100000 1000000
 100032 Max
nc 1/1/1 3557 0 100000 1000000
 100032 Max
=====
*A:card-1>config#

```

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

```

*A:SASD>config>port# show pools 1/1/9 access-uplink-egress
=====
Pool Information
=====
Port : 1/1/9
Application : Net-Egr Pool Name : default
Resv CBS : Sum

High Slope

QueueId State Start-Avg(%) Max-Avg(%) Max-Prob(%)

Queue1 Down 70 90 75
Queue2 Down 70 90 75
Queue3 Down 70 90 75
Queue4 Down 70 90 75
Queue5 Down 70 90 75
Queue6 Down 70 90 75
Queue7 Down 70 90 75
Queue8 Down 70 90 75

Low Slope

QueueId State Start-Avg(%) Max-Avg(%) Max-Prob(%)

Queue1 Down 50 75 75
Queue2 Down 50 75 75

```

|        |      |    |    |    |
|--------|------|----|----|----|
| Queue3 | Down | 50 | 75 | 75 |
| Queue4 | Down | 50 | 75 | 75 |
| Queue5 | Down | 50 | 75 | 75 |
| Queue6 | Down | 50 | 75 | 75 |
| Queue7 | Down | 50 | 75 | 75 |
| Queue8 | Down | 50 | 75 | 75 |

-----  
Non Tcp Slope  
-----

| QueueId | State | Start-Avg (%) | Max-Avg (%) | Max-Prob (%) |
|---------|-------|---------------|-------------|--------------|
| Queue1  | Down  | 50            | 75          | 75           |
| Queue2  | Down  | 50            | 75          | 75           |
| Queue3  | Down  | 50            | 75          | 75           |
| Queue4  | Down  | 50            | 75          | 75           |
| Queue5  | Down  | 50            | 75          | 75           |
| Queue6  | Down  | 50            | 75          | 75           |
| Queue7  | Down  | 50            | 75          | 75           |
| Queue8  | Down  | 50            | 75          | 75           |

-----  
Time Avg Factor  
-----

| Queue Id | Time Avg Factor |
|----------|-----------------|
| Queue1   | 7               |
| Queue2   | 7               |
| Queue3   | 7               |
| Queue4   | 7               |
| Queue5   | 7               |
| Queue6   | 7               |
| Queue7   | 7               |
| Queue8   | 7               |

MMU Pool Total In Use: 0 KB

MMU Pool Shared In\*: 0 KB

Pool Total : 186 KB  
Pool Shared : 102 KB

Pool Resv : 68 KB

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

Pool Resv In Use : 0 KB

| ID    | FC-MAPS | CBS (B) | Depth | A.CIR<br>O.CIR | A.PIR<br>O.PIR |
|-------|---------|---------|-------|----------------|----------------|
| 1/1/9 | be      | 8698    | 0     | 0              | 40000<br>Max   |
| 1/1/9 | l2      | 8698    | 0     | 0              | 40000<br>Max   |
| 1/1/9 | af      | 8698    | 0     | 0              | 40000<br>Max   |
| 1/1/9 | l1      | 8698    | 0     | 0              | 40000<br>Max   |
| 1/1/9 | h2      | 8698    | 0     | 0              | 40000<br>Max   |
| 1/1/9 | ef      | 8698    | 0     | 0              | 40000<br>Max   |

```

1/1/9 h1 8698 0 0 40000
 0
 0 Max
1/1/9 nc 8698 0 0 40000
 0
 0 Max

```

```

=====
* indicates that the corresponding row element may have been truncated.
*A:SASD>config>port#

```

**Table 37 Output Fields: Pool**

| Label                                  | Description                                                                                                                                                                                                   |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                   | Specifies the pool type.                                                                                                                                                                                      |
| ID                                     | Specifies the card/mda or card/MDA/port designation.                                                                                                                                                          |
| Application/Type                       | Specifies the nature of usage the pool would be used for. The pools could be used for access or access uplink at egress.                                                                                      |
| Pool Name                              | Specifies the name of the pool being used.                                                                                                                                                                    |
| Resv CBS                               | Specifies the percentage of pool size reserved for CBS.                                                                                                                                                       |
| Utilization                            | Specifies the type of the slope policy.                                                                                                                                                                       |
| State                                  | The administrative status of the port.                                                                                                                                                                        |
| Start-Threshold                        | Specifies the percentage of the buffer utilized after which the drop probability starts to rise above 0.                                                                                                      |
| Actual ResvCBS                         | Specifies the actual percentage of pool size reserved for CBS.                                                                                                                                                |
| Admin ResvCBS                          | Specifies the percentage of pool size reserved for CBS.                                                                                                                                                       |
| Pool Total                             | Displays the total pool size.                                                                                                                                                                                 |
| Pool Shared                            | Displays the amount of the pool which is shared.                                                                                                                                                              |
| Pool Resv                              | Specifies the percentage of reserved pool size.                                                                                                                                                               |
| Pool Total In Use                      | Displays the total amount of the pool which is in use.                                                                                                                                                        |
| Pool Shared In Use                     | Displays the amount of the shared pools that is in use.                                                                                                                                                       |
| <b>For 7210 SAS-D and 7210 SAS-Dxp</b> |                                                                                                                                                                                                               |
| 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. |

---

## 2.18.2.2.2 Port Show Commands

### port

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

**Description**    This command displays port information.

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



**Note:** The out-of-band Ethernet port is not supported on 7210 SAS-D and 7210 SAS-Dxp platforms.

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

**Values**    1 to 60 (depending on the MDA type)

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

**description** — Displays port description strings.

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

**ethernet** — Displays Ethernet port information.

**efm-oam** — Displays EFM OAM information.

**detail** — Displays detailed information about the Ethernet port.

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

**optical** — Displays optical port DDM information retrieved from the cache, which is updated periodically only for ports that are operationally up or operationally down due to loss of Rx signal.

**Output** The following outputs are examples of port information, and [Table 38](#), [Table 39](#), [Table 40](#), [Table 41](#), [Table 42](#), [Table 43](#), [Table 44](#), [Table 45](#), and [Table 46](#) describe the output fields.

### Sample Output

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

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

### Sample Output (for 7210 SAS-D)

```
*A:7210SAS>show# port 1/1/2 detail
=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet SFP
Interface : 1/1/2 Oper Speed : 1 Gbps
Link-level : Ethernet Config Speed : 1 Gbps
Admin State : up Oper Duplex : full
Oper State : up Config Duplex : full
Physical Link : Yes MTU : 1518
Single Fiber Mode : No LoopBack Mode : Internal
```

```

IfIndex : 35717120 Hold time up : 0 seconds
Last State Change : 01/01/1970 00:18:10 Hold time down : 0 seconds
Last Cleared Time : N/A DDM Events : Enabled

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

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

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

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

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

Down On Int. Error : Disabled

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

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

```

Transceiver Data

```

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

```

```

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

Value High Alarm High Warn Low Warn Low Alarm

Temperature (C) +26.8 +95.0 +90.0 -20.0 -25.0
Supply Voltage (V) 3.27 3.90 3.70 2.90 2.70

```

|                            |       |       |       |        |        |
|----------------------------|-------|-------|-------|--------|--------|
| Tx Bias Current (mA)       | 6.9   | 17.0  | 14.0  | 2.0    | 1.0    |
| Tx Output Power (dBm)      | -4.39 | -2.00 | -2.00 | -11.02 | -11.74 |
| Rx Optical Power (avg dBm) | -7.24 | 1.00  | -1.00 | -18.01 | -20.00 |

=====  
Traffic Statistics  
=====

|         | Input | Output |
|---------|-------|--------|
| -----   | ----- | -----  |
| Octets  | 0     | 0      |
| Packets | 0     | 0      |
| Errors  | 0     | 0      |

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

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

|                                  |   |
|----------------------------------|---|
| Octets :                         | 0 |
| Packets :                        | 0 |
| Packets of 64 Octets :           | 0 |
| Packets of 65 to 127 Octets :    | 0 |
| Packets of 128 to 255 Octets :   | 0 |
| Packets of 256 to 511 Octets :   | 0 |
| Packets of 512 to 1023 Octets :  | 0 |
| Packets of 1024 to 1518 Octets : | 0 |
| Packets of 1519 or more Octets : | 0 |

=====  
\* indicates that the corresponding row element may have been truncated.  
=====

=====  
Port Statistics  
=====

|                        | Input | Output |
|------------------------|-------|--------|
| -----                  | ----- | -----  |
| Unicast Packets        | 0     | 0      |
| Multicast Packets      | 0     | 0      |
| Broadcast Packets      | 0     | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     |        |

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

|                    |   |                   |   |
|--------------------|---|-------------------|---|
| Alignment Errors : | 0 | Sngl Collisions : | 0 |
| FCS Errors :       | 0 | Mult Collisions : | 0 |
| SQE Test Errors :  | 0 | Late Collisions : | 0 |
| CSE :              | 0 | Excess Collisns : | 0 |
| Too long Frames :  | 0 | Int MAC Tx Errs : | 0 |
| Symbol Errors :    | 0 | Int MAC Rx Errs : | 0 |

=====

```

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

 Packets Octets

Egress Queue 1 (be)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 2 (l2)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 3 (af)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 4 (l1)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 5 (h2)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 6 (ef)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 7 (h1)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 8 (nc)
Fwd Stats : 0 0
Drop Stats : 0 0
=====
*A:7210SAS>show#

```

Entering port ranges:

```
*A:7210SAS# show port
```

```

=====
Ports on Slot 1
=====

Port Admin Link Port Cfg Oper LAG/ Port Port Port SFP/XFP/
Id State State MTU MTU Bndl Mode Encp Type MDIMDX

1/1/1 Down No Down 1514 1514 - accs null xcme
1/1/2 Up Yes Up 1518 1518 - accs dotq xcme MDI GIGE-SX
1/1/3 Up No Down 1518 1518 - accs dotq xcme
1/1/4 Up No Down 1514 1514 - accs null xcme
1/1/5 Up Yes Up 1518 1518 - accs dotq xcme MDI GIGE-T
1/1/6 Down No Down 1514 1514 - accs null xcme
1/1/7 Down No Down 1514 1514 - accs null xcme
1/1/8 Down No Down 1514 1514 - accs null xcme
1/1/9 Up Yes Up 1522 1522 - l2up qinq xcme MDX
1/1/10 Up Yes Up 1522 1522 - l2up qinq xcme MDI
=====
*A:7210SAS#

```

**Sample Output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and  
7210 SAS-K 3SFP+ 8C**

\*A:SAH01-051&gt;show# port 1/1/3

```

=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet Combo
Interface : 1/1/3 Oper Speed : N/A
Link-level : Ethernet Config Speed : 1 Gbps
Admin State : up Oper Duplex : N/A
Oper State : down Config Duplex : full
Oper Grp : disabled Monitor Oper Grp : disabled
Physical Link : No MTU : 1514
Config Conn Type : Auto-SFP Oper Conn Type : N/A
Single Fiber Mode : No LoopBack Mode : None
IfIndex : 35749888 Hold time up : 0 seconds
Last State Change : 01/16/2014 03:19:32 Hold time down : 0 seconds
Last Cleared Time : 01/16/2014 03:12:24
Phys State Chng Cnt: 0

Configured Mode : access Encap Type : null
Dot1Q Ethertype : 0x8100 QinQ Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100 Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default Network Qos Pol : n/a
Auto-negotiate : limited MDI/MDX : unknown
Accounting Policy : None Collect-stats : Disabled
Egress Rate : Default Max Burst : Default
LACP Tunnel : Disabled DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped : Disabled Keep-alive : 10
Loop Detected : False Retry : 120
Use Broadcast Addr : False

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

Down On Int. Error : Disabled

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

Configured Address : 00:03:fa:27:15:52
Hardware Address : 00:03:fa:27:15:52

=====
Traffic Statistics
=====

Input Output

Octets 0 0
Packets 0 0
Errors 0 0
=====

```

\* indicates that the corresponding row element may have been truncated.

```

=====
Port Statistics
=====

```

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 0     | 0      |
| Multicast Packets      | 0     | 0      |
| Broadcast Packets      | 0     | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     | 0      |

```

=====

```

```

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

```

|                    |   |                   |   |
|--------------------|---|-------------------|---|
| Alignment Errors : | 0 | Sngl Collisions : | 0 |
| FCS Errors :       | 0 | Mult Collisions : | 0 |
| SQE Test Errors :  | 0 | Late Collisions : | 0 |
| CSE :              | 0 | Excess Collisns : | 0 |
| Too long Frames :  | 0 | Int MAC Tx Errs : | 0 |
| Symbol Errors :    | 0 | Int MAC Rx Errs : | 0 |

```

=====

```

```

*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show#
*A:SAH01-051>show# ^C
*A:SAH01-051>show# port 1/1/3 de
detail description
*A:SAH01-051>show# port 1/1/3 detail

```

```

=====
Ethernet Interface
=====

```

|                     |                             |                  |             |
|---------------------|-----------------------------|------------------|-------------|
| Description         | : 10/100/Gig Ethernet Combo |                  |             |
| Interface           | : 1/1/3                     | Oper Speed       | : N/A       |
| Link-level          | : Ethernet                  | Config Speed     | : 1 Gbps    |
| Admin State         | : up                        | Oper Duplex      | : N/A       |
| Oper State          | : down                      | Config Duplex    | : full      |
| Oper Grp            | : disabled                  | Monitor Oper Grp | : disabled  |
| Physical Link       | : No                        | MTU              | : 1514      |
| Config Conn Type    | : Auto-SFP                  | Oper Conn Type   | : N/A       |
| Single Fiber Mode   | : No                        | LoopBack Mode    | : None      |
| IfIndex             | : 35749888                  | Hold time up     | : 0 seconds |
| Last State Change   | : 01/16/2014 03:19:32       | Hold time down   | : 0 seconds |
| Last Cleared Time   | : 01/16/2014 03:12:24       |                  |             |
| Phys State Chng Cnt | : 0                         |                  |             |
| Configured Mode     | : access                    | Encap Type       | : null      |
| Dot1Q Ethertype     | : 0x8100                    | QinQ Ethertype   | : 0x8100    |
| PBB Ethertype       | : 0x88e7                    |                  |             |
| Ing. Pool % Rate    | : 100                       | Egr. Pool % Rate | : 100       |
| Net. Egr. Queue Pol | : default                   | Network Qos Pol  | : n/a       |
| Auto-negotiate      | : limited                   | MDI/MDX          | : unknown   |

```
Accounting Policy : None Collect-stats : Disabled
Egress Rate : Default Max Burst : Default
LACP Tunnel : Disabled DEI Classificati*: Disabled
```

```
Split Horizon Group: (Not Specified)
Down-when-looped : Disabled Keep-alive : 10
Loop Detected : False Retry : 120
Use Broadcast Addr : False
```

```
Sync. Status Msg. : Disabled Rx Quality Level : N/A
Tx DUS/DNU : Disabled Tx Quality Level : N/A
SSM Code Type : sdh
```

Down On Int. Error : Disabled

```
CRC Mon SD Thresh : Disabled CRC Mon Window : 10 seconds
CRC Mon SF Thresh : Disabled
```

```
Configured Address : 00:03:fa:27:15:52
Hardware Address : 00:03:fa:27:15:52
```

=====  
Traffic Statistics  
=====

|         | Input | Output |
|---------|-------|--------|
| Octets  | 0     | 0      |
| Packets | 0     | 0      |
| Errors  | 0     | 0      |

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

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

```
Octets : 0
Packets : 0
Packets of 64 Octets : 0
Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 0
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 0
Packets of 1024 to 1518 Octets : 0
Packets of 1519 or more Octets : 0
```

\* indicates that the corresponding row element may have been truncated.

=====  
Port Statistics  
=====

|                   | Input | Output |
|-------------------|-------|--------|
| Unicast Packets   | 0     | 0      |
| Multicast Packets | 0     | 0      |

```

Broadcast Packets 0 0
Discards 0 0
Unknown Proto Discards 0
=====
Ethernet-like Medium Statistics
=====
Alignment Errors : 0 Sngl Collisions : 0
FCS Errors : 0 Mult Collisions : 0
SQE Test Errors : 0 Late Collisions : 0
CSE : 0 Excess Collisns : 0
Too long Frames : 0 Int MAC Tx Errs : 0
Symbol Errors : 0 Int MAC Rx Errs : 0
=====
*A:SAH01-051>show#

```

**Sample Output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C**

