7210 Service Access System

Release 26.9.R1

7210 SAS-Mxp, R6, R12, S, Sx, T OAM and Diagnostics Guide

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1 Getting started

This chapter provides process flow information to configure service mirroring and Operations, Administration and Management (OAM) tools, and also provides an overview of the document organization, content, and terminology used in this guide.

1.1 About this guide

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

This guide describes Operations, Administration and Management (OAM) and diagnostic tools provided by the following 7210 SAS platforms, operating in one of the modes described in Table 1: Supported modes of operation and configuration methods. If multiple modes of operation apply, they are explicitly noted in the topic.

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

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

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

- **network mode of operation**

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

- **standalone mode of operation**

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

- **standalone and standalone-VC mode of operation**

  7210 SAS-Sx/S 1/10GE

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

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1.1.1 Document structure and content

This guide uses the following structure to describe routing protocols and route policies content.

Note:
This guide generically covers Release 26.*x*.R*x* content and may include some content that will be released in later maintenance loads. See the *7210 SAS Software Release Notes 26.x.Rx*, part number 3HE 27852 000*x* TQZZA, for information about features supported in each load of the Release 26.*x*.R*x* software.

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

1.2 7210 SAS modes of operation

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

Note:
Not all CLI commands are supported on all 7210 SAS platforms in all modes of operation. Users can only configure CLI commands supported by the current operating mode of the router. See the *7210 SAS Software Release Notes 26.x.Rx*, part number 3HE 27852 000*x* TQZZA, and to the appropriate 7210 SAS software user guide for information about features and capabilities supported by a 7210 SAS platform when operating in a specific mode.

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

- **access-uplink**

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

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

- **network**

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

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

- **satellite**

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

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

- **standalone**

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

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

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

- **standalone-VC**

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

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

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

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

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

The following table lists the supported modes of operation and the configuration methods for the 7210 SAS platforms.

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-K 2F1C2T		Implicit	Implicit		

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

1.3 7210 SAS port modes

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

- **access port mode**

  Access ports are configured for customer-facing traffic if Service Access Ports (SAP) 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 by configuring port mode as access-uplink. With this option, the encap-type can

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

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

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

4 Supports MPLS uplinks only and implicitly operates in network mode

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be configured to only QinQ. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access-uplink port to allow the operator to differentiate multiple services being carried over a single uplink port.

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

- **network port mode**

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

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

- **hybrid port mode**

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

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

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

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

Table 2: Supported port modes by mode of operation

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

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

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

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Table 3: 7210 SAS platforms supporting port modes

Platform	Port mode			
	Access	**Network**	**Hybrid**	**Access-uplink**
7210 SAS-D	Yes	No	No	Yes
7210 SAS-Dxp	Yes	No	No	Yes
7210 SAS-K 2F1C2T	Yes	No	No	Yes
7210 SAS-K 2F6C4T	Yes	Yes	Yes	Yes
7210 SAS-K 3SFP+ 8C	Yes	Yes	Yes	Yes
7210 SAS-Mxp	Yes	Yes	Yes	No
7210 SAS-R6 IMM-b (IMMv2)	Yes	Yes	Yes	No
7210 SAS-R6 IMM-c 100GE (IMM-c 1QSFP28)	Yes	Yes	Yes	No
7210 SAS-R12 IMM-b	Yes	Yes	Yes	No
7210 SAS-R12 IMM-c 100GE (IMM-c 1QSFP28)	Yes	Yes	Yes	No
7210 SAS-Sx/S 1/10GE	Yes	Yes	Yes	No
7210 SAS-Sx 10/100GE	Yes	Yes	Yes	No
7210 SAS-T	Yes	Yes[6]	Yes[7]	Yes[8]

1.4 Nokia 7210 SAS services configuration process

The following table lists the tasks necessary to configure mirroring, and perform tools monitoring functions. 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.

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

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

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

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Table 4: Configuration process

Area	Task	Chapter
Diagnostics/ Service verification	Mirroring	Mirror services
	OAM	OAM and SAA
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and protocol support

1.5 Conventions

This section describes the general conventions used in this guide.

1.5.1 Precautionary and information messages

The following information symbols are used in the documentation.

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

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

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

Note: Note provides additional operational information.