```

*7210SAS>show# port 1/1/3 ethernet
=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet Combo
Interface : 1/1/3 Oper Speed : N/A
Link-level : Ethernet Config Speed : 1 Gbps
Admin State : down Oper Duplex : N/A
Oper State : down Config Duplex : full
Oper Grp : disabled Monitor Oper Grp : disabled
Physical Link : No MTU : 9212
Config Conn Type : Copper Oper Conn Type : N/A
Single Fiber Mode : No LoopBack Mode : None
IfIndex : 35749888 Hold time up : 0 seconds
Last State Change : 02/21/2017 08:50:53 Hold time down : 0 seconds
Last Cleared Time : N/A
Phys State Chng Cnt: 0

Configured Mode : network Encap Type : null
Dot1Q Ethertype : 0x8100 QinQ Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100 Egr. Pool % Rate : 100
Net. Egr. Queue Pol: default Network Qos Pol : 2
Auto-negotiate : true MDI/MDX : unknown
Port-clock : automatic
Accounting Policy : None Collect-stats : Disabled
Acct Plcy Eth Phys : None Collect Eth Phys : Disabled
Egress Rate : Default Max Burst : Default
LACP Tunnel : Disabled DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped : Disabled Keep-alive : 10
Loop Detected : False Retry : 120
Use Broadcast Addr : False

```

```

Sync. Status Msg. : Disabled
Tx DUS/DNU : Disabled
SSM Code Type : sdh

Rx Quality Level : N/A
Tx Quality Level : N/A

Frame Based Acc : No

Down On Int. Error : Disabled

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

EFM OAM : Disabled
EFM OAM Link Mon : Disabled

Configured Address : c4:08:4a:88:25:fd
Hardware Address : c4:08:4a:88:25:fd

```

Transceiver Data

Transceiver Status : not-equipped

=====  
\* indicates that the corresponding row element may have been truncated.

Traffic Statistics

```

=====
 Input Output

Octets 0 0
Packets 0 0
Errors 0 0

```

Port Statistics

```

=====
 Input Output

Unicast Packets 0 0
Multicast Packets 0 0
Broadcast Packets 0 0
Discards 0 0
Unknown Proto Discards 0 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#

**Table 38 Output Fields: Show General Port**

| Label       | Description                                                                                  |
|-------------|----------------------------------------------------------------------------------------------|
| Port ID     | The port ID configured or displayed in the <i>slot/mda/port</i> format.                      |
| Admin State | Up<br>The administrative state is up.                                                        |
|             | Down<br>The administrative state is down.                                                    |
| Phy Link    | Yes<br>A physical link is present.                                                           |
|             | No<br>A physical link is not present.                                                        |
| Port State  | Up<br>The port is physically present and has physical link present.                          |
|             | Down<br>The port is physically present but does not have a link.                             |
|             | Ghost<br>A port that is not physically present.                                              |
|             | None<br>The port is in its initial creation state or about to be deleted.                    |
|             | Link Up<br>A port that is physically present and has physical link present.                  |
|             | Link Down<br>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<br>The port is configured for transport network use.                                 |
|             | access<br>The port is configured for service access.                                         |

**Table 38 Output Fields: Show General Port (Continued)**

| Label       | Description                                                                                              |
|-------------|----------------------------------------------------------------------------------------------------------|
| Port Encap  | Null<br>Ingress frames will not use tags or labels to delineate a service.                               |
|             | dot1q<br>Ingress frames carry 802.1Q tags where each tag signifies a different service.                  |
| Port Type   | The type of port or optics installed.                                                                    |
| SFP/MDI MDX | GIGE<br>Indicates the GigE SFP type.                                                                     |
|             | FASTE<br>Indicates the Fast Ethernet SFP type.                                                           |
|             | MDI<br>Indicates that the Ethernet interface is of type MDI (Media Dependent Interface).                 |
|             | MDX<br>Indicates that the Ethernet interface is of type MDX (Media Dependent Interface with crossovers). |
| IP MTU      | Displays the configured IP MTU value.                                                                    |

**Sample Output**

```
*A:SN12345678# show port 1/1/15
=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet TX
Interface : 1/1/15 Oper Speed : 1 Gbps
Link-level : Ethernet Config Speed : 1 Gbps
Admin State : up Oper Duplex : full
Oper State : up Config Duplex : full
Physical Link : Yes MTU : 1522
IfIndex : 36143104 Hold time up : 0 seconds
Last State Change : 03/19/2001 21:21:07 Hold time down : 0 seconds
Last Cleared Time : N/A
IP MTU : 1000

Configured Mode : access Encap Type : QinQ
Dot1Q Ethertype : 0x8100 QinQ Ethertype : 0x8100
Net. Egr. Queue Pol: default Access Egr. Qos *: n/a
Egr. Sched. Pol : default Network Qos Pol : 1
Auto-negotiate : limited MDI/MDX : MDI
Accounting Policy : None Collect-stats : Disabled
Egress Rate : Default Ingress Rate : Default
Uplink : Yes
```

```
Down-when-looped : Disabled Keep-alive : 10
Loop Detected : False Retry : 120
Down On Int. Error : Disabled
```

```
CRC Mon SD Thresh : Enabled CRC Mon Window : 10 seconds
CRC Mon SF Thresh : Enabled
Configured Address : 00:87:98:76:65:0e
Hardware Address : 00:87:98:76:65:0e
Cfg Alarm :
Alarm Status :
```

=====  
 Traffic Statistics  
 =====

|         | Input         | Output |
|---------|---------------|--------|
| Octets  | 2229540275006 | 0      |
| Packets | 2177285416    | 0      |
| Errors  | 14            | 0      |

\* indicates that the corresponding row element may have been truncated.

=====  
 Port Statistics  
 =====

|                        | Input      | Output |
|------------------------|------------|--------|
| Unicast Packets        | 2177285416 | 0      |
| Multicast Packets      | 0          | 0      |
| Broadcast Packets      | 0          | 0      |
| Discards               | 0          | 0      |
| Unknown Proto Discards | 0          | 0      |

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

```
Alignment Errors : 0 Sngl Collisions : 0
FCS Errors : 13 Mult Collisions : 0
SQE Test Errors : 0 Late Collisions : 0
CSE : 0 Excess Collisns : 0
Too long Frames : 0 Int MAC Tx Errs : 0
Symbol Errors : 0 Int MAC Rx Errs : 0
```

```
*A:SN12345678#
*A:SN12345678# show port 1/1/15 detail
```

=====  
 Ethernet Interface  
 =====

```
Description : 10/100/Gig Ethernet TX
Interface : 1/1/15 Oper Speed : 1 Gbps
Link-level : Ethernet Config Speed : 1 Gbps
Admin State : up Oper Duplex : full
Oper State : up Config Duplex : full
Physical Link : Yes MTU : 1522
IfIndex : 36143104 Hold time up : 0 seconds
Last State Change : 03/19/2001 21:21:07 Hold time down : 0 seconds
Last Cleared Time : N/A
```

```
Configured Mode : access Encap Type : QinQ
```

```

Dot1Q Ethertype : 0x8100
Net. Egr. Queue Pol : default
Egr. Sched. Pol : default
Auto-negotiate : limited
Accounting Policy : None
Egress Rate : Default
Uplink : Yes
QinQ Ethertype : 0x8100
Access Egr. Qos * : n/a
Network Qos Pol : 1
MDI/MDX : MDI
Collect-stats : Disabled
Ingress Rate : Default

```

```

Down-when-looped : Disabled
Loop Detected : False
Down On Int. Error : Disabled
Keep-alive : 10
Retry : 120

```

```

CRC Mon SD Thresh : Enabled
CRC Mon SF Thresh : Enabled
Configured Address : 00:87:98:76:65:0e
Hardware Address : 00:87:98:76:65:0e
Cfg Alarm :
Alarm Status :

```

=====  
Traffic Statistics  
=====

|         | Input         | Output |
|---------|---------------|--------|
| Octets  | 2199575527230 | 0      |
| Packets | 2148022967    | 0      |
| Errors  | 14            | 0      |

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

```

Broadcast Pckts : 0 Drop Events : 0
Multicast Pckts : 0 CRC/Align Errors : 13
Undersize Pckts : 0 Fragments : 1
Oversize Pckts : 0 Jabbers : 0
Collisions : 0

```

```

Octets : 2199575527230
Packets : 2148022967
Packets of 64 Octets : 0
Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 1
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 12
Packets of 1024 to 1518 Octets : 2148022966
Packets of 1519 or more Octets : 0

```

\* indicates that the corresponding row element may have been truncated.

=====  
Port Statistics  
=====

|                        | Input      | Output |
|------------------------|------------|--------|
| Unicast Packets        | 2148272026 | 0      |
| Multicast Packets      | 0          | 0      |
| Broadcast Packets      | 0          | 0      |
| Discards               | 0          | 0      |
| Unknown Proto Discards | 0          | 0      |

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

```

=====
Alignment Errors : 0 Sngl Collisions : 0
FCS Errors : 13 Mult Collisions : 0
SQE Test Errors : 0 Late Collisions : 0
CSE : 0 Excess Collisns : 0
Too long Frames : 0 Int MAC Tx Errs : 0
Symbol Errors : 0 Int MAC Rx Errs : 0
=====
Meter Statistics
=====

Packets Octets

Ingress Meter 1 (Unicast)
For. InProf : 0 0
For. OutProf : 0 0
Ingress Meter 9 (Multipoint)
For. InProf : 0 0
For. OutProf : 0 0
=====
*A:SN12345678#

```

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

\*A:SAS-D>config# show port 1/1/2

```

=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet SFP
Interface : 1/1/2 Oper Speed : N/A
Link-level : Ethernet Config Speed : 1 Gbps
Admin State : down Oper Duplex : N/A
Oper State : down Config Duplex : full
Physical Link : No MTU : 1514
Single Fiber Mode : No
IfIndex : 35717120 Hold time up : 0 seconds
Last State Change : 01/01/1970 00:00:08 Hold time down : 0 seconds
Last Cleared Time : N/A DDM Events : Enabled

Configured Mode : access Encap Type : null
Dot1Q Ethertype : 0x8100 QinQ Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100 Egr. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Net. Egr. Queue Pol: default Network Qos Pol : n/a
Egr. Sched. Pol : default Access Egr. Qos *: 1
Auto-negotiate : true MDI/MDX : unknown
Port-clock : master
Accounting Policy : None Collect-stats : Disabled
Egress Rate : Default Max Burst : Default
Load-balance-algo : default LACP Tunnel : Disabled
LACP Tunnel : Disabled

Uplink : No

```

```

Split Horizon Group: (Not Specified)
Down-when-looped : Disabled Keep-alive : 10
Loop Detected : False Retry : 120
Use Broadcast Addr : False

```

```

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

```

```

CRC Mon SD Thresh : Enabled CRC Mon Window : 10 seconds
CRC Mon SF Thresh : Enabled
Configured Address : 00:3f:11:ab:ca:14
Hardware Address : 00:3f:11:ab:ca:14
Cfg Alarm :
Alarm Status :

```

```

=====
Traffic Statistics
=====
 Input Output

Octets 0 0
Packets 0 0
Errors 0 0
=====
* indicates that the corresponding row element may have been truncated.

```

```

=====
Port Statistics
=====
 Input Output

Unicast Packets 0 0
Multicast Packets 0 0
Broadcast Packets 0 0
Discards 0 0
Unknown Proto Discards 0
=====

```

```

=====
Ethernet-like Medium Statistics
=====
Alignment Errors : 0 Sngl Collisions : 0
FCS Errors : 0 Mult Collisions : 0
SQE Test Errors : 0 Late Collisions : 0
CSE : 0 Excess Collisns : 0
Too long Frames : 0 Int MAC Tx Errs : 0
Symbol Errors : 0 Int MAC Rx Errs : 0
=====

```

```

*A:ALA-A# show port 1/1/1 detail
=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet SFP
Interface : 1/1/1 Oper Speed : 0 mbps

```

```

Link-level : Ethernet Config Speed : 1 Gbps
Admin State : up Oper Duplex : N/A
Oper State : down Config Duplex : full
Reason Down : linkLossFwd
Physical Link : No MTU : 1514
IfIndex : 35684352 Hold time up : 0 seconds
Last State Change : 01/22/2010 23:54:49 Hold time down : 0 seconds
Last Cleared Time : 01/21/2010 17:40:16

Configured Mode : access Encap Type : null
Dot1Q Ethertype : 0x8100 QinQ Ethertype : 0x8100
Net. Egr. Queue Pol : default Access Egr. Qos * : 1
Egr. Sched. Pol : default Network Qos Pol : n/a
Auto-negotiate : false MDI/MDX : unknown
Accounting Policy : None Collect-stats : Disabled
Egress Rate : Default Max Burst : Default
Uplink : No

Down-when-looped : Disabled Keep-alive : 10
Loop Detected : False Retry : 120
Down On Int. Error : Disabled

CRC Mon SD Thresh : Enabled CRC Mon Window : 10 seconds
CRC Mon SF Thresh : Enabled
Configured Address : 28:06:01:01:00:01
Hardware Address : 28:06:01:01:00:01
Cfg Alarm :
Alarm Status :

```

```

=====
Traffic Statistics
=====
 Input Output

Octets 0 0
Packets 0 0
Errors 0 0

```

```

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

Broadcast Pckts : 0 Drop Events : 0
 0 Pckts : 0 CRC/Align Errors : 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.

```

```
*A:ALA-A#
```

```
*A:SAS-D>config# show port 1/1/2 detail
```

```
=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet SFP
Interface : 1/1/2
Link-level : Ethernet
Admin State : down
Oper State : down
Physical Link : No
Single Fiber Mode : No
IfIndex : 35717120
Last State Change : 01/01/1970 00:00:08
Last Cleared Time : N/A

Oper Speed : N/A
Config Speed : 1 Gbps
Oper Duplex : N/A
Config Duplex : full
MTU : 1514

Hold time up : 0 seconds
Hold time down : 0 seconds
DDM Events : Enabled

Configured Mode : access
Dot1Q Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Net. Egr. Queue Pol : default
Egr. Sched. Pol : default
Auto-negotiate : true
Accounting Policy : None
Egress Rate : Default
Load-balance-algo : default
LACP Tunnel : Disabled

Encap Type : null
QinQ Ethertype : 0x8100
Egr. Pool % Rate : 100

Network Qos Pol : n/a
Access Egr. Qos *: 1
MDI/MDX : unknown
Collect-stats : Disabled
Max Burst : Default
LACP Tunnel : Disabled

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

Keep-alive : 10
Retry : 120

Sync. Status Msg. : Disabled
Code-Type : SDH
Tx DUS/DNU : Disabled
Down On Int. Error : Disabled

Rx Quality Level : N/A
Tx Quality Level : N/A

CRC Mon SD Thresh : Enabled
CRC Mon SF Thresh : Enabled
Configured Address : 00:3f:11:ab:ca:14
Hardware Address : 00:3f:11:ab:ca:14
Cfg Alarm :
Alarm Status :
```

```
=====
Traffic Statistics
=====
```

|         | Input | Output |
|---------|-------|--------|
| Octets  | 0     | 0      |
| Packets | 0     | 0      |
| Errors  | 0     | 0      |

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

|                  |   |                    |   |
|------------------|---|--------------------|---|
| Broadcast Pkts : | 0 | Drop Events :      | 0 |
| Multicast Pkts : | 0 | CRC/Align Errors : | 0 |
| Undersize Pkts : | 0 | Fragments :        | 0 |
| Oversize Pkts :  | 0 | Jabbers :          | 0 |
| Collisions :     | 0 |                    |   |

|                                  |   |
|----------------------------------|---|
| Octets :                         | 0 |
| Packets :                        | 0 |
| Packets of 64 Octets :           | 0 |
| Packets of 65 to 127 Octets :    | 0 |
| Packets of 128 to 255 Octets :   | 0 |
| Packets of 256 to 511 Octets :   | 0 |
| Packets of 512 to 1023 Octets :  | 0 |
| Packets of 1024 to 1518 Octets : | 0 |
| Packets of 1519 or more Octets : | 0 |

\* indicates that the corresponding row element may have been truncated.