Tip: Tip provides suggestions for use or best practices.

1.5.2 Options or substeps in procedures and sequential workflows

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

Example: Options in a procedure

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

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

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

Example: Substeps in a procedure

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

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2 Mirror services

This chapter provides information to configure mirroring.

2.1 Service mirroring

When troubleshooting complex operational problems, customer packets can be examined as they traverse the network. Nokia's service mirroring provides the capability to mirror customer packets to allow for trouble shooting and offline analysis.

This capability also extends beyond troubleshooting services. Telephone companies have the ability to obtain itemized calling records and wire-taps where legally required by investigating authorities. The process can be very complex and costly to carry out on data networks. Service Mirroring greatly simplifies these tasks, as well as reduces costs through centralization of analysis tools and skilled technicians.

Original packets are forwarded while a copy is sent out the mirrored port to the mirroring (destination) port. Service mirroring allows an operator to see the actual traffic on a customer's service with a sniffer sitting in a central location. In many cases, this reduces the need for a separate, costly overlay sniffer network.

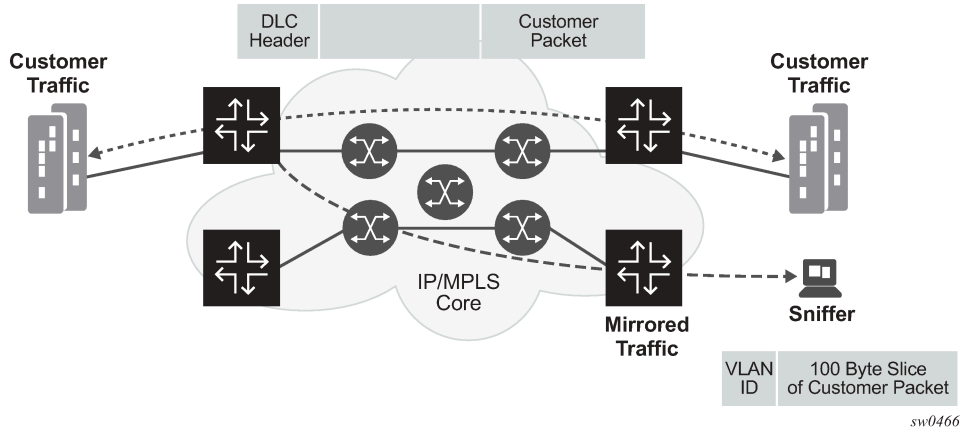
7210 SAS devices configured in access-uplink mode support only local mirroring.

When using local mirroring user has an option to use NULL SAP or a dot1q SAP or a Q1.* SAP as mirror destination. Use of Dot1q SAP or a Q1.* SAP as the mirror destination allows the mirrored traffic to share the same uplink as the service traffic (when the uplinks are L2 based).

On some 7210 SAS platforms, when using Dot1q SAP or a Q1.* SAP or MPLS SDP as the mirror destination user needs to dedicate the resources of a port for use with mirror application (see below for more details).

The following figure shows an example of service mirroring.

Figure 1: Service mirroring



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2.2 Mirror implementation

Mirroring can be configured on ingress or egress of certain service entities (For example, SAPs, ports, filter entries) and they are referred to as mirror sources. For more information, see the Mirror source and destinations.

Nokia's implementation of packet mirroring is based on the following assumptions:

- Ingress and egress packets are mirrored as they appear on the wire. This is important for troubleshooting encapsulation and protocol issues. When mirroring at ingress, an exact copy of the original ingress packet is sent to the mirror destination while normal forwarding proceeds on the original packet.
- When mirroring is at egress, the system performs normal packet handling on the egress packet, encapsulating it for the destination interface. A copy of the forwarded packet (as seen on the wire) is forwarded to the mirror destination, as follows:
  - On the 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, 7210 SAS-R6 with IMMV2, 7210 SAS-R12, the mirror copy of the packet is a copy of the forwarded copy.
  - On the 7210 SAS-T and 7210 SAS-Sx 10/100GE, the mirror copy of the packet is not a exact copy of the forwarded copy in case of port egress mirroring.
  - On the 7210 SAS, mirroring at egress takes place before the packet is processed by egress QoS. Hence, there exists a possibility that a packet is dropped by egress QoS mechanisms (because of RED mechanisms and so on) and therefore not forwarded, but it is still mirrored.
  - Remote destinations are reached by encapsulating the ingress or egress packet within an SDP, like the traffic for distributed VPN connectivity services. At the remote destination, the tunnel encapsulation is removed and the packet is forwarded out a local SAP.

2.2.1 Mirror source and destinations

Mirror sources and destinations have the following characteristics for 7210 SAS devices operating in network mode:

- Mirror source and mirror destination can be on the same node (local mirroring) or on different nodes (remote mirroring).
- Each mirror destination should terminate on a distinct port carrying only null encapsulation or a Dot1q SAP or a Q1.* SAP or a MPLS SDP in case of remote mirroring.
- Packets ingressing a port can have a mirror destination separate from packets egressing another or the same port (the ports must be on the same node).
- Multiple mirror destinations are supported (local only) on a single chassis.

Listed below are the mirror source and destination characteristics for 7210 SAS devices configured in access-uplink mode:

- Mirroring source and destination needs to be on the same node (that is, only local mirroring is supported).
- A mirror destination can terminate on only one port (NULL SAP or dot1q SAP or a Q1.* SAP).
- Packets ingressing a port can have a mirror destination separate from packets egressing another or the same port.

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The following table lists the combinations of SAPs, spoke SDPs, and remote sources allowed in a mirror service using different mirror-source-type on 7210 SAS devices configured in network mode.

Table 5: Combinations of SAPs, spoke-SDPs, and remote sources allowed in a mirror service

Mirror-source-type	Mirror sources allowed	Mirror destination allowed
Local	Port Ingress Port Egress SAP ingress ACL ingress	NULL SAP Dot1q SAP QinQ SAP Spoke-SDP
Remote	remote-source	NULL SAP Dot1q SAP QinQ SAP
Both	Port Ingress Port Egress SAP ingress ACL ingress remote-source	NULL SAP Dot1q SAP QinQ SAP

2.2.1.1 Local and remote mirroring

Note:

- Local mirroring is supported on all 7210 SAS platforms as described in this document, including those operating in access-uplink mode.
- Remote mirroring is supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.
- The 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE (standalone mode), and 7210 SAS-Sx 10/100GE (standalone mode), does not support the use of segment routing tunnels for remote mirroring.

The 7210 SAS devices allows multiple concurrent mirroring sessions so traffic from more than one ingress mirror source can be mirrored to the same or different mirror destinations. For more information, see the Configuration notes.

Remote mirroring uses a service distribution path (SDP) which acts as a logical way of directing traffic from one router to another through a unidirectional (one-way) service tunnel. The SDP terminates at the far-end router which directs packets to the correct destination on that device.

The SDP configuration from the mirrored device to a far-end router requires a return path SDP from the far-end router back to the mirrored router. Each device must have an SDP defined for every remote router to which it provides mirroring services. SDPs must be created first, before services can be configured.

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2.2.2 Mirroring performance

Replication of mirrored packets can, typically, affect performance and should be used carefully.

The following tables list the mirroring that can be performed based on the following criteria (that is, mirror sources).

Table 6: Mirroring support for 7210 SAS-T access-uplink mode

Mirroring	7210 SAS-T
Port (ingress and egress)	✓
SAP (ingress only)	✓
MAC filter (ingress only)	✓
IP filter (ingress only)	✓

Table 7: Mirroring support for 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-T, 7210 SAS-Mxp, and 7210 SAS-R6 and 7210 SAS-R12

Platforms	Port (ingress and egress)	SAP (ingress only)	MAC filter (ingress only)	IP filter (ingress only)
7210 SAS-T	✓	✓	✓	✓
7210 SAS-Mxp	✓	✓	✓	✓
7210 SAS-Sx/S 1/10GE	✓	✓	✓	✓
7210 SAS-Sx 10/100GE	✓	✓	✓	✓
7210 SAS-R6	✓	✓	✓	✓

2.2.3 Mirroring configuration

Configuring mirroring is similar to creating a unidirection service. Mirroring requires the configuration of:

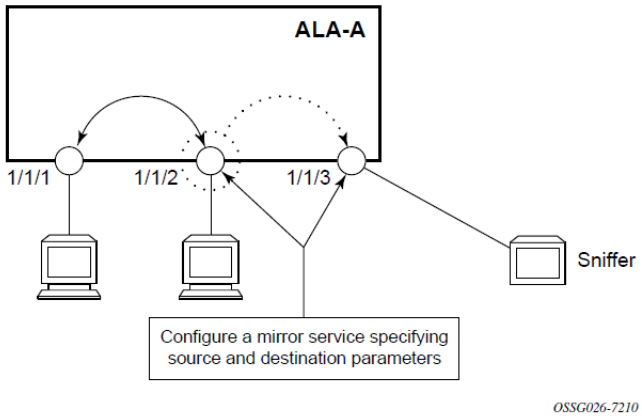
- mirror source - the traffic on specific points to mirror
- mirror destination - the location to send the mirrored traffic, where the sniffer will be located

The following figure shows a local mirror service configured on ALA-A:

- Port 1/1/2 is specified as the source. Mirrored traffic ingressing and egressing this port will be sent to port 1/1/3.
- SAP 1/1/3 is specified as the destination. The sniffer is physically connected to this port. Mirrored traffic ingressing and egressing port 1/1/2 is sent here. SAP, encapsulation requirements, and mirror classification parameters are configured.

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Figure 2: Local mirroring example



The following figure shows a remote mirror service configured as ALA B as the mirror source and ALA A as the mirror destination. Mirrored traffic ingressing and egressing port 5/2/1 (the source) on ALA B is handled the following ways:

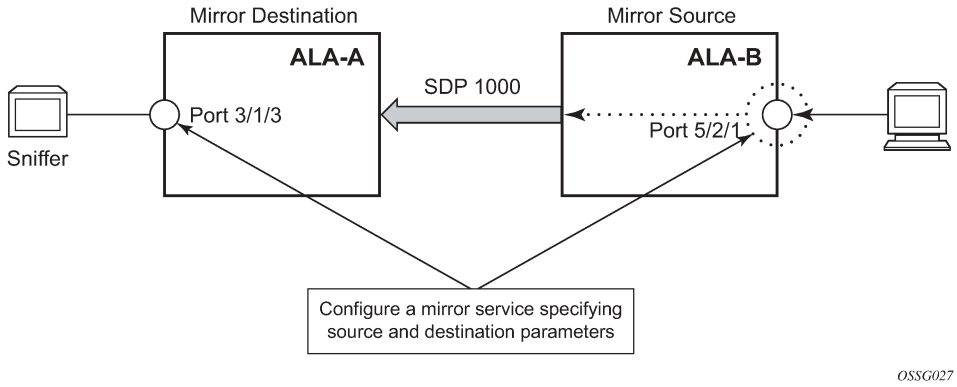
- Port 5/2/1 is specified as the mirror source port. Parameters are defined to select specific traffic ingressing and egressing this port.

  Destination parameters are defined to specify where the mirrored traffic is sent. In this case, mirrored traffic sent to a SAP configured as part of the mirror service on port 3/1/3 on ALA A (the mirror destination).

  ALA A decodes the service ID and sends the traffic out of port 3/1/3.

  The sniffer is physically connected to this port (3/1/3). SAP, encapsulation requirements, packet slicing, and mirror classification parameters are configured in the destination parameters.