=====  
 Port Statistics  
 =====

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 0     | 0      |
| Multicast Packets      | 0     | 0      |
| Broadcast Packets      | 0     | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     |        |

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

|                    |   |                   |   |
|--------------------|---|-------------------|---|
| Alignment Errors : | 0 | Sngl Collisions : | 0 |
| FCS Errors :       | 0 | Mult Collisions : | 0 |
| SQE Test Errors :  | 0 | Late Collisions : | 0 |
| CSE :              | 0 | Excess Collisns : | 0 |
| Too long Frames :  | 0 | Int MAC Tx Errs : | 0 |
| Symbol Errors :    | 0 | Int MAC Rx Errs : | 0 |

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

|                     | Packets | Octets |
|---------------------|---------|--------|
| Egress Queue 1 (be) |         |        |
| Fwd Stats :         | 0       | 0      |
| Drop Stats :        | 0       | 0      |
| Egress Queue 2 (12) |         |        |
| Fwd Stats :         | 0       | 0      |

```

Drop Stats : 0 0
Egress Queue 3 (af)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 4 (l1)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 5 (h2)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 6 (ef)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 7 (h1)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 8 (nc)
Fwd Stats : 0 0
Drop Stats : 0 0
=====

```

### Sample Output for 7210 SAS-D Ethernet

```
*7210SAS-D># show port 1/1/3 detail
```

```
=====
Ethernet Interface
=====
```

```

Description : 10/100/Gig Ethernet SFP
Interface : 1/1/3
Link-level : Ethernet
Admin State : up
Oper State : up
Physical Link : Yes
Single Fiber Mode : No
IfIndex : 35749888
Last State Change : 01/01/1970 00:15:29
Last Cleared Time : N/A

Oper Speed : 1 Gbps
Config Speed : 1 Gbps
Oper Duplex : full
Config Duplex : full
MTU : 1514
LoopBack Mode : None
Hold time up : 0 seconds
Hold time down : 0 seconds
DDM Events : Enabled

Configured Mode : access
Dot1Q Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Net. Egr. Queue Pol: default
Egr. Sched. Pol : default
Auto-negotiate : true
Accounting Policy : None
Egress Rate : Default
LACP Tunnel : Disabled

Encap Type : null
QinQ Ethertype : 0x8100
Acc Egr Sch Mode : Fc-Based
Egr. Pool % Rate : 100

Network Qos Pol : n/a
Access Egr. Qos *: 1
MDI/MDX : MDI
Collect-stats : Disabled
Max Burst : Default

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

Keep-alive : 10
Retry : 120

```

```

Sync. Status Msg. : Enabled
Code-Type : SDH
Tx DUS/DNU : Disabled
Down On Int. Error : Disabled
Rx Quality Level : 0x2 (prc)
Tx Quality Level : 0xf (dnu)

```

```

CRC Mon SD Thresh : Enabled
CRC Mon SF Thresh : Enabled
Configured Address : 00:32:fb:04:1a:04
Hardware Address : 00:32:fb:04:1a:04
Cfg Alarm :
Alarm Status :

```

Transceiver Data

```

Transceiver Type : SFP
Model Number : 3HE00027AAAA02 ALA IPUIAELDAB
TX Laser Wavelength: 850 nm
Connector Code : LC
Manufacture date : 2010/06/02
Serial Number : PHP2JMJ
Part Number : FTRJ8519P2BNL-A6
Optical Compliance : GIGE-SX
Link Length support: 550m for 50u MMF; 300m for 62.5u MMF
Diag Capable : yes
Vendor OUI : 00:90:65
Media : Ethernet

```

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

|                            | Value | High Alarm | High Warn | Low Warn | Low Alarm |
|----------------------------|-------|------------|-----------|----------|-----------|
| Temperature (C)            | +44.9 | +95.0      | +90.0     | -20.0    | -25.0     |
| Supply Voltage (V)         | 3.30  | 3.90       | 3.70      | 2.90     | 2.70      |
| Tx Bias Current (mA)       | 6.8   | 17.0       | 14.0      | 2.0      | 1.0       |
| Tx Output Power (dBm)      | -4.71 | -2.00      | -2.00     | -11.02   | -11.74    |
| Rx Optical Power (avg dBm) | -5.18 | 1.00       | -1.00     | -18.01   | -20.00    |

=====  
 Traffic Statistics  
 =====

|         | Input | Output |
|---------|-------|--------|
| Octets  | 30976 | 30720  |
| Packets | 308   | 304    |
| Errors  | 0     | 0      |

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

```

Broadcast Pckts : 0 Drop Events : 0
Multicast Pckts : 612 CRC/Align Errors : 0
Undersize Pckts : 0 Fragments : 0
Oversize Pckts : 0 Jabbers : 0
Collisions : 0

Octets : 61696
Packets : 612
Packets of 64 Octets : 260

```

```

Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 352
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 0
Packets of 1024 to 1518 Octets : 0
Packets of 1519 or more Octets : 0

```

=====  
 \* indicates that the corresponding row element may have been truncated.

=====  
 Port Statistics  
 =====

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 0     | 0      |
| Multicast Packets      | 308   | 304    |
| Broadcast Packets      | 0     | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     |        |

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

|                    |   |                   |   |
|--------------------|---|-------------------|---|
| Alignment Errors : | 0 | Sngl Collisions : | 0 |
| FCS Errors :       | 0 | Mult Collisions : | 0 |
| SQE Test Errors :  | 0 | Late Collisions : | 0 |
| CSE :              | 0 | Excess Collisns : | 0 |
| Too long Frames :  | 0 | Int MAC Tx Errs : | 0 |
| Symbol Errors :    | 0 | Int MAC Rx Errs : | 0 |

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

|                     | Packets | Octets |
|---------------------|---------|--------|
| -----               |         |        |
| Egress Queue 1 (be) |         |        |
| Fwd Stats :         | 0       | 0      |
| Drop Stats :        | 0       | 0      |
| Egress Queue 2 (12) |         |        |
| Fwd Stats :         | 0       | 0      |
| Drop Stats :        | 0       | 0      |
| Egress Queue 3 (af) |         |        |
| Fwd Stats :         | 0       | 0      |
| Drop Stats :        | 0       | 0      |
| Egress Queue 4 (11) |         |        |
| 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 (hl)
Fwd Stats : 0 0
Drop Stats : 0 0
Egress Queue 8 (nc)
Fwd Stats : 0 0
Drop Stats : 0 0
=====
```

**Sample Output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C**

```
*A:SAH01-051>show# port
=====
Ports on Slot 1
=====
Port Admin Link Port Cfg Oper LAG/ Port Port Port C/QS/S/XFP/
Id State State MTU MTU Bndl Mode Encp Type MDIMDX

1/1/1 Up Yes Up 1514 1514 - accs null xcme MDX GIGE-T
1/1/2 Down No Down 1514 1514 - accs null xcme
1/1/3 Up No Down 1514 1514 - accs null xcme COMBO
1/1/4 Up Yes Up 1514 1514 - accs null xcme MDI
1/1/5 Up Yes Up 1514 1514 - accs null xcme MDI
=====
```

```
*A:SAH01-051>show# port 1/1/1 ethernet
=====
Ethernet Interface
=====
Description : 10/100/Gig Ethernet SFP
Interface : 1/1/1
Link-level : Ethernet
Admin State : up
Oper State : up
Oper Grp : disabled
Physical Link : Yes
Config Conn Type : SFP
Single Fiber Mode : No
IfIndex : 35684352
Last State Change : 01/16/2014 03:26:46
Last Cleared Time : N/A
Phys State Chng Cnt: 5

Oper Speed : 1 Gbps
Config Speed : 1 Gbps
Oper Duplex : full
Config Duplex : full
Monitor Oper Grp : disabled
MTU : 1514
Oper Conn Type : SFP
LoopBack Mode : None
Hold time up : 0 seconds
Hold time down : 0 seconds
DDM Events : Enabled

Configured Mode : access
Dot1Q Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100
Net. Egr. Queue Pol: default
Auto-negotiate : true
Accounting Policy : None
Egress Rate : Default
LACP Tunnel : Disabled

Encap Type : null
QinQ Ethertype : 0x8100
Egr. Pool % Rate : 100
Network Qos Pol : n/a
MDI/MDX : MDX
Collect-stats : Disabled
Max Burst : Default
DEI Classificati*: Disabled

Split Horizon Group: (Not Specified)
Down-when-looped : Disabled
Loop Detected : False
Use Broadcast Addr : False
Keep-alive : 10
Retry : 120
```

```

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

```

Down On Int. Error : Disabled

```

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

```

```

Configured Address : 00:03:fa:27:15:50
Hardware Address : 00:03:fa:27:15:50

```

Transceiver Data

```

Transceiver Type : SFP
Model Number : 3HE00062AAAA01 ALA IPUIAEHDA
TX Laser Wavelength: 0 nm
Connector Code : Unknown
Manufacture date : 2011/08/09
Serial Number : PL71FG4
Part Number : FCMJ-8521-3-A5
Optical Compliance : GIGE-T
Link Length support: 100m for copper
Diag Capable : no
Vendor OUI : 90:00:00
Media : Ethernet

```

=====  
Traffic Statistics  
=====

|         | Input      | Output   |
|---------|------------|----------|
| Octets  | 1889792832 | 38756224 |
| Packets | 29528013   | 605566   |
| Errors  | 0          | 0        |

\* indicates that the corresponding row element may have been truncated.

=====  
Port Statistics  
=====

|                        | Input    | Output |
|------------------------|----------|--------|
| Unicast Packets        | 1577678  | 605566 |
| Multicast Packets      | 0        | 0      |
| Broadcast Packets      | 27950335 | 0      |
| Discards               | 0        | 0      |
| Unknown Proto Discards | 0        | 0      |

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

|                    |   |                   |   |
|--------------------|---|-------------------|---|
| Alignment Errors : | 0 | Sngl Collisions : | 0 |
| FCS Errors :       | 0 | Mult Collisions : | 0 |
| SQE Test Errors :  | 0 | Late Collisions : | 0 |
| CSE :              | 0 | Excess Collisns : | 0 |
| Too long Frames :  | 0 | Int MAC Tx Errs : | 0 |
| Symbol Errors :    | 0 | Int MAC Rx Errs : | 0 |

\*A:SAH01-051>show#

**Table 39 Output Fields: Show Specific Port**

| Label          | Description                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description    | A text description of the port.                                                                                                                                                                                                                                                                                                           |
| Interface      | The port ID displayed in the <i>slot/mda/port</i> format.                                                                                                                                                                                                                                                                                 |
| Speed          | The speed of the interface.                                                                                                                                                                                                                                                                                                               |
| Link-level     | Ethernet<br>The port is configured as Ethernet.                                                                                                                                                                                                                                                                                           |
| MTU            | The size of the largest packet which can be sent/received on the Ethernet physical interface, specified in octets.                                                                                                                                                                                                                        |
| LoopBack Mode  | Indicates if the port is in use by loopback mac-swap application. If 'None' is displayed the port is not enabled for loopback testing. If 'Internal' is displayed, the port is in use by port loopback mac-swap application and no services can be configured on this port. This field is displayed only on the 7210 SAS-D sample output. |
| Admin State    | Up<br>The port is administratively up.                                                                                                                                                                                                                                                                                                    |
|                | Down<br>The port is administratively down.                                                                                                                                                                                                                                                                                                |
| Oper State     | Up<br>The port is operationally up.                                                                                                                                                                                                                                                                                                       |
|                | Down<br>The port is operationally down.                                                                                                                                                                                                                                                                                                   |
|                | Additionally, the <i>lag-id</i> of the LAG it belongs to in addition to the status of the LAG member (active or standby) is specified.                                                                                                                                                                                                    |
| Duplex         | Full<br>The link is set to full duplex mode.                                                                                                                                                                                                                                                                                              |
|                | Half<br>The link is set to half duplex mode.                                                                                                                                                                                                                                                                                              |
| Hold time up   | The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols.                                                                                                                                                                                |
| Hold time down | The link down dampening time in seconds. The <b>down</b> timer controls the dampening timer for link down transitions.                                                                                                                                                                                                                    |

**Table 39 Output Fields: Show Specific Port (Continued)**

| Label               | Description                                                                                |
|---------------------|--------------------------------------------------------------------------------------------|
| Physical Link       | Yes<br>A physical link is present.                                                         |
|                     | No<br>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<br>The port is configured for transport network use.                               |
|                     | access<br>The port is configured for service access.                                       |
| Dot1Q Ethertype     | Indicates the Ethertype expected when the port's encapsulation type is Dot1Q.              |
| QinQ Ethertype      | Indicates the Ethertype expected when the port's encapsulation type is QinQ.               |
| Net. Egr. Queue Pol | Specifies the network egress queue policy or that the default policy is used.              |
| Access Egr. Qos     | Specifies the access egress policy or that the default policy 1 is in use                  |
| Egr. Sched. Pol     | Specifies the port scheduler policy or that the default policy default is in use           |
| Encap Type          | Null<br>Ingress frames will not use any tags or labels to delineate a service.             |
|                     | dot1q<br>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<br>The link attempts to automatically negotiate the link speed and duplex parameters. |
|                     | False<br>The duplex and speed values are used for the link.                                |

**Table 39 Output Fields: Show Specific Port (Continued)**

| Label              | Description                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port-clock         | Displays the mode of the port-clock. The port-clock can be set either as master, slave, or it can be automatic.                                                                                                                                       |
| Alarm State        | The current alarm state of the port.                                                                                                                                                                                                                  |
| Collect Stats      | Enabled<br>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<br>The collection of accounting and statistical data for the network Ethernet port is disabled. Statistics are still accumulated by the IOM cards, however, the CPU will not obtain the results and write them to the billing file.          |
| Configured Address | The base chassis Ethernet MAC address.                                                                                                                                                                                                                |
| Hardware Address   | The interface's hardware or system assigned MAC address at its protocol sub-layer.                                                                                                                                                                    |
| Transceiver Type   | Type of the transceiver.                                                                                                                                                                                                                              |
| Model Number       | The model number of the transceiver.                                                                                                                                                                                                                  |
| Transceiver Code   | The code for the transmission media.                                                                                                                                                                                                                  |
| Laser Wavelength   | The light wavelength transmitted by the transceiver's laser.                                                                                                                                                                                          |
| Connector Code     | The vendor organizationally unique identifier field (OUI) contains the IEEE company identifier for the vendor.                                                                                                                                        |
| Diag Capable       | Indicates if the transceiver is capable of doing diagnostics.                                                                                                                                                                                         |
| Vendor OUI         | The vendor-specific identifier field (OUI) contains the IEEE company identifier for the vendor.                                                                                                                                                       |
| Manufacture date   | The manufacturing date of the hardware component in the mmddyyyy ASCII format.                                                                                                                                                                        |
| Media              | The media supported for the SFP.                                                                                                                                                                                                                      |
| Serial Number      | The vendor serial number of the hardware component.                                                                                                                                                                                                   |
| Part Number        | The vendor part number contains ASCII characters, defining the vendor part number or product name.                                                                                                                                                    |
| Input/Output       | When the collection of accounting and statistical data is enabled, the octet, packet, and error statistics are displayed.                                                                                                                             |

**Table 39 Output Fields: Show Specific Port (Continued)**

| Label                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Errors Input/Output            | <p>For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.</p> <p>For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.</p> |
| Unicast Packets Input/Output   | The number of packets, delivered by this 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 | <p>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.</p> <p>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.</p> <p>For a MAC layer protocol, this includes both Group and Functional addresses.</p>                                                                                                                                                                     |
| Discards Input/Output          | The number of inbound packets chosen to be discarded to possibly free up buffer space.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**Table 39 Output Fields: Show Specific Port (Continued)**

| Label                               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unknown Proto Discards Input/Output | For packet-oriented interfaces, the number of packets received through the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. |
| Errors                              | This field displays the number of cells discarded due to uncorrectable HEC errors. Errors do not show up in the raw cell counts.                                                                                                                                                                                                                                                                                                                                            |
| Sync. Status Msg                    | Whether synchronization status messages are enabled or disabled.                                                                                                                                                                                                                                                                                                                                                                                                            |
| Tx DUS/DNU                          | Whether the QL value is forcibly set to QL-DUS/QL-DNU.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Rx Quality Level                    | Indicates which QL value has been received from the interface.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Tx Quality Level                    | Indicates which QL value is being transmitted out of the interface.                                                                                                                                                                                                                                                                                                                                                                                                         |
| SSM Code Type                       | Indicates the SSM code type in use on the port.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Frame Based Acc                     | Indicates if frame-based-accounting is enabled or disabled on the port                                                                                                                                                                                                                                                                                                                                                                                                      |

**Table 40 Output Fields: Show Port Detail**

| Label       | Description                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| Description | A text description of the port.                                                                                    |
| Interface   | The port ID displayed in the <i>slot/mda/port</i> format.                                                          |
| Speed       | The speed of the interface.                                                                                        |
| Link-level  | Ethernet<br>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<br>The port is administratively up.                                                                             |
|             | Down<br>The port is administratively down.                                                                         |

**Table 40 Output Fields: Show Port Detail (Continued)**

| Label           | Description                                                                                                                                                |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oper State      | Up<br>The port is operationally up.                                                                                                                        |
|                 | Down<br>The port is operationally down.                                                                                                                    |
| Duplex          | Full<br>The link is set to full duplex mode.                                                                                                               |
|                 | Half<br>The link is set to half duplex mode.                                                                                                               |
| Hold time up    | The link up dampening time in seconds. The port link dampening timer value which reduces the number of link transitions reported to upper layer protocols. |
| Hold time down  | The link down dampening time in seconds. The <b>down</b> timer controls the dampening timer for link down transitions.                                     |
| IfIndex         | Displays the interface's index number which reflects its initialization sequence.                                                                          |
| Phy Link        | Yes<br>A physical link is present.                                                                                                                         |
|                 | No<br>A physical link is not present.                                                                                                                      |
| Configured Mode | network<br>The port is configured for transport network use.                                                                                               |
|                 | access<br>The port is configured for service access.                                                                                                       |
| Network Qos Pol | The QoS policy ID applied to the port.                                                                                                                     |
| Access Egr. Qos | Specifies the access egress policy or that the default policy 1 is in use.                                                                                 |
| Egr. Sched. Pol | Specifies the port scheduler policy or that the default policy default is in use.                                                                          |

**Table 40 Output Fields: Show Port Detail (Continued)**

| Label              | Description                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Encap Type         | Null<br>Ingress frames will not use any tags or labels to delineate a service.                                                                                                                                                                        |
|                    | dot1q<br>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<br>The link attempts to automatically negotiate the link speed and duplex parameters.                                                                                                                                                            |
|                    | False<br>The duplex and speed values are used for the link.                                                                                                                                                                                           |
| Alarm State        | The current alarm state of the port.                                                                                                                                                                                                                  |
| Collect Stats      | Enabled<br>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<br>Collection is disabled. Statistics are still accumulated by the IOM cards, however, the CPU will not obtain the results and write them to the billing file.                                                                               |
| Down-When-Looped   | Shows whether the feature is enabled or disabled.                                                                                                                                                                                                     |
| Down On Int. Error | Indicates if down-on-internal-error is enabled or not.                                                                                                                                                                                                |
| CRC Mon SD Thresh  | Indicates if signal-degrade threshold is configured or not.                                                                                                                                                                                           |
| CRC Mon SF Thresh  | Indicates if signal-fail threshold is configured or not.                                                                                                                                                                                              |
| CRC Mon Window     | Displays the value of window size used for CRC error monitoring when the signal-degrade or signal-fail thresholds are configured.                                                                                                                     |
| Egress Rate        | The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.                                                                                                                                            |
| Configured Address | The base chassis Ethernet MAC address.                                                                                                                                                                                                                |
| Hardware Address   | The interface's hardware or system assigned MAC address at its protocol sub-layer.                                                                                                                                                                    |

**Table 40 Output Fields: Show Port Detail (Continued)**

| Label                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Errors Input/Output            | <p>For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.</p> <p>For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors.</p> |
| Unicast Packets Input/Output   | <p>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.</p>                                                                                                                                                                                                                              |
| Multicast Packets Input/Output | <p>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.</p>                                                                                                      |
| Broadcast Packets Input/Output | <p>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.</p> <p>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.</p> <p>For a MAC layer protocol, this includes both Group and Functional addresses.</p>                                                                                                                                                                     |
| Discards Input/Output          | <p>The number of inbound packets chosen to be discarded to possibly free up buffer space.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

**Table 40 Output Fields: Show Port Detail (Continued)**

| Label                               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unknown Proto Discards Input/Output | For packet-oriented interfaces, the number of packets received through the interface which were discarded because of an unknown or unsupported protocol. For character-oriented or fixed-length interfaces that support protocol multiplexing the number of transmission units received via the interface which were discarded because of an unknown or unsupported protocol. For any interface that does not support protocol multiplexing, this counter will always be 0. |
| LLF Admin State                     | Displays the Link Loss Forwarding administrative state.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| LLF Oper State                      | Displays the Link Loss Forwarding operational state.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Rx S1 Byte                          | Displays the received S1 byte and its decoded QL value.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Tx DUS/DNU                          | Displays whether the QL value is forcibly set to QL-DUS/QL-DNU.                                                                                                                                                                                                                                                                                                                                                                                                             |
| Qinq etype                          | Displays the Ethertype used for qinq packet encapsulation.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Sync. Status Msg.                   | Enabled — If SSM is enabled.<br>Disabled — If SSM is disabled.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Code-Type                           | Displays the encoding type of SSM messages as SONET or SDH.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Rx Quality Level                    | When SSM is enabled on this port, it displays the Clock Quality level for the clock received through that interface. The Clock Quality level is typically sent by the peer in the ESMC/SSM protocol. The quality level shown depends on the quality level mode used (SONET or SDH).                                                                                                                                                                                         |
| Tx Quality Level                    | When SSM is enabled on this port, it displays the System Clock Quality level that the system advertises to the peer using the ESMC/SSM protocol. The quality level shown depends on the quality level mode used (SONET or SDH).                                                                                                                                                                                                                                             |

**Sample Output for 7210 SAS-E**