Figure 3: Remote mirroring example

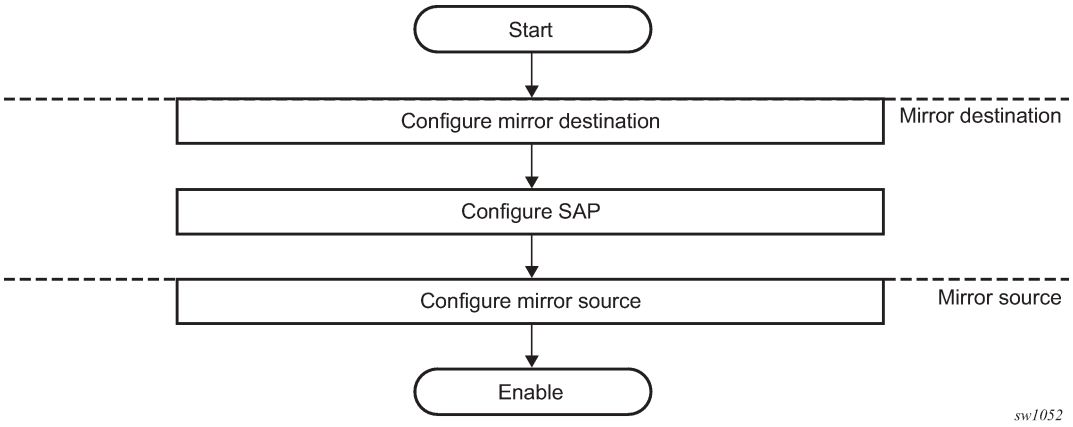


2.3 Configuration process overview

The following figure shows the process to provision basic mirroring parameters.

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Figure 4: Mirror configuration and implementation flow



2.4 Configuration notes

This section describes mirroring configuration restrictions, as follows:

- Multiple mirroring service IDs (mirror destinations) may be created within a single system.
- A mirrored source can only have one destination.
- On the 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE before using a Dot1q SAP or Q1.* SAP as a mirror destination, the user must configure a port for use with this feature using the command **config>system>loopback-no-svc-port mirror**. The user has an option to use either one of the available virtual internal port resources or a front panel port. The virtual internal port resources available can be determined using the command **show system internal-loopback-ports detail**. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide* for more information about both commands.
- On 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, and 7210 SAS-Sx 10/100GE before using a MPLS SDP as a mirror destination, the user must configure a port for use with this feature using the command **config> system> loopback-no-svc-port mirror**. No services can be configured on this port. The user has an option to use either one of the available virtual internal port resources or a front panel port. The virtual internal port resources available can be determined using the command show system internal-loopback-ports detail. More details of both the commands can be found in the *7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide*.
- Spoke SDP is supported only on local mirror service type. Please see the Table 5: Combinations of SAPs, spoke-SDPs, and remote sources allowed in a mirror service section for more information.
- Remote source mirror type service accepts only MPLS labeled traffic from remote sources.
- The destination mirroring service IDs and service parameters are persistent between router (re)boots and are included in the configuration saves.

  Mirror source criteria configuration (defined in **debug>mirror>mirror-source**) is not preserved in a configuration save (**admin save**). Debug mirror source configuration can be saved using **admin>debug-save**.
- Physical layer problems, such as collisions, jabbers, and so on, are not mirrored. Typically, only complete packets are mirrored.

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- Starting and shutting down mirroring:
  - Mirror destinations:
    - The default state for a mirror destination service ID is shutdown. You must issue a **no shutdown** command to enable the feature.
    - When a mirror destination service ID is shutdown, mirrored packets associated with the service ID are not accepted from its mirror source. The associated mirror source is put into an operationally down mode. Mirrored packets are not transmitted out the SAP. Each mirrored packet is silently discarded.
    - Issuing the **shutdown** command causes the mirror destination service or its mirror source to be put into an administratively down state. Mirror destination service IDs must be shut down first in order to delete a service ID, or SAP association from the system.
  - Mirror sources:
    - The default state for a mirror source for a given **mirror-dest** service ID is **no shutdown**. Enter a **shutdown** command to deactivate (disable) mirroring from that mirror-source.
    - Mirror sources do not need to be shutdown to remove them from the system. When a mirror source is shutdown, mirroring is terminated for all sources defined locally for the mirror destination service ID.

2.5 Configuring service mirroring with CLI

This section provides information about service mirroring.

2.5.1 Mirror configuration overview

7210 SAS node mirroring can be organized in the following logical entities:

- The mirror source is defined as the location from where the traffic should be mirrored. A mirror source could be ingress of service entity or egress of a service entity. The list of mirror sources supported on a specific platform is listed preceding Table 8: Mirror source port requirements .
- A SAP is defined in local mirror services as the mirror destination to where the mirrored packets are sent.

2.5.1.1 Defining mirrored traffic

In some scenarios, or when multiple services are configured on the same port, specifying the port does not provide sufficient resolution to separate traffic. In Nokia's implementation of mirroring, multiple source mirroring parameters can be specified to further identify traffic.

Mirroring of packets matching specific filter entries in an IP or MAC filter can be applied to refine what traffic is mirrored to flows of traffic within a service. The IP criteria can be combinations of:

- source IP address/mask
- destination IP address/mask
- IP Protocol value
- source port value (for example, UDP or TCP port)

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- destination port value (for example, UDP or TCP port)
- DiffServ Code Point (DSCP) value
- ICMP code
- ICMP type
- IP fragments
- TCP ACK set/reset
- TCP SYN set/reset

The MAC criteria can be combinations of:

- IEEE 802.1p value/mask
- source MAC address/mask
- destination MAC address/mask
- Ethernet Type II Ethernet type value

Note:
The list of packet fields that are available to match packets in IP and MAC ACLs for different platforms is different. For more information about the lists of packet fields available on different platforms, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Router Configuration Guide*.

2.6 Basic mirroring configuration

Destination mirroring parameters must include at least:

- a mirror destination ID (same as the mirror source service ID)
- a mirror destination SAP

Mirror source parameters must include at least:

- a mirror service ID (same as the mirror destination service ID)
- at least one source type (port, SAP, IP filter or MAC filter) specified

Output example

The following is a sample local mirrored service (ALA-A) configuration output.

```
*A:ALA-A>config>mirror# info
----------------------------------------------
        mirror-dest 103 create


            sap 1/1/1 create



            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-A>config>mirror#
```


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Output example

The following is a sample mirror source configuration output.

```
*A:ALA-A>debug>mirror-source# show debug mirror
debug
    mirror-source 103

        port 1/1/24 egress ingress
no shutdown
    exit
exit
*A:ALA-A>debug>mirror-source# exit
```

2.6.1 Mirror classification rules

The Nokia implementation of mirroring can be performed by configuring parameters to select network traffic according to any of the entities in this section.

2.6.1.1 Port

The **port** command associates a port to a mirror source. The port is identified by the port ID. The defined port can be Ethernet or a Link Aggregation Group (LAG) ID. When a LAG ID is specified as the port ID, mirroring is enabled on all ports making up the LAG.

Mirror sources can be ports in either access or network mode. Port mirroring is supported in the combinations described in the following table.

Table 8: Mirror source port requirements

Port type	Port mode	Port encapsulation type
faste/gige/10gige	access	null, dot1q and QinQ
faste/gige/10gige	access uplink	qinq
faste/gige/10gige	network	null/dot1q
faste/gige/10gige	hybrid	null/dot1q/qinq

```
debug>mirror-source# port {port-id|lag lag-id}{[egress][ingress]}
```

Example:

```
*A:ALA-A>debug>mirror-source# port 1/1/2 ingress egress
```


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2.6.1.2 SAP

More than one SAP can be associated within a single mirror source. Each SAP has its own ingress parameter keyword to define which packets are mirrored to the **mirror-dest** service ID. A SAP that is defined within a mirror destination cannot be used in a mirror source.

```
debug>mirror-source# sap sap-id {[ingress]}
```

Example:

```
*A:ALA-A>debug>mirror-source# sap 1/1/4:100 ingress
```

2.6.1.3 MAC filter

MAC filters are configured in the **config**>**filter**>**mac-filter** context. The **mac-filter** command causes all the packets matching the explicitly defined list of entry IDs to be mirrored to the mirror destination specified by the *service-id* of the mirror source.

```
debug>mirror-source# mac-filter mac-filter-id entry entry-id[entry-id …]
```

Output example:

```
*A:ALA-2>debug>mirror-source# mac-filter 12 entry 15 20 25
```

2.6.1.4 IP filter

IP filters are configured in the **config**>**filter**>**ip-filter** context. The **ip-filter** command causes all the packets matching the explicitly defined list of entry IDs to be mirrored to the mirror destination specified by the *service-id* of the mirror source.

Ingress mirrored packets are mirrored to the mirror destination before any ingress packet modifications.

```
debug>mirror-source# ip-filter ip-filter-id entry entry-id[entry-id …]
```

Example:

```
*A:ALA-A>debug>mirror-source# ip-filter 1 entry 20
```

Note:
An IP filter cannot be applied to a mirror destination SAP.