```

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

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

Octets : 0

```

```

Packets : 0
Packets of 64 Octets : 0
Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 0
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 0
Packets of 1024 to 1518 Octets : 0
Packets of 1519 or more Octets : 0

```

=====  
\* indicates that the corresponding row element may have been truncated.

=====  
Port Statistics  
=====

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 0     | 0      |
| Multicast Packets      | 0     | 0      |
| Broadcast Packets      | 0     | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     |        |

=====

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

|                  |       |                    |   |
|------------------|-------|--------------------|---|
| Broadcast Pkts : | 42621 | Drop Events :      | 0 |
| Multicast Pkts : | 0     | CRC/Align Errors : | 0 |
| Undersize Pkts : | 0     | Fragments :        | 0 |
| Oversize Pkts :  | 0     | Jabbers :          | 0 |
| Collisions :     | 0     |                    |   |

```

Octets : 2727744
Packets : 42621
Packets of 64 Octets : 42621
Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 0
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 0
Packets of 1024 to 1518 Octets : 0
Packets of 1519 or more Octets : 0

```

=====  
Port Statistics  
=====

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 0     | 0      |
| Multicast Packets      | 0     | 0      |
| Broadcast Packets      | 42621 | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     |        |

=====

...

**Table 41 Output Fields: Show Ethernet Port**

| Label            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Broadcast Pckts  | <p>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.</p> <p>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.</p> <p>For a MAC layer protocol, this includes both Group and Functional addresses.</p>                                                                |
| Multicast Pckts  | <p>The number of packets, delivered by this 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.</p> |
| Undersize Pckts  | <p>The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed.</p>                                                                                                                                                                                                                                                                                                                                                  |
| Oversize Pckts   | <p>The total number of packets received that were longer than can be accepted by the physical layer of that port (9900 octets excluding framing bits, but including FCS octets for GE ports) and were otherwise well formed.</p>                                                                                                                                                                                                                                                                                   |
| Collisions       | <p>The best estimate of the total number of collisions on this Ethernet segment.</p>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Drop Events      | <p>The total number of events in which packets were dropped by the probe 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.</p>                                                                                                                                                                                                                                                                    |
| CRC Align Errors | <p>The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).</p>                                                                                                                                                                                      |
| Fragments        | <p>The total number of packets received that were less than 64 octets (excluding framing bits but including FCS octets) and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).</p>                                                                                                                                                                                                                     |

**Table 41 Output Fields: Show Ethernet Port (Continued)**

| Label            | Description                                                                                                                                                                                                                                                                                   |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jabbers          | The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error). |
| Octets           | The total number of octets received.                                                                                                                                                                                                                                                          |
| Packets          | The total number of packets received.                                                                                                                                                                                                                                                         |
| Packets to       | The number of packets received that were equal to or less than the displayed octet limit.                                                                                                                                                                                                     |
| Config Conn Type | The type of ethernet configuration connection.                                                                                                                                                                                                                                                |

**Sample Output for 7210 SAS-E**

```

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

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

A:ALA-48# show port 1/3/1 detail
=====
...
=====
Ethernet-like Medium Statistics
=====

Alignment Errors : 0 Sngl Collisions : 0
FCS Errors : 0 Mult Collisions : 0
SQE Test Errors : 0 Late Collisions : 0
CSE : 0 Excess Collisns : 0
Too long Frames : 0 Int MAC Tx Errs : 0
Symbol Errors : 0 Int MAC Rx Errs : 0
*A:ALU-SAS#
=====
...
Meter Statistics
=====

 Packets Octets

Ingress Meter 1 (Unicast)
For. InProf : 0 0
For. OutProf : 0 0

```

```
Ingress Meter 9 (Multipoint)
For. InProf : 0 0
For. OutProf : 0 0
...
=====
*A:ALU-SAS#
```

**Table 42 Output Fields: Show Ethernet-like Medium Statistics**

| Label            | Description                                                                                                                                                                                                                                                                                          |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alignment Errors | The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets. |
| FCS Errors       | The number of frames received on a particular interface that are an integral number of octets but do not pass the FCS check.                                                                                                                                                                         |
| SQE Errors       | The number of times that the SQE TEST ERROR is received on a particular interface.                                                                                                                                                                                                                   |
| CSE              | The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame on a particular interface.                                                                                                                                                       |
| Too long Frames  | The number of frames received on a particular interface that exceed the maximum permitted frame size.                                                                                                                                                                                                |
| Symbol Errors    | For an interface operating at 100 Mb/s, the number of times there was an invalid data symbol when a valid carrier was present.                                                                                                                                                                       |
| Sngl Collisions  | The number of frames that are involved in a single collision, and are subsequently transmitted successfully.                                                                                                                                                                                         |
| Mult Collisions  | The number of frames that are involved in more than one collision and are subsequently transmitted successfully.                                                                                                                                                                                     |
| Late Collisions  | The number of times that a collision is detected on a particular interface later than one slot time into the transmission of a packet.                                                                                                                                                               |
| Excess Collisns  | The number of frames for which transmission on a particular interface fails due to excessive collisions.                                                                                                                                                                                             |
| Int MAC Tx Errs  | The number of frames for which transmission on a particular interface fails due to an internal MAC sublayer transmit error,                                                                                                                                                                          |
| Int MAC Rx Errs  | The number of frames for which reception on a particular interface fails due to an internal MAC sublayer receive error.                                                                                                                                                                              |
| Ingress Meter    | Specifies the meter ID.                                                                                                                                                                                                                                                                              |

**Table 42 Output Fields: Show Ethernet-like Medium Statistics (Continued)**

| Label        | Description                                                                                      |
|--------------|--------------------------------------------------------------------------------------------------|
| For. InProf  | The number of in-profile packets and octets (rate below CIR) forwarded by the ingress meter.     |
| For. OutProf | The number of out-of-profile packets and octets (rate below CIR) forwarded by the ingress meter. |

**Table 43 Output Fields: Show Ethernet-like Medium Statistics Detailed**

| 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.                                                                                                                                                                                                      |

**Table 43 Output Fields: Show Ethernet-like Medium Statistics Detailed**

| Label            | Description                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Int MAC Rx Errs  | The number of frames for which a reception fails due to an internal MAC sub-layer receive error.                                                                                                                                                                                                                                                                                |
| Multicast Pckts  | The number of packets, delivered by this sub-layer to a higher (sub-) layer, which were not addressed to a unicast or broadcast address at this sub-layer. The total number of packets that higher-level protocols requested be transmitted, and which were not addressed to a unicast or broadcast address at this sub-layer, including those that were discarded or not sent. |
| Undersize Pckts  | The total number of packets received that were shorter than 64 octets (excluding framing bits, but including FCS octets) but were otherwise well formed.                                                                                                                                                                                                                        |
| Oversize Pckts   | The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) but were otherwise well formed.                                                                                                                                                                                                                       |
| Collisions       | The best estimate of the total number of collisions on this Ethernet segment.                                                                                                                                                                                                                                                                                                   |
| Drop Events      | The total number of times that packets were detected as being dropped due to a lack of resources (not necessarily the total number of packets dropped).                                                                                                                                                                                                                         |
| CRC Align Errors | The total number of packets received that were between 64 and 1518 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).                                                                                 |
| Fragments        | The total number of packets received that were shorter than 64 octets (excluding framing bits but including FCS octets) that had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).                                                                                     |
| 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 43 Output Fields: Show Ethernet-like Medium Statistics Detailed**

| 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.                                                                                                                                                                                                                                                                                                                                                                                                                          |

**Sample Output**

```
A:ALA-1# show port 1/1/6 associations
=====
Interface Table
=====
Router/ServiceId Name Encap Val

Router: Base if1000 1000
Router: Base if2000 2000
```

```

Interfaces

A;ALA-1#
```

**Table 44 Output Fields: Port Associations**

| Label       | Description                                                             |
|-------------|-------------------------------------------------------------------------|
| Svc ID      | The service identifier.                                                 |
| Name        | The name of the IP interface.                                           |
| Encap Value | The dot1q or qinq encapsulation value on the port for this IP interface |

**Sample Output**

```
A:7210>show# port A/1 detail

=====
Ethernet Interface
=====
Description : 10/100 Ethernet TX
Interface : A/1
Link-level : Ethernet
Admin State : up
Oper State : up
Physical Link : Yes
Single Fiber Mode : No
IfIndex : 67141632
Last State Change : 07/09/2010 16:30:04
Last Cleared Time : N/A

Oper Speed : 10 mbps
Config Speed : 100 mbps
Oper Duplex : half
Config Duplex : full
MTU : 1514
Hold time up : 0 seconds
Hold time down : 0 seconds

Configured Mode : network
Dot1Q Ethertype : 0x8100
PBB Ethertype : 0x88e7
Ing. Pool % Rate : 100
Ing. Pool Policy : n/a
Egr. Pool Policy : n/a
Egr. Pool % Rate : 100
Net. Egr. Queue Pol :
Egr. Sched. Pol : default
Egr. Sched. Pol : default
Auto-negotiate : true
Accounting Policy : None
Egress Rate : Default

Encap Type : null
QinQ Ethertype : 0x8100
Network Qos Pol : n/a
Access Egr. Qos * : n/a
MDI/MDX : MDI
Collect-stats : Disabled
Max Burst : Default

Split Horizon Group : (Not Specified)
Down-when-looped : N/A
Loop Detected : N/A
Use Broadcast Addr : N/A

Keep-alive : N/A
Retry : N/A

Sync. Status Msg. : Disabled
Down On Int. Error : Disabled
Rx Quality Level : N/A