2.7 Common configuration tasks

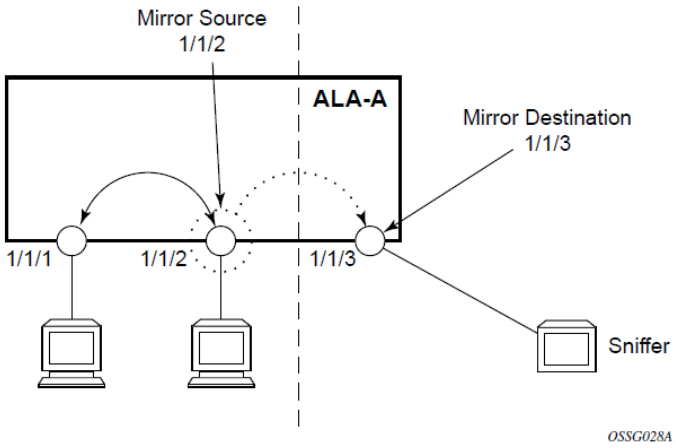
This section provides a brief overview of the tasks that must be performed to configure local mirror services and provides CLI command syntax. Note that the local mirror source and mirror destination components must be configured under the same service ID context.

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Each local mirrored service (Figure 5: Local mirrored service tasks) (within the same router) requires the following configurations:

1. Specify mirror destination (SAP).
2. Specify mirror source (port, SAP, IP filter, MAC filter).

Figure 5: Local mirrored service tasks



2.7.1 Configuring a local mirror service

To configure a local mirror service, the source and destinations must be located on the same router. Note that local mirror source and mirror destination components must be configured under the same service ID context.

The **mirror-source** commands are used as traffic selection criteria to identify traffic to be mirrored at the source. Each of these criteria are independent. For example, use the **debug**>**mirror-source**>**port** {*port-id* | **lag** *lag-id*} {[**egress**] [**ingress**]} command and **debug**>**mirror-source ip-filter** *ip-filter-id* **entry** *entry-id* [*entry-id*…] command to capture (mirror) traffic that matches a specific IP filter entry and traffic ingressing and egressing a specific port. A filter must be applied to the SAP or interface if only specific packets are to be mirrored.

Use the following syntax to configure one or more mirror source parameters.

The **mirror-dest** commands are used to specify where the mirrored traffic is to be sent. Use the following syntax to configure mirror destination parameters.

```
config>mirror mirror-dest service-id [type {ether}] [create]
        description string
        sap sap-id [create]
        no shutdown
```

```
debug# mirror-source service-id
        ip-filter ip-filter-id entry entry-id [entry-id …]
        ipv6-filter ip-filter-id entry entry-id [entry-id …]
        mac-filter mac-filter-id entry entry-id [entry-id …]
        port {port-id|lag lag-id} {[egress][ingress]}
        sap sap-id {[ingress]}
        no shutdown
```


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The following is a sample local mirrored service using a NULL SAP configuration output. On ALA-A, mirror service 103 is mirroring traffic matching IP filter 2, entry 1 as well as egress and ingress traffic on port 1/1/23 and sending the mirrored packets to SAP 1/1/24.

Example

```
*A:ALA-A>config>mirror# info
----------------------------------------------
        mirror-dest 103 create

            sap 1/1/24 create




            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-A>config>mirror#
```

The following is a sample local mirrored service using a dot1q SAP configuration output. User needs to configure a front-panel port for use with the mirroring application when the mirror destination is a Dot1q SAP or a Q1.* SAP, as follows.

Example

```
*A:ALA-A>config>system>
-------------------------------------------------------
loopback-no-svc-port mirror 1/1/14
-------------------------------------------------------

*A:ALA-A>config>mirror# info
----------------------------------------------
mirror-dest 103 create
sap 1/1/10:100 create
exit
no shutdown
exit
----------------------------------------------
*A:ALA-A>config>mirror#
```

Example

The following is sample debug mirroring information.

```
*A:ALA-A>debug>mirror-source# show debug mirror
debug
    mirror-source 103
no shutdown

        port 1/1/23 ingress

ip-filter 2 entry 1
    exit
exit
*A:ALA-A>debug>mirror-source# exit
```


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2.7.2 Configuring a remote mirror service

The source and destination are configured on different routers for remote mirroring. Note that *mirror source* and *mirror destination* parameters must be configured under the same service ID context.