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

```
CRC Mon SF Thresh : Enabled
Configured Address : 00:aa:01:ab:02:02
Hardware Address : 00:aa:01:ab:02:02
Cfg Alarm :
Alarm Status :
```

```
=====
Traffic Statistics
=====
```

|         | Input   | Output |
|---------|---------|--------|
| Octets  | 5950409 | 0      |
| Packets | 4274    | 0      |
| Errors  | 0       | 0      |

```
=====
Ethernet Statistics
=====
```

```
Broadcast Pckts : 38 Drop Events : 0
Multicast Pckts : 0 CRC/Align Errors : 0
Undersize Pckts : 0 Fragments : 0
Oversize Pckts : 0 Jabbers : 0
Collisions : 0
```

```
Octets : 6102041
Packets : 4382
Packets of 64 Octets : 34
Packets of 65 to 127 Octets : 0
Packets of 128 to 255 Octets : 366
Packets of 256 to 511 Octets : 0
Packets of 512 to 1023 Octets : 0
Packets of 1024 to 1518 Octets : 3982
Packets of 1519 or more Octets : 0
```

```
* indicates that the corresponding row element may have been truncated.
```

```
=====
Port Statistics
=====
```

|                        | Input | Output |
|------------------------|-------|--------|
| Unicast Packets        | 4416  | 0      |
| Multicast Packets      | 0     | 0      |
| Broadcast Packets      | 38    | 0      |
| Discards               | 0     | 0      |
| Unknown Proto Discards | 0     | 0      |

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

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

=====

**Table 45 Output Fields: Show A1 Detailed**

| Label         | Description                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description   | A text description of the port.                                                                                                                           |
| Interface     | The port ID displayed in the slot/mda/port format.                                                                                                        |
| Oper Speed    | The operating speed of the interface.                                                                                                                     |
| Link-level    | Ethernet — the port is configured as Ethernet.                                                                                                            |
| Config Speed  | The configured speed of the interface.                                                                                                                    |
| Admin State   | up<br>The port is administratively up.                                                                                                                    |
|               | down<br>The port is administratively down.                                                                                                                |
| Oper Duplex   | The operating duplex mode of the interface.                                                                                                               |
| Oper State    | up<br>The port is operationally up.                                                                                                                       |
|               | down<br>The port is operationally down.                                                                                                                   |
| Config Duplex | full<br>The link is configured to full duplex mode.                                                                                                       |
|               | half<br>The link is configured to half duplex mode.                                                                                                       |
| Physical Link | Yes<br>A physical link is present.                                                                                                                        |
|               | No<br>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. |

**Table 45 Output Fields: Show A1 Detailed (Continued)**

| Label               | Description                                                                                                                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 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<br>The port is configured for transport.                                                                                                    |
|                     | network use access<br>The port is configured for service access.                                                                                    |
| Encap Type          | null<br>Ingress frames will not use any tags or labels to delineate a service.                                                                      |
|                     | dot1q<br>Ingress frames carry 802.1Q tags where each tag signifies a different service.                                                             |
| Dot1Q Ethertype     | The protocol carried in an Ethernet frame.                                                                                                          |
| Net.Egr. Queue Pol. | The number of the associated network egress queue QoS policy, or default if the default policy is used.                                             |
| ACFC                | Indicates whether Address and Control Field PPP Header Compression is enabled.                                                                      |
| PFC                 | Indicates whether Protocol Field PPP Header Compression is enabled.                                                                                 |
| Auto-negotiate      | true<br>The link attempts to automatically negotiate the link speed and duplex parameters.                                                          |
|                     | false<br>The duplex and speed values are used for the link.                                                                                         |
| Egress Rate         | The maximum amount of egress bandwidth (in kilobits per second) that this Ethernet interface can generate.                                          |
| Loopback            | The type of loopback configured on the port, either line, internal, or none.                                                                        |
| Loopback Time Left  | The number of seconds left in a timed loopback. If there is no loopback configured or the configured loopback is latched, the value is unspecified. |
| Configured Address  | The base chassis Ethernet MAC address.                                                                                                              |

**Table 45 Output Fields: Show A1 Detailed (Continued)**

| Label               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hardware Address    | The interface hardware or system assigned MAC address at its protocol sub-layer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Traffic Statistics  | <p>Octets input/output — Specifies the total number of octets received and transmitted on the port Packets input/output, or the number of packets, delivered by this 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.</p> <p>Errors input/output — For packet-oriented interfaces, this field specifies the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.</p> <p>For packet-oriented interfaces, this field specifies the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed length interfaces, the number of outbound transmission units that could not be transmitted because of errors.</p> |
| 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**Sample Output for dot1x detail**

```
A:7210SAS>show# port 1/1/2 dot1x detail
=====
802.1x Port Status
=====

Port control : force-auth
Port status : authorized
Authenticator PAE state : force-auth
Backend state : idle
Reauth enabled : no Reauth period : N/A
Max auth requests : 2 Transmit period : 30
Supplicant timeout : 30 Server timeout : 30
Quiet period : 60
Radius-plcy : N/A
Dot1x-Tunnel : Disabled
```

```

=====
802.1x Session Statistics
=====

authentication method : remote-radius
last session id : PAC-02210000-C28294A4
last session time : 49213d07h
last session username : N/A
last session term cause : N/A
user tx octets : 0 user tx frames : 0
user rx octets : 2648353056 user rx frames : 247852776

=====
802.1x Authentication Statistics
=====

tx frames : 0 rx frames : 0
tx req/id frames : 0 rx resp/id frames : 0
tx request frames : 0 rx response frames : 0
rx start frames : 0 rx logoff frames : 0
rx unknown frame type : 0 rx bad eap length : 0
rx last version : 0 rx last source mac :

=====
802.1x Authentication Diagnostics
=====

Enters Connecting : 0
EapLogoffs While Connecting : 0
Logoffs While Connecting : 0
Success While Authenticating : 0
Timeouts While Authenticating : 0
Failures While Authenticating : 0
Reauths While Authenticating : 0
EapStarts While Authenticating : 0
EapLogoffs While Authenticating : 0
Reauths While Authenticated : 0
EapStarts While Authenticated : 0
EapLogoffs While Authenticated : 0
Backend Responses : 0
Backend Access Challenges : 0
Backend Requests To Supplicant : 0
Backend Access Challenges : 0
Backend Non Nak Responses : 0
Backend Auth Successes : 0
Backend Auth Failures : 0

```

### Sample Output - Optical

The following output is an example of optical information, and [Table 46](#) describes the output fields.

```

A:SAS# show port 1/1/1 optical force
=====
Optical Interface
=====

```

```

Transceiver Data
Transceiver Status : operational
Transceiver Type : SFP
Model Number : 3HE04824AAAA01 ALA IPU3ANLEAA
TX Laser Wavelength: 850 nm Diag Capable : yes
Connector Code : LC Vendor OUI : 00:01:9c
Manufacture date : 2016/04/10 Media : Ethernet
Serial Number : CG15KT0TF
Part Number : PLRXPLSCS43AL1
Optical Compliance : 10GBASE-SR
Link Length support: 80m for OM2 50u MMF; 30m for OM1 62.5u MMF; 300m for OM3*
=====
Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated
=====
 Value High Alarm High Warn Low Warn Low Alarm

Temperature (C) +41.1 +80.0 +75.0 -5.0 -10.0
Supply Voltage (V) 3.30 3.70 3.63 2.97 2.85
Tx Bias Current (mA) 5.0 10.0 8.5 3.0 2.6
Tx Output Power (dBm) -2.15 -1.00 -1.30 -7.50 -8.00
Rx Optical Power (avg dBm) -26.02 1.50 1.00 -12.00! -14.00!
=====

```

**Table 46 Output Fields: Optical**

| Label                                                                  | Description                                                                                                    |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Transceiver Data                                                       |                                                                                                                |
| Transceiver Status                                                     | The status of the transceiver.                                                                                 |
| Transceiver Type                                                       | The type of the transceiver.                                                                                   |
| Model Number                                                           | The model number of the transceiver.                                                                           |
| TX Laser Wavelength                                                    | Indicates the transceiver laser wavelength.                                                                    |
| Connector Code                                                         | The vendor Organizationally Unique Identifier field (OUI) contains the IEEE company identifier for the vendor. |
| Manufacture date                                                       | The manufacturing date of the hardware component in the mmddyyyy ASCII format.                                 |
| Serial Number                                                          | The vendor serial number of the hardware component.                                                            |
| Part Number                                                            | The vendor part number contains ASCII characters, defining the vendor part number or product name.             |
| Optical Compliance                                                     | Specifies the optical compliance code of the transceiver.                                                      |
| Link Length support                                                    | Specifies the link length support for the transceiver.                                                         |
| Transceiver Digital Diagnostic Monitoring (DDM), Internally Calibrated |                                                                                                                |
| Temperature (C)                                                        | The temperature of the transceiver.                                                                            |

**Table 46 Output Fields: Optical (Continued)**

| Label                      | Description                                      |
|----------------------------|--------------------------------------------------|
| Supply Voltage (V)         | The supply voltage of the transceiver.           |
| Tx Bias Current (mA)       | The transmitted bias current of the transceiver. |
| Tx Output Power (dBm)      | The transmitted output power of the transceiver. |
| Rx Optical Power (avg dBm) | The received optical power of the transceiver.   |

## 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

**Description** This command displays Link Layer Discovery Protocol (LLDP) information.

**Parameters**

- nearest-bridge** — Displays nearest bridge information.
- nearest-non-tpmr** — Displays nearest Two-Port MAC Relay (TPMR) information.
- nearest-customer** — Displays nearest customer information.
- remote-info** — Displays remote information about the bridge MAC.
- detail** — Displays detailed information.

**Output** The following output is an example of LLDP information, and [Table 47](#) describes the output fields.

### Sample Output

```
*A:hw_sasm_duta>show# port 1/1/1 ethernet lldp

=====
Link Layer Discovery Protocol (LLDP) Port Information
=====

Port 1/1/1 Bridge nearest-bridge

Admin State : disabled Notifications : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs : None
PortID TLV Subtype : tx-local

Management Address Transmit Configuration:
```

```
Index 1 (system) : Disabled Address : 0.0.0.0
Index 2 (IPv6 system) : Disabled Address : ::
```

Port 1/1/1 Bridge nearest-non-tpmr

```

Admin State : disabled Notifications : Disabled
Transmit TLVs : None
PortID TLV Subtype : tx-local
```

Management Address Transmit Configuration:

```
Index 1 (system) : Disabled Address : 0.0.0.0
Index 2 (IPv6 system) : Disabled Address : ::
```

Port 1/1/1 Bridge nearest-customer

```

Admin State : disabled Notifications : Disabled
Transmit TLVs : None
PortID TLV Subtype : tx-local
```

Management Address Transmit Configuration:

```
Index 1 (system) : Disabled Address : 0.0.0.0
Index 2 (IPv6 system) : Disabled Address : ::
```

```
=====
*A:hw_sasm_duta>show#
```

```
*A:hw_sasm_duta>show# port 1/1/1 ethernet lldp nearest-bridge
```

```
=====
Link Layer Discovery Protocol (LLDP) Port Information
=====
```

Port 1/1/1 Bridge nearest-bridge

```

Admin State : disabled Notifications : Disabled
Tunnel Nearest Bridge : Disabled
Transmit TLVs : None
PortID TLV Subtype : tx-local
```

Management Address Transmit Configuration:

```
Index 1 (system) : Disabled Address : 0.0.0.0
Index 2 (IPv6 system) : Disabled Address : ::
```

```
=====
*A:hw_sasm_duta>show#
```

```
*A:7210-SAS# show port 1/1/3 ethernet lldp remote-info detail
```

```
=====
Link Layer Discovery Protocol (LLDP) Port Information
=====
```

Port 1/1/3 Bridge nearest-bridge Remote Peer Information

```

No remote peers found
```

Port 1/1/3 Bridge nearest-non-tpmr Remote Peer Information

```

Remote Peer Index 142 at timestamp 06/10/2010 00:23:22:
Supported Caps : bridge router
Enabled Caps : bridge router
Chassis Id Subtype : 4 (macAddress)
Chassis Id : 0a:a5:ff:00:00:00
PortId Subtype : 7 (local)
Port Id : 35749888
Port Description : 10/100/Gig Ethernet SFP
System Name : Dut-B
System Description : TiMOS-B-0.0.I927 both/i386 NOKIA SAS 7210
 Copyright (c) 2017 Nokia.
 All rights reserved. All use subject to applicable
 license agreements.
 Built on Wed Dec 1 22:23:12 IST 2010 by builder in
 /builder/0.0/panos/main

```

```

Remote Peer Index 142 management addresses at time 06/10/2010 00:23:22:
No remote management addresses found

```

Port 1/1/3 Bridge nearest-customer Remote Peer Information

```

Remote Peer Index 143 at timestamp 06/10/2010 00:23:22:
Supported Caps : bridge router
Enabled Caps : bridge router
Chassis Id Subtype : 4 (macAddress)
Chassis Id : 0a:a7:ff:00:00:00
PortId Subtype : 7 (local)
Port Id : 35782656
Port Description : 10/100 Ethernet TX
System Name : Dut-G
System Description : TiMOS-B-8.0.R5 both/i386 NOKIA SR 7750 Copyright (c)
 2017 Nokia.
 All rights reserved. All use subject to applicable
 license agreements.
 Built on Tue Sep 28 18:24:07 PDT 2010 by builder in
 /rel8.0/b1/R5/panos/main

```

```

Remote Peer Index 143 management addresses at time 06/10/2010 00:23:22:

```

**Table 47** Output Fields: Port Ethernet LLDP

| Label                 | Description                                                                          |
|-----------------------|--------------------------------------------------------------------------------------|
| Admin State           | The LLDP transmission/reception frame handling.                                      |
| Notifications         | Indicates whether LLDP notifications are enabled.                                    |
| Tunnel Nearest Bridge | n/a.                                                                                 |
| Transmit TLVs         | The optional TLVs that are transmitted by this port.                                 |
| PortID TLV Subtype    | Indicates the setting for the port ID subtype: tx-if-alias, tx-fi-name, or tx-local. |

**Table 47 Output Fields: Port Ethernet LLDP (Continued)**

| Label                                            | Description                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Management Address Transmit Configuration</b> |                                                                                                                                                                                                                                                                                                           |
| Index 1 (system)<br>Index 2 (IPv6 system)        | Details of the management address configuration. The 7705 SAR can only be configured to send or not send the system address.<br><br>Enabled: the management address TLV is included in LLDPDUs sent by the port.<br><br>Disabled: the management address TLV is not included in LLDPDUs sent by the port. |
| Address                                          | The address transmitted by the port when tx-mgmt-address command is enabled.                                                                                                                                                                                                                              |
| Supported Caps                                   | Describes the system capabilities supported by the remote peer.                                                                                                                                                                                                                                           |
| Enabled Caps                                     | Describes the system capabilities enabled on the remote peer.                                                                                                                                                                                                                                             |
| Chassis Id Subtype                               | An integer value and text definition that indicates the basis for the chassis ID entity listed in the chassis ID field.                                                                                                                                                                                   |
| Chassis Id                                       | The chassis identifier of the chassis containing the Ethernet port that sent the LLDPDU.                                                                                                                                                                                                                  |
| PortId Subtype                                   | An integer value and text definition that indicates the basis for the port ID entity listed in the port ID field.                                                                                                                                                                                         |
| Port Id                                          | The port identifier of the Ethernet port that sent the LLDPDU.                                                                                                                                                                                                                                            |
| Port Description                                 | Describes the port that sent the LLDPDU and indicates that the description is the ifDescr object text string from RFC 2863 - IF MIB.                                                                                                                                                                      |
| System Name                                      | The name of the system that sent the LLDPDU.                                                                                                                                                                                                                                                              |
| System Description                               | Describes the system that sent the LLDPDU.                                                                                                                                                                                                                                                                |

## internal-loopback-ports

|                            |                                          |
|----------------------------|------------------------------------------|
| <b>Syntax</b>              | <b>internal-loopback-ports [detail]</b>  |
| <b>Context</b>             | show>system                              |
| <b>Supported Platforms</b> | 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-E |

**Description** This command displays information about internal loopback ports.

**Parameters** **detail** — Displays application information

**Output** The following output is an example of internal loopback port information, and [Table 48](#) describes the output fields.

### Sample Output

```
*A:7210SAS>config>port# show system internal-loopback-ports detail
=====
Internal Loopback Port Status
=====
Port Loopback Application Service
Id Type

1/1/2 Physical Mac-Swap Yes
1/1/11 Virtual Mac-Swap No

=====
Mac-swap Application Status
=====
Enabled : Yes
Test Service Id : 1
Test Sap Id : 1/1/2:40
Loopback Src Addr : 00:00:01:00:02:00
Loopback Dst Addr : 00:00:01:00:03:00
=====
*A:7210SAS>config>port#
```

**Table 48** Output Fields: Show MAC Swap Application

| Label             | Description                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------|
| Port Id           | Displays the port ID.                                                                                  |
| LoopBack Type     | The Loopback type indicates whether the port is in Physical Front panel port or Internal Virtual port. |
| Application       | Application mentions the application in use of the port.                                               |
| Service enabled   | The Service enabled displays, if services can be configured over this port.                            |
| Enabled           | Displays the current status.                                                                           |
| Test Service Id   | The service ID that is used in the configuration of Mac-swap test.                                     |
| Test Sap Id       | The SAP ID that is used to configure the loopback SAP for the Mac-swap application.                    |
| Loopback Src Addr | The source MAC address that is used in the configuration of port loopback mac-swap test.               |

**Table 48 Output Fields: Show MAC Swap Application (Continued)**

| Label             | Description                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------|
| Loopback Dst Addr | The destination MAC address that is used in the configuration of port loopback mac-swap test. |

## lldp

|                            |                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>lldp</b><br><b>lldp neighbor</b>                                                                                                                                                   |
| <b>Context</b>             | show>system                                                                                                                                                                           |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                     |
| <b>Description</b>         | 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. |
| <b>Parameters</b>          | <b>neighbor</b> — Display all peer summary information                                                                                                                                |
| <b>Output</b>              | The following output is an example of system 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

**Description** This command displays Link Aggregation Group (LAG) information.  
If no command line options are specified, a summary listing of all LAGs is displayed.

**Parameters** *lag-id* — Displays only information about the specified LAG ID.

**Default** Display information for all LAG IDs.

**Values** 1 to 3 (7210 SAS-K 2F1C2T)  
1 to 5 (7210 SAS-D)  
1 to 6 (7210 SAS-Dxp, 7210 SAS-E, 7210 SAS-K 2F6C4T,  
7210 SAS-K 3SFP+ 8C)

**detail** — Displays detailed LAG information.

**Default** Displays summary information.

**statistics** — Displays LAG statistics information.

**associations** — Displays a list of current router interfaces to which the LAG is assigned.

**description** — Displays LAG description strings.

**port** — Display the LAG ports

**Output** The following outputs are examples of LAG information, and the associated tables describe the output fields.

- [Sample Output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, Table 49](#)
- [Sample Output for LAG Detail, Table 50](#)
- [Sample Output for LAG Statistics, Table 51](#)
- [Sample Output for LAG Associations, Table 52](#)
- [Sample Output Without MC LAG, Table 53](#)

**Sample Output for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C**

```
*A:SAH01-051>show# lag 1

=====
Lag Data
=====
Lag-id Adm Opr Port-Threshold Up-Link-Count MC Act/Stdby

1 down down 0 0 N/A
=====
*A:SAH01-051>show#
*A:SAH01-051>show# lag 1 de
detail description
*A:SAH01-051>show# lag 1 detail
```

```

=====
LAG Details
=====
Description : N/A

Details

Lag-id : 1 Mode : access
Adm : down Opr : down
Thres. Exceeded Cnt : 0 Port Threshold : 0
Thres. Last Cleared : 04/29/2014 20:51:33 Threshold Action : down
Dynamic Cost : false Encap Type : null
Configured Address : 00:03:fa:27:15:6a Lag-IfIndex : 1342177281
Hardware Address : 00:03:fa:27:15:6a
Hold-time Down : 0.0 sec
LACP : disabled
Uplink : No
Standby Signaling : lacp DEI Classification : Disabled

Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio

*A:SAH01-051>show#

```

**Table 49 Output Fields: LAG**

| Label          | Description                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------|
| LAG ID         | The LAG ID that the port is assigned to.                                                             |
| Adm            | Up<br>The LAG is administratively up.                                                                |
|                | Down<br>The LAG is administratively down.                                                            |
| Opr            | Up<br>The LAG is operationally up.                                                                   |
|                | Down<br>The LAG is operationally down.                                                               |
| Port-Threshold | The number of operational links for the LAG at or below which the configured action will be invoked. |
| Up-Link-Count  | The number of ports that are physically present and have physical links present.                     |
| MC Act/Stdby   | Member port is selected as active or standby link.                                                   |

**Sample Output for LAG Detail**

```
*A:Dut-B# show lag 10 detail
```

```

=====
LAG Details
=====
Description : N/A

Details

Lag-id : 10 Mode : access
Adm : up Opr : up
Thres. Exceeded Cnt : 1 Port Threshold : 0
Thres. Last Cleared : 05/17/2009 19:33:00 Threshold Action : down
Dynamic Cost : false Encap Type : qinq
Configured Address : 00:03:fa:8d:45:d2 Lag-IfIndex : 1342177290
Hardware Address : 00:03:fa:8d:45:d2 Adapt Qos : distribute
Hold-time Down : 0.0 sec Port Type : standard
Per FP Ing Queuing : disabled
LACP : enabled Mode : active
LACP Transmit Intvl : fast LACP xmit stdby : enabled
Selection Criteria : highest-count Slave-to-partner : disabled
Number of sub-groups: 1 Forced : -
System Id : 00:03:fa:8d:44:88 System Priority : 32768
Admin Key : 32777 Oper Key : 40009
Prtr System Id : 00:03:fa:13:6f:a7 Prtr System Priority : 32768
Prtr Oper Key : 32777
MC Peer Address : 10.20.1.2 MC Peer Lag-id : 10
MC System Id : 00:02:80:01:00:0a MC System Priority : 100
MC Admin Key : 40009 MC Active/Standby : active
MC Lacp ID in use : true MC extended timeout : false
MC Selection Logic : peer decided
MC Config Mismatch : no mismatch
Source BMAC LSB : use-lacp-key Oper Src BMAC LSB : 9c:49

Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio

1/1/10 up active up yes 1 - 32768

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

1/1/10 actor No No Yes Yes Yes Yes Yes Yes
1/1/10 partner No No Yes Yes Yes Yes Yes Yes
=====
*A:ALA-48>show# lag 1 detail
=====
LAG Details
=====
Description:

Details

Lag-id : 1 Mode : access
Adm : up Opr : down
Thres. Exceeded Cnt : 0 Port Threshold : 3
Thres. Last Cleared : 02/21/2007 12:39:36 Threshold Action : dynamic cost
Dynamic Cost : false Encap Type : null
Configured Address : 04:67:01:01:00:01 Lag-IfIndex : 1342177281
Hardware Address : 14:30:ff:00:01:41 Adapt Qos : distribute
Hold-time Down : 0.0 sec
LACP : enabled Mode : active
LACP Transmit Intvl : fast LACP xmit stdby : enabled

```

```

Selection Criteria : highest-count Slave-to-partner : enabled
Number of sub-groups: 0 Forced : -
System Id : 14:30:ff:00:00:00 System Priority : 1
Admin Key : 32768 Oper Key : 32666
Prtr System Id : Prtr System Priority : 0
Prtr Oper Key : 0

```

```

MC Peer Address : 10.10.10.2 MC Peer Lag-id : 1
MC System Id : 00:00:00:33:33:33 MC System Priority : 32888
MC Admin Key : 32666 MC Active/Standby : active
MC Lacp ID in use : true MC extended timeout : false
MC Selection Logic : peer timed out (no route to peer), selected local
 subgroup
MC Config Mismatch : no mismatch

```

```

Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio

=====
*A:ALA-48>show#

```

```
*A:7210-SAS>show# lag 1 detail
```

```
=====
LAG Details
=====
```

```
Description : N/A

```

```
Details

```

```

Lag-id : 1 Mode : access
Adm : up Opr : down
Thres. Exceeded Cnt : 0 Port Threshold : 1
Thres. Last Cleared : 05/31/2011 11:55:49 Threshold Action : down
Encap Type : null
Configured Address : 00:25:ba:0a:33:cc Lag-IfIndex : 1342177281
Hardware Address : 00:25:ba:0a:33:cc
Hold-time Down : 0.0 sec
LACP : disabled
Uplink : No
Split Horizon Group : (Not Specified)

```

```

Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio

=====
*A:7210-SAS>show#

```

```
*A:PE4-M2>show# lag 1 detail
```

```
=====
LAG Details
=====
```

```
Description : N/A

```

```
Details

```

```

Lag-id : 1 Mode : network
Adm : up Opr : up
Thres. Exceeded Cnt : 10 Port Threshold : 0

```

```

Thres. Last Cleared : 11/03/2016 18:38:22 Threshold Action : down
Dynamic Cost : false Encap Type : null
Configured Address : c4:08:41:61:61:bf Lag-IfIndex : 1342177281
Hardware Address : c4:08:41:61:61:bf Load Balancing : default
Hold-time Down : 0.0 sec
LACP : enabled Mode : active
LACP Transmit Intvl : fast LACP xmit stdby : enabled
Selection Criteria : highest-count Slave-to-partner : disabled
MUX control : coupled
Subgrp hold time : 0.0 sec Remaining time : 0.0 sec
Subgrp selected : 1 Subgrp candidate : -
Subgrp count : 1
System Id : c4:08:41:61:61:a3 System Priority : 32768
Admin Key : 31776 Oper Key : 31776
Prtr System Id : 4c:5f:d2:c1:5d:3a Prtr System Priority : 32768
Prtr Oper Key : 31776
Standby Signaling : lacp DEI Classification : Disabled

```

```

Port-id Adm Act/Stdby Opr Primary Sub-group Forced Prio

1/1/1 up active up yes 1 - 32768
1/1/7 up active up yes 1 - 32768

```

```

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

1/1/1 actor No No Yes Yes Yes Yes Yes Yes
1/1/1 partner No No Yes Yes Yes Yes Yes No
1/1/7 actor No No Yes Yes Yes Yes Yes Yes
1/1/7 partner No No Yes Yes Yes Yes Yes No

```

\*A:PE4-M2>show#

**Table 50 Output Fields: LAG Detail**

| Label               | Description                                                                                            |
|---------------------|--------------------------------------------------------------------------------------------------------|
| LAG ID              | The LAG or multi-link trunk (MLT) that the port is assigned to.                                        |
| Adm                 | Up<br>The LAG is administratively up.<br>Down<br>The LAG is administratively down.                     |
| Port Threshold      | If the number of available links is equal or below this number, the threshold action is executed.      |
| Thres. Last Cleared | The last time that keepalive stats were cleared.                                                       |
| Dynamic Cost        | The OSPF costing of a link aggregation group based on the available aggregated, operational bandwidth. |
| Configured Address  | The base chassis Ethernet MAC address.                                                                 |

**Table 50 Output Fields: LAG Detail (Continued)**

| Label                | Description                                                                                                                           |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Hardware Address     | The hardware address.                                                                                                                 |
| Hold-Time Down       | The timer, in tenths of seconds, which controls the delay between detecting that a LAG is down and reporting it to the higher levels. |
| LACP                 | Enabled<br>LACP is enabled.                                                                                                           |
|                      | Down<br>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.                                                                                                        |
| Opr                  | Up<br>The LAG is operationally up.                                                                                                    |
|                      | Down<br>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.                                                                                                        |

**Table 50 Output Fields: LAG Detail (Continued)**

| Label             | Description                                                               |
|-------------------|---------------------------------------------------------------------------|
| (LACP) Mode       | LACP active or passive mode.                                              |
| LACP xmit standby | LACP transmits on standby links enabled or disabled.                      |
| Slave-to-partner  | Configured enabled or disabled.                                           |
| Port-id           | Displays the member port ID.                                              |
| Adm               | Displays the member port administrative state.                            |
| Active/stdby      | Indicates that the member port is selected as the active or standby link. |
| Opr               | Indicates the member port is in the operational state.                    |
| Primary           | Indicates that the member port is the primary port of the LAG.            |
| Sub-group         | Displays the member subgroup where the member port belongs to.            |
| Priority          | Displays the member port priority.                                        |

**Sample Output for LAG Statistics**

```
ALA-1# show lag statistics
=====
LAG Statistics
=====
Description:
Lag-id Port-id Input Input Output Output Input Output
 Bytes Packets Bytes Packets Errors Errors

1 1/1/3 0 1006 0 2494 0 0
 1/1/4 0 435 0 401 0 0
 1/1/5 0 9968 0 9833 0 0

Totals 0 11409 0 12728 0 0
=====
ALA-1#
```

**Table 51 Output Fields: LAG Statistics**

| Label         | Description                                                             |
|---------------|-------------------------------------------------------------------------|
| LAG ID        | The LAG or multi-link trunk (MLT) that the port is assigned to.         |
| Port ID       | The port ID configured or displayed in the <i>slot/mda/port</i> format. |
| Input Bytes   | The number of incoming bytes for the LAG on a per-port basis.           |
| Input Packets | The number of incoming packets for the LAG on a per-port basis.         |

**Table 51 Output Fields: LAG Statistics (Continued)**

| Label               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Bytes        | The number of outbound bytes for the LAG on a per-port basis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Output Packets      | The number of outbound packets for the LAG on a per-port basis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Input/Output Errors | For packet-oriented interfaces, the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.<br><br>For packet-oriented interfaces, the number of outbound packets that could not be transmitted because of errors. For character-oriented or fixed-length interfaces, the number of outbound transmission units that could not be transmitted because of errors. |
| Totals              | Displays the column totals for bytes, packets, and errors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

**Sample Output for LAG Associations**

```
A:ALA-1# show lag 5 associations
=====
Interface Table
=====
Router/ServiceId Name Encap Val

Router: Base LAG2West 0

Interfaces
=====
A:ALA-1#
```

**Table 52 Output Fields: LAG Associations**

| Label      | Description                                  |
|------------|----------------------------------------------|
| Service ID | The service associated with the LAG.         |
| Name       | The name of the IP interface.                |
| Encap Val  | The values of the port for the IP interface. |

**Sample Output Without MC LAG**

```
*A:pc5# show lag 2 detail
=====
LAG Details
=====
```

```

Description:

Details

Lag-id : 2 Mode : access
Adm : up Opr : up
Thres. Exceeded Cnt : 4 Port Threshold : 0
Thres. Last Cleared : 04/11/2007 02:03:49 Threshold Action : down
Dynamic Cost : false Encap Type : dot1q
Configured Address : 8e:8b:ff:00:01:42 Lag-IFIndex :
1342177282
Hardware Address : 8e:8b:ff:00:01:42 Adapt Qos :
distribute
Hold-time Down : 0.0 sec
LACP : enabled Mode : active
LACP Transmit Intvl : fast LACP xmit stdby : enabled
Selection Criteria : highest-count Slave-to-partner : disabled
Number of sub-groups: 2 Forced : -
System Id : 8e:8b:ff:00:00:00 System Priority : 32768
Admin Key : 32768 Oper Key : 32768
Prtr System Id : 8e:89:ff:00:00:00 Prtr System Priority : 32768
Prtr Oper Key : 32768

Port-id Adm Act/Stdby Opr Primary Sub-group Forced
Prio

1/1/1 up active up yes 7 - 99
1/1/2 up standby down no 8 - 100

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

1/1/1 actor No No Yes Yes Yes Yes Yes Yes
1/1/1 partner No No Yes Yes Yes Yes Yes Yes
1/1/2 actor No No No No No Yes Yes Yes
1/1/2 partner No No No No Yes Yes Yes Yes
=====

```

**Table 53 Output Fields: LAG (no MC LAG)**

| Label               | Description                                         |
|---------------------|-----------------------------------------------------|
| Lag-id              | The LAG identifier                                  |
| Mode                | The mode of the LAG: access or network              |
| Adm                 | Up: the LAG is administratively up                  |
|                     | Down: the LAG is administratively down              |
| Opr                 | Up: the LAG is operationally up                     |
|                     | Down: the LAG is operationally down                 |
| Thres. Exceeded Cnt | The number of times that the drop count was reached |

**Table 53 Output Fields: LAG (no MC LAG) (Continued)**

| Label               | Description                                                                                  |
|---------------------|----------------------------------------------------------------------------------------------|
| Port Threshold      | The number of operational links at or below which the LAG is regarded as operationally down. |
| Thres. Last Cleared | The last time that keepalive statistics were cleared.                                        |
| Threshold Action    | Action to take when the number of operational links is equal to or below the port threshold. |
| Dynamic Cost        | n/a                                                                                          |
| Encap Type          | The encapsulation method used to distinguish customer traffic on a LAG.                      |
| Configured Address  | The base chassis Ethernet MAC address.                                                       |
| Lag-IfIndex         | A unique number assigned to this interface.                                                  |
| Hardware Address    | The hardware address.                                                                        |
| Adapt Qos           | The configured QoS mode.                                                                     |
| Hold-time Down      | The hold-time, in tenths of seconds, before a failure is reported to higher levels.          |
| Port Type           | Standard: standard Ethernet port types are supported.                                        |
| LACP                | Enabled<br>LACP is enabled.                                                                  |
|                     | Disabled<br>LACP is disabled.                                                                |
| Mode                | Active<br>LACP operates in active mode.                                                      |
|                     | Passive<br>LACP operates in passive mode.                                                    |
| Role                | Actor<br>Local device (7705 SAR) participating in LACP negotiation.                          |
|                     | Partner<br>Remote device participating in LACP negotiation.                                  |
| LACP Transmit Intvl | LACP timeout signaled to peer.                                                               |
| LACP xmit stdby     | LACP transmit on standby links enabled or disabled.                                          |
| Selection Criteria  | Configured subgroup selection criteria.                                                      |

**Table 53 Output Fields: LAG (no MC LAG) (Continued)**

| Label                | Description                                                           |
|----------------------|-----------------------------------------------------------------------|
| Slave-to-partner     | Slave-to-partner flag enabled or disabled.                            |
| Number of sub-groups | Total subgroups in LAG.                                               |
| Forced               | n/a                                                                   |
| System Id            | System ID used by actor in LACP messages.                             |
| System Priority      | System priority used by actor in LACP messages.                       |
| Admin Key            | Configured LAG key.                                                   |
| Oper Key             | Key used by actor in LACP messages.                                   |
| Prtr System Id       | System ID used by partner in LACP messages.                           |
| Prtr System Priority | System priority used by partner in LACP messages.                     |
| Prtr Oper Key        | The key used by partner in LACP messages.                             |
| Port-id              | The member physical port ID expressed in <i>slot/mda/port</i> format. |
| Adm                  | Up<br>The member port is administratively up.                         |
|                      | Down<br>The member port is administratively down.                     |
| Act/Stdby            | Active<br>The member port is active.                                  |
|                      | Standby<br>The member port is on standby.                             |
| Opr                  | Up<br>The member port is operationally up.                            |
|                      | Down<br>The member port is operationally down.                        |
| Primary              | Indicates whether the member port is the primary port.                |
| Sub-group            | The member port subgroup.                                             |
| Prio                 | The member port priority.                                             |

---

## redundancy

|                            |                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>redundancy</b>                                                                 |
| <b>Context</b>             | show                                                                              |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.                       |
| <b>Description</b>         | This command enables the context to display multi-chassis redundancy information. |

## multi-chassis

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>all</b><br><b>mc-lag peer</b> <i>ip-address</i> [ <b>lag</b> <i>lag-id</i> ]<br><b>mc-lag</b> [ <b>peer</b> <i>ip-address</i> [ <b>lag</b> <i>lag-id</i> ]] <b>statistics</b><br><b>sync peer</b> [ <i>ip-address</i> ]<br><b>sync peer</b> [ <i>ip-address</i> ] <b>detail</b><br><b>sync peer</b> [ <i>ip-address</i> ] <b>statistics</b>                                                                                                                                                                                       |
| <b>Context</b>             | show>redundancy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Supported Platforms</b> | Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>         | This command displays multi-chassis redundancy information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>          | <b>all</b> — Displays all multi-chassis information.<br><b>mc-lag</b> — Displays multi-chassis LAG information.<br><b>peer</b> <i>ip-address</i> — Displays the address of the multi-chassis peer.<br><b>lag</b> <i>lag-id</i> — Displays the specified LAG ID on this system that forms an multi-chassis LAG configuration with the indicated peer.<br><b>statistics</b> — Displays statistics for the multi-chassis peer.<br><b>sync</b> — Displays synchronization information.<br><b>detail</b> — Displays detailed information. |
| <b>Output</b>              | 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 sync peer 10.3.3.3

```

=====
Multi-chassis Peer Table
=====
Peer

Peer IP Address : 10.3.3.3
Description : (Not Specified)
Authentication : Enabled
Source IP Address : 10.2.2.2
Admin State : Enabled

Sync: Not-configured

```

\*A:SAS# show redundancy multi-chassis sync peer 3.3.3.3 detail

```

=====
Multi-chassis Peer Table
=====
Peer

Peer IP Address : 10.3.3.3
Description : (Not Specified)
Authentication : Enabled
Source IP Address : 10.2.2.2
Admin State : Enabled

Sync: Not-configured

```

```

=====
Ports synced on peer 10.3.3.3
=====

```

```

Port/Encap Tag

=====
DHCP Server instances synced on peer 10.3.3.3
=====
Router-Name Server-Name
Tag

No instances found
=====

```

**Table 54 Show Multi-Chassis Output Fields**

| Label   | Description                                                                                      |
|---------|--------------------------------------------------------------------------------------------------|
| Peer IP | Displays the multi-chassis redundancy peer IP address                                            |
| Src IP  | Displays the source IP address used to communicate with the multi-chassis peer                   |
| Auth    | If configured, displays the authentication key used between this node and the multi-chassis peer |

## mc-lag

**Syntax** **mac-lag peer** *ip-address* [**lag** *lag-id*]  
**mac-lag** [**peer** *ip-address* [**lag** *lag-id*]] **statistics**

**Context** show>redundancy>multi-chassis

**Supported Platforms** Supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

**Description** This command displays multi-chassis LAG information.

**Parameters** **peer** *ip-address* — Specifies the peer IP address for which to display multi-chassis LAG information.

**lag** *lag-id* — Displays information about the specified LAG ID

**statistics** — Displays LAG statistics information.

**Output** The following output is an example of multi-chassis LAG information, and [Table 55](#) describes the output fields.

### Sample Output

```

*7210-SAS>show>redundancy>multi-chassis# mc-lag peer 1.1.1.1
=====

```

```

Multi-Chassis MC-Lag Peer 1.1.1.1
=====
Last State chg : 08/13/2011 09:02:31
Admin State : Down Oper State : Down
KeepAlive : 10 deci-seconds Hold On Ngbr Failure : 3

Lag Id Lacp Remote System Id Sys Last State Changed
 Key Lag Id Prio

No LAGs found
=====
*7210-SAS>show>redundancy>multi-chassis# ^C
*A:SAS# show redundancy multi-chassis mc-lag peer 3.3.3.3 statistics
=====
Multi-Chassis Statistics, Peer 3.3.3.3
=====
Packets Rx : 8333
Packets Rx Keepalive : 8321
Packets Rx Config : 1
Packets Rx Peer Config : 2
Packets Rx State : 9
Packets Dropped State Disabled : 0
Packets Dropped Packets Too Short : 0
Packets Dropped Tlv Invalid Size : 0
Packets Dropped Tlv Invalid LagId : 0
Packets Dropped Out of Seq : 0
Packets Dropped Unknown Tlv : 0
Packets Dropped MD5 : 0
Packets Tx : 9229
Packets Tx Keepalive : 8705
Packets Tx Peer Config : 509
Packets Tx Failed : 1
=====

```

**Table 55** Output Fields: MC-LAG

| Label                | Description                                                                                                                                     |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Last State chg       | Displays date and time of the last state change for the MC-LAG peer                                                                             |
| Admin State          | Displays the administrative state of the MC-LAG peer                                                                                            |
| KeepAlive            | Displays the time interval between keepalive messages exchanged between peers                                                                   |
| Oper State           | Displays the operational state of the MC-LAG peer                                                                                               |
| Hold On Ngbr Failure | Displays how many keep alive intervals the standby will wait for packets from the active node before assuming a redundant neighbor node failure |
| Lag Id               | Displays the LAG identifier, expressed as a decimal integer                                                                                     |

**Table 55 Output Fields: MC-LAG (Continued)**

| Label                             | Description                                                                                                         |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Lacp Key                          | Displays the 16-bit Lacp key                                                                                        |
| Remote system Id                  | Displays the LAG identifier of the remote system, expressed as a decimal integer                                    |
| Multi-Chassis Statistics          |                                                                                                                     |
| Packets Rx                        | Displays the number of MC-LAG packets received from the peer                                                        |
| Packets Rx Keepalive              | Displays the number of MC-LAG keepalive packets received from the peer                                              |
| Packets Rx Config                 | Displays the number of MC-LAG configured packets received from the peer                                             |
| Packets Rx Peer Config            | Displays the number of MC-LAG packets configured by the peer                                                        |
| Packets Rx State                  | Displays the number of received MC-LAG "lag" state packets received from the peer                                   |
| Packets Dropped State Disabled    | Displays the number of packets that were dropped because the peer was administratively disabled                     |
| Packets Dropped Packets Too Short | Displays the number of packets that were dropped because the packet was too short                                   |
| Packets Dropped Tlv Invalid Size  | Displays the number of packets that were dropped because the packet size was invalid                                |
| Packets Dropped Tlv Invalid LagId | Displays the number of packets that were dropped because the packet referred to an invalid or non-multi-chassis LAG |
| Packets Dropped Out of Seq        | Displays the number of packets that were dropped because the packet was out of sequence                             |
| Packets Dropped Unknown Tlv       | Displays the number of packets that were dropped because the packet contained an unknown TLV                        |
| Packets Dropped MD5               | Displays the number of packets that were dropped because the packet failed MD5 authentication                       |
| Packets Tx                        | Displays the number of packets transmitted from this system to the peer                                             |
| Packets Tx Keepalive              | Displays the number of keepalive packets transmitted from this system to the peer                                   |
| Packets Tx Peer Config            | Displays the number of configured packets transmitted from this system to the peer                                  |

**Table 55 Output Fields: MC-LAG (Continued)**

| Label             | Description                                                                               |
|-------------------|-------------------------------------------------------------------------------------------|
| Packets Tx Failed | Displays the number of packets that failed to be transmitted from this system to the peer |

### 2.18.2.3 Port Monitor Commands

port

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

**Context** monitor

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

**Description** This command enables port traffic monitoring. The specified port statistical information displays at the configured interval until the configured count is reached.

The first screen displays the current statistics related to the specified ports. The subsequent statistical information listed for each interval is displayed as a delta to the previous display.

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

Monitor commands are similar to **show** commands but only statistical information displays. Monitor commands display the selected statistics according to the configured number of times at the interval specified.

**Parameters** *port-id* — Specifies up to five port IDs in the form *slot/mda/port*.

*interval* — Specifies the interval for each display, in seconds.

**Default** 10

**Values** 3 to 60

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

**Default** 10

**Values** 1 to 999

**absolute** — Displays raw statistics. No calculations are performed on the delta or rate statistics.

**rate** — Displays the rate-per-second for each statistic instead of the delta.

**Output**

**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#
```

## 2.18.2.4 MACsec Show Commands

### macsec

|                            |                                           |
|----------------------------|-------------------------------------------|
| <b>Syntax</b>              | <b>macsec</b>                             |
| <b>Context</b>             | show                                      |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C |
| <b>Description</b>         | This command displays MACsec information. |

### connectivity-association

|                            |                                                                                                                                  |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>connectivity-association</b> [ <i>ca-name</i> ] [ <b>detail</b> ]                                                             |
| <b>Context</b>             | show>macsec                                                                                                                      |
| <b>Supported Platforms</b> | 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C                                                                                        |
| <b>Description</b>         | This command displays MACsec specific CA information.                                                                            |
| <b>Parameters</b>          | <i>ca-name</i> — Displays CA name information, up to 256 characters.<br><b>detail</b> — Displays MACsec CA detailed information. |
| <b>Output</b>              | The following outputs are examples of CA information, and the associated tables describe the output fields:                      |

- [Sample Output: MACsec CA, Table 56](#)
- [Sample Output: MACsec CA with CA Name, Table 57](#)

#### Sample Output: MACsec CA

```
A:Dut-C# show macsec connectivity-association

ca-name : dut_B_C_128_01
ca-name : dut_B_C_256_01
ca-name : to_Juniper_1_1_2__1
```

```
ca-name : abcdefghijklmnopqrstuvwxyz@!
=====
```

**Table 56 Output Fields: MACsec Connectivity Association**

| Label   | Description            |
|---------|------------------------|
| ca-name | Specifies the CA name. |

**Sample Output: MACsec CA with CA Name**

```
A:Dut-C# show macsec connectivity-association "abcdefghijklmnopqrstuvwxyz@!"
=====
Connectivity Association "abcdefghijklmnopqrstuvwxyz@!"
=====
Admin State : Up
Description : alsfjalsfjafja;lsjflasjflasjfl
Replay Protection : Disabled
Replay Window Size : 333
Macsec Encrypt : Enabled
Clear Tag Mode : dual-tag
Cipher Suite : gcm-aes-256
Encryption Offset : 30
Assigned ports : 2/1/9 2/1/10

Static Cak

MKA Key Server Priority : 16
Active Pre-Shared-Key Index : 1
Active Pre-Shared-Key CKN : aabbccddeeff00112233445566778899
=====
```

**Table 57 Output Fields: MACsec CA with CA Name**

| Label              | Description                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Admin State        | Up — The CA is administratively up.                                                                                                                |
|                    | Down — The CA is administratively down.<br>If port <x/y/z> ethernet>macsec is shutdown, the admin state is down. Otherwise, the admin state is up. |
| Description        | Displays a user description for this CA.                                                                                                           |
| Replay Protection  | Enabled — Replay Protection is enabled.                                                                                                            |
|                    | Disabled — Replay Protection is disabled.<br>If replay protection is enabled for this CA, the out of window packet is discarded.                   |
| Replay Window Size | Displays the size, in packets, of the replay window.                                                                                               |

**Table 57 Output Fields: MACsec CA with CA Name (Continued)**

| Label                       | Description                                                                          |
|-----------------------------|--------------------------------------------------------------------------------------|
| Macsec Encrypt              | Enabled<br>MACsec is enabled.                                                        |
|                             | Disabled<br>MACsec is disabled.                                                      |
| Clear Tag Mode              | Displays the clear tag mode: single-tag, dual-tag.                                   |
| Cipher Suite                | Displays the cipher suite used for encrypting the SAK:<br>gcm-aes-128 or gcm-aes-256 |
| Encryption Offset           | Displays the encryption offset configured on this node: 0, 30, 50.                   |
| Assigned ports              | Displays all ports that contain this CA.                                             |
| MKA Key Server Priority     | Displays the MKA key server priority: 0 to 255 (default 16).                         |
| Active Pre-Shared Key Index | Displays the active pre-shared key index: 1 to 2 (default 1).                        |
| Active Pre-Shared Key CKN   | Displays the active PSK CAK name.                                                    |

## mka-session

**Syntax** **mka-session** [**port** *port-id*]  
**mka-session** [**port** *port-id*] **detail**  
**mka-session** [**port** *port-id*] **statistics**

**Context** show>macsec

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

**Description** This command displays MACsec MKA session information.

**Parameters** *port-id* — Specifies the port ID, up to 17 characters.  
**detail** — Displays MACsec MKA session detailed information.  
**statistics** — Displays MACsec MKA session statistical information.

**Output** The following outputs are examples of MACsec MKA session information, and the associated tables describe the output fields:

- [Sample Output: MACsec MKA-Session Port, Table 58](#)
- [Sample Output: MACsec MKA-Session Port \(Detail\), Table 59](#)

- [Sample Output: MACsec MKA-Session \(Statistics\), Table 59](#)

**Sample Output: MACsec MKA-Session Port**

```
A:Dut-C# show macsec mka-session port 2/1/11
=====
MKA Session for port 2/1/11
=====
Port : 2/1/11
Security Zone : 3
=====
Live Peer List
=====
Member Identifier Mesg Num Rx-SCI KS priority

bf4102704294fa1057022bdf 28322 a47b2ce112ef0000 16
=====
Potential Peer List
=====
Member Identifier Mesg Num Rx-SCI KS priority

```

**Table 58 Output Fields: MACsec MKA-Session Port**

| Label                | Description                                                                                                                                                                                                                                                                                                                           |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MKA Session for port | Displays the MKA session for the current port.                                                                                                                                                                                                                                                                                        |
| Port                 | Displays the MKA session current port.                                                                                                                                                                                                                                                                                                |
| Security Zone        | Displays security zone this port belongs to.                                                                                                                                                                                                                                                                                          |
| Live Peer List       | Displays peers (participants) that have provided their MI and MN via KMA. The peer entry is in the Live Peer List.                                                                                                                                                                                                                    |
| Member Identifier    | Displays the MI of the peer entry.                                                                                                                                                                                                                                                                                                    |
| Mesg Num             | Displays the latest Member Number of the peer entry.                                                                                                                                                                                                                                                                                  |
| Rx-SCI               | Displays the Peer Rx-SCI.                                                                                                                                                                                                                                                                                                             |
| KS-priority          | Displays the Peer Key server priority.                                                                                                                                                                                                                                                                                                |
| Potential Peer List  | Peers (participants) that have Potential Peers List includes all the other peers that have transmitted an MKPDU that has been directly received by the participant or that were included in the Live Peers List of a MKPDU transmitted by a peer that has proved liveness, an MKA PDU. The peer entry is in the Potential Peers List. |

**Sample Output: MACsec MKA-Session Port (Detail)**

```

A:Dut-C# show macsec mka-session port 2/1/11 detail
=====
MKA Session for port 2/1/11
=====
Port : 2/1/11
Security Zone : 3
MKA Oper State : unknown value
Oper Cipher Suite : unknown value
Oper Encrypt Offset : 0
CAK Name : 11223344556677889900aabbccddeeff11223344556677889900aabbcc*
MKA Member ID : f134218784b114eb61dbe834
Transmit Interval : 2000
Outbound SCI : a4:7b:2c:e1:12:8f
Message Number : 28298
Key Number : 878
Key Server : yes
Key Server Priority : 16
Latest SAK AN : 3
Latest SAK KI : f134218784b114eb61dbe8340000036d
Previous SAK AN : 2
Previous SAK KI : f134218784b114eb61dbe83400000000
=====
* indicates that the corresponding row element may have been truncated.
=====
Live Peer List
=====
Member Identifier Mesg Num Rx-SCI KS priority

bf4102704294fa1057022bdf 28323 a47b2ce112ef0000 16
=====
Potential Peer List
=====
Member Identifier Mesg Num Rx-SCI KS priority

=====
MKA Session Statistics for port 2/1/11
=====
Peer Removed Due to Timeout : 0
CKN Not Found : 0
New Live peer : 0
SAK Generated by Server : 0
SAK Installed for TX : 0
SAK Installed for RX : 0
PDU Too Small : 0
PDU Too Big : 0
PDU Not Quad Size : 0
PDU Message Number Invalid : 0
PDU Param Set Size Invalid : 0
PDU Liveness Check Fail : 0
Param Set Not Quad Size : 0
Unsupported Agility : 0
Invalid CAK Name Length : 0
ICV Check Failed : 0
Peer Using Same MID : 0
SAK From Non-Live Peer : 0
SAK From Non-Key Server : 0
SAK Decrypt Fail : 0

```

```
SAK Encrypt Fail : 0
Key Number Invalid : 0
SAK Installation Failed : 0
CAK Info Missing : 0
Max Peers Set as Zero : 0
```

**Sample Output: MACsec MKA-Session (Statistics)**

```
A:Dut-C# show macsec mka-session statistics
=====
MKA Session Statistics for port 2/1/11
=====
Peer Removed Due to Timeout : 0
CKN Not Found : 0
New Live peer : 0
SAK Generated by Server : 0
SAK Installed for TX : 0
SAK Installed for RX : 0
PDU Too Small : 0
PDU Too Big : 0
PDU Not Quad Size : 0
PDU Message Number Invalid : 0
PDU Param Set Size Invalid : 0
PDU Liveness Check Fail : 0
Param Set Not Quad Size : 0
Unsupported Agility : 0
Invalid CAK Name Length : 0
ICV Check Failed : 0
Peer Using Same MID : 0
SAK From Non-Live Peer : 0
SAK From Non-Key Server : 0
SAK Decrypt Fail : 0
SAK Encrypt Fail : 0
Key Number Invalid : 0
SAK Installation Failed : 0
CAK Info Missing : 0
Max Peers Set as Zero : 0
=====
```

**Table 59 Output Fields: MACsec MKA-Session Port (Detail and Statistics)**

| Label               | Description                                                                                                                                                                         |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MKA Oper State      | Displays the operational state of the MKA participant on this port. The operational MKA state will be up if MKA hellos are received on this port and have a valid session.          |
| Oper Cipher Suite   | Displays the operational encryption algorithm used for datapath PDUs when all parties in the CA have the SAK. This value is specified by the key server: gcm-aes-128 or gcm-aes-256 |
| Oper Encrypt Offset | Displays the operational encryption offset used for the datapath PDUs when all parties in the CA have the SAK. This value is specified by the key server: 0, 30, 50.                |

**Table 59 Output Fields: MACsec MKA-Session Port (Detail and Statistics)**

| Label                       | Description                                                                                                                                                                                |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CAK Name                    | Displays the name of the CAK in use by this MKA which is used to find the correct CAK.                                                                                                     |
| MKA Member ID               | Displays the Member Identifier (MI) for the MKA instance.                                                                                                                                  |
| Transmit Interval           | Displays the time interval (in ms) at which the MKA broadcasts its liveliness to its peers and is non-configurable.                                                                        |
| Outbound SCI                | Displays the Secure Channel Identifier (SCI) information for transmitting MACsec frames and consists of the outgoing port MAC Address and a port identifier.                               |
| Message Number              | Displays the current count of MKA messages that is attached to MKA PDUs.                                                                                                                   |
| Key Number                  | Displays the number of the currently assigned CAK. When a new CAK is generated, this number is incremented. A SAK is identified by 128-bit Key Identifier (KI) and 32-bit Key-Number (KN). |
| Key Server                  | Displays whether this server is the highest priority server in the peer group: no, yes.                                                                                                    |
| Key Server Priority         | Displays the priority of the active key server: 0-255 (default 16).                                                                                                                        |
| Latest SAK AN               | Displays the Association Number (AN) of the latest SAK. This number is concatenated with an SCI to identify a Secure Association (SA). In SR OS, only 2 SAKs are supported.                |
| Latest SAK KI               | Displays the Key Identifier (KI) of the latest SAK. This number is derived from the MI of the key server and the key number.                                                               |
| Previous SAK AN             | Displays the AN of the previous SAK. This number is concatenated with an SCI to identify an SA.                                                                                            |
| Previous SAK KI             | Displays the KI of the previous SAK. This number is derived from the MI of the key server and the key number.                                                                              |
| Peer Removed Due to Timeout | Displays the number of peers removed from the live/potential peer list due to not receiving an MKPDU within the MKA Live Time (6.0 seconds) and is not configurable.                       |
| CKN Not Found               | Displays the number of MKPDUs received with a CKN that does not match the CA configured for the port.                                                                                      |
| New Live Peer               | Displays the number of validated peers that have been added to the live peer list.                                                                                                         |
| SAK Generated by Server     | Displays the number of SAKs generated by this MKA instance.                                                                                                                                |
| SAK Installed for TX        | Displays the number of SAKs installed for transmitting.                                                                                                                                    |

**Table 59 Output Fields: MACsec MKA-Session Port (Detail and Statistics)**

| Label                      | Description                                                                                                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| SAK Installed for RX       | Displays the number of SAKs installed for receiving.                                                                                                     |
| PDU Too small              | Indicates that the number of MKPDUs received that are less than 32 octets.                                                                               |
| PDU Too big                | Indicates the number of MKPDUs received where the EAPOL header indicates a size larger than the received packet.                                         |
| PDU Not Quad Size          | Indicates the number of MKPDUs received with a size that is not a multiple of 4 octets long.                                                             |
| PDU Message Number Invalid | Indicates the number of MKPDUs received out of order as indicated by the Message Number.                                                                 |
| PDU Param Set Size Invalid | Indicates the number of MKPDUs received which contain a parameter set body length that exceeds the remaining length of the MKPDU.                        |
| PDU Liveness Check Fail    | Indicates the number of MKPDUs received which contain an MN that is not acceptably recent.                                                               |
| Param Set Not Quad Size    | Indicates the number of MKPDUs received which contain a parameter set that is not a multiple of 4 octets long.                                           |
| Unsupported Agility        | Indicates the number of MKPDUs received which contain an unsupported Algorithm Agility value.                                                            |
| Invalid CAK Name Length    | Indicates the number of MKPDUs received which contain a CAK name that exceeds the maximum CAK name length.                                               |
| ICV Check Failed           | Indicates the number of MKPDUs received which contain an ICV value that does not authenticate.                                                           |
| Peer Using Same MID        | Indicates the number of MKPDUs received which contain a peer list with an MI entry which conflicts with the local MI.                                    |
| SAK From Non-Live Peer     | Indicates the number of SAKs received from peer that is not a member of the Live Peers List.                                                             |
| SAK From Non-Key Server    | Indicates the number of SAKs received from an MKA participant that has not been designated as the Key Server. Only the key server should distribute SAK. |
| SAK Decrypt Fail           | Indicates the number of AES Key Wrap SAK decryption failures that have occurred.                                                                         |
| SAK Encrypt Fail           | Indicates the number of AES Key Wrap SAK encryption failures that have occurred.                                                                         |
| Key Number Invalid         | Indicates the number of SAKs received with an invalid Key Number.                                                                                        |

**Table 59 Output Fields: MACsec MKA-Session Port (Detail and Statistics)**

| Label                   | Description                                                                                               |
|-------------------------|-----------------------------------------------------------------------------------------------------------|
| SAK Installation Failed | Indicates the number of Secy SAK installation failures that have occurred.                                |
| CAK Info Missing        | Indicates the number of times internal CAK data is not available for the generation of the SAK.           |
| Max Peers Set as Zero   | Indicates the number of Secy SAK installations that have failed due to the max peer entry being set to 0. |

### 2.18.2.5 Clear Commands

#### lag

|                            |                                                                                                                                                                                                                                                                                                                                                 |               |                                                                                                                                |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>lag</b> <i>lag-id</i> <b>statistics</b>                                                                                                                                                                                                                                                                                                      |               |                                                                                                                                |
| <b>Context</b>             | clear                                                                                                                                                                                                                                                                                                                                           |               |                                                                                                                                |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                               |               |                                                                                                                                |
| <b>Description</b>         | This command clears statistics for the specified LAG ID.                                                                                                                                                                                                                                                                                        |               |                                                                                                                                |
| <b>Parameters</b>          | <i>lag-id</i> — Specifies the LAG ID for which to clear statistics.<br><table> <tr> <td><b>Values</b></td> <td>1 to 3 (7210 SAS-K 2F1C2T)<br/>1 to 5 (7210 SAS-D)<br/>1 to 6 (7210 SAS-Dxp, 7210 SAS-E, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C)</td> </tr> </table> <b>statistics</b> — Specifies to clear statistics for the specified LAG ID. | <b>Values</b> | 1 to 3 (7210 SAS-K 2F1C2T)<br>1 to 5 (7210 SAS-D)<br>1 to 6 (7210 SAS-Dxp, 7210 SAS-E, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C) |
| <b>Values</b>              | 1 to 3 (7210 SAS-K 2F1C2T)<br>1 to 5 (7210 SAS-D)<br>1 to 6 (7210 SAS-Dxp, 7210 SAS-E, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C)                                                                                                                                                                                                                  |               |                                                                                                                                |

#### port

|                            |                                                                   |
|----------------------------|-------------------------------------------------------------------|
| <b>Syntax</b>              | <b>port</b> <i>port-id</i> <b>statistics</b>                      |
| <b>Context</b>             | clear                                                             |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document |
| <b>Description</b>         | This command clears port statistics for the specified ports.      |
| <b>Parameters</b>          | <i>port-id</i> — Specifies the port identifier.                   |

---

**statistics** — Specifies that port statistics will be cleared.

## 2.18.2.6 Debug Commands

### lag

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <b>lag</b> [ <b>lag-id</b> <i>lag-id</i> [ <b>port</b> <i>port-id</i> ]] [ <b>all</b> ]<br><b>lag</b> [ <b>lag-id</b> <i>lag-id</i> [ <b>port</b> <i>port-id</i> ]] [ <b>sm</b> ] [ <b>pkt</b> ] [ <b>cfg</b> ] [ <b>red</b> ] [ <b>iom-upd</b> ] [ <b>port-state</b> ] [ <b>timers</b> ] [ <b>sel-logic</b> ]<br><b>no lag</b> [ <b>lag-id</b> <i>lag-id</i> ]                                                                                                                                                                                                                                                                                    |
| <b>Context</b>             | debug                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Supported Platforms</b> | Supported on all 7210 SAS platforms as described in this document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b>         | This command enables debugging for LAG.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>          | <i>lag-id</i> — Specifies the link aggregation group ID.<br><i>port-id</i> — Specifies the physical port ID.<br><i>sm</i> — Specifies to display trace LACP state machine.<br><i>pkt</i> — Specifies to display trace LACP packets.<br><i>cfg</i> — Specifies to display trace LAG configuration.<br><i>red</i> — Specifies to display trace LAG high availability.<br><i>iom-upd</i> — Specifies to display trace LAG IOM updates.<br><i>port-state</i> — Specifies to display trace LAG port state transitions.<br><i>timers</i> — Specifies to display trace LAG timers.<br><i>sel-logic</i> — Specifies to display trace LACP selection logic. |

## 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)

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## Ethernet

- IEEE 802.1AB, Station and Media Access Control Connectivity Discovery is supported on D, E, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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 Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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

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- RFC 1035, Domain Names - Implementation and Specification is supported on D, E, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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



**Note:** Only IPv4 is supported.

- 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



**Note:** Only IPv4 is supported.

- RFC 6528, Defending against Sequence Number Attacks is supported on D, E, Dxp, 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



**Note:** IGMP v1, v2, v3 is supported.

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, Dxp, 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 Rendezvous 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



**Note:** MSDP is not supported.

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



**Note:** MLD is not supported.

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



**Note:** Only IPv4 is supported.

RFC 6514, BGP Encodings and Procedures for Multicast in MPLS/IP VPNs is supported on T(N), Mxp, R6, and R12



**Note:** Only IPv4 is supported.

RFC 6515, IPv4 and IPv6 Infrastructure Addresses in BGP Updates for Multicast VPNs is supported on T(N), Mxp, R6, and R12



**Note:** Only IPv4 is supported.

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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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



**Note:** Supported only for OSPFv3 authentication; not supported for services.

- 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



**Note:** Only for use with OSPFv3 authentication; not supported for services.

- 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



**Note:** Only for use with OSPFv3 authentication; not supported for services.

## 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

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- ISO/IEC 10589:2002, Second Edition, Nov. 2002, Intermediate system to Intermediate system intra-domain routing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473) is supported on K12, K30, 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

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



**Note:** K12, K30, M(N), support only a single instance and can operate in multi-instance deployment as it supports the processing of TLVs for multi-instance support.

draft-ietf-isis-segment-routing-extensions-04, IS-IS Extensions for Segment Routing is supported on K12, K30, and Mxp

## Management

draft-ietf-snmpv3-update-mib-05, Management Information Base (MIB) for the Simple Network Management Protocol (SNMP) is supported on D, E, Dxp, 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

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- 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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

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- 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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

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- RFC 2863, The Interfaces Group MIB is supported on D, E, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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 Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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)



**Note:** Support for DS1, E1 only.

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



**Note:** P2MP LSPs only.

## **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

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- 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

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, K30, and Mxp

draft-ietf-ospf-segment-routing-extensions-04, OSPF Extensions for Segment Routing is supported on K12, K30, and Mxp

## **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 K12, K30, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp, 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, Dxp-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, Dxp-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, Dxp-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, Dxp-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, Dxp-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, Dxp-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, Dxp-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, Dxp-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, Dxp-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, Dxp, 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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