Note:
Remote mirroring using MPLS SDP is supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

The **mirror-source** commands are used as traffic selection criteria to identify traffic to be mirrored at the source. For example, use the **port** *port-id* [*lag-id*] {[**egress**] [**ingress**]} and **mac-filter** *mac-filter-id* **entry** *entry-id* [*entry-id* …] commands.

Use the following syntax to configure one or more mirror source parameters.

```
debug> mirror-source service-id
        ip-filter ip-filter-id entry entry-id [entry-id …]
        ipv6-filter ip-filter-id entry entry-id [entry-id …]
        mac-filter mac-filter-id entry entry-id [entry-id …]
        port {port-id|lag lag-id} {[egress][ingress]}
        sap sap-id {[ingress]}
        no shutdown
```

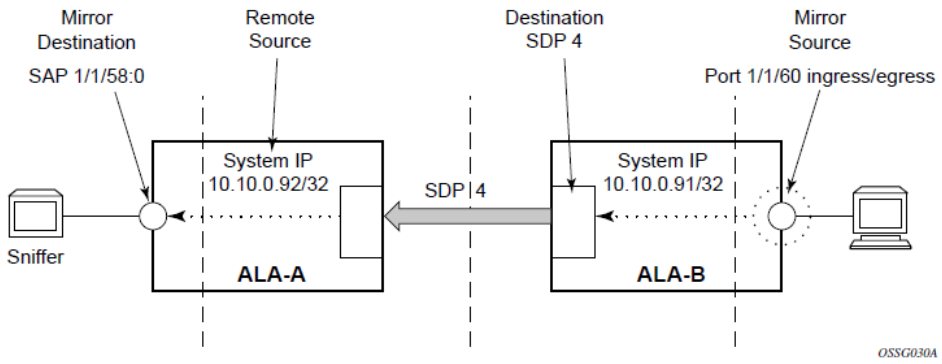
The **mirror-dest** commands are used to specify where the mirrored traffic is to be sent, the forwarding class, and the size of the packet. Use the following syntax to configure mirror destination parameters.

```
config>mirror#
    mirror-dest service-id
        [create] [type <mirror-type>][mirror-source-type <mirror-source-type>]
            description string
            fc fc-name [profile <profile>]
            remote-source
                far-end ip-address [vc-id vc-id] [ing-svc-label ingress-vc-label|tldp]
            sap sap-id create
            no shutdown
```

The following figure shows the mirror destination, which is on ALA-A, configuration for mirror service 1216. This configuration specifies that the mirrored traffic coming from the mirror source (10.10.0.91) is to be directed to SAP /1/58 and states that the service only accepts traffic from far end 10.10.0.92 (ALA-B) with an ingress service label of 5678. When a forwarding class is specified, then all mirrored packets transmitted to the destination SAP or SDP override the default (be) forwarding class.

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Figure 6: Remote mirrored service tasks



The following example displays the CLI output showing the configuration of remote mirrored service 1216. The traffic ingressing and egressing port 1/1/60 on 10.10.0.92 (ALA-B) will be mirrored to the destination SAP 1/1/58:0 on ALA-A.

Example

The following is a sample remote mirror destination configuring the front panel port with mirroring application.

```
*A:7210SAS>config>mirror# info
----------------------------------------------
        mirror-dest 23 mirror-source-type remote create
            description "Added by createMirrorDestination 23"
            fc be
            remote-source
                far-end 2.2.2.2 ing-svc-label 14000
            exit
            sap 1/1/4 create
            exit
            no shutdown
        exit
        mirror-dest 1000 create
            fc be
            spoke-sdp 200:1000 create
                egress
                    vc-label 15000
                exit
                no shutdown
            exit
            no shutdown
        exit
----------------------------------------------
*A:7210SAS>config>mirror# /show system internal-loopback-ports

===============================================================================
Internal Loopback Port Status
===============================================================================
Port                Loopback            Application         Service
Id                  Type                                    Enabled
-------------------------------------------------------------------------------
1/1/9               Physical            Dot1q-Mirror        No
===============================================================================
```

The following is a sample mirror destination configuration output for mirror service 1216 on ALA-A.

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Example

```
*A:ALA-A>config>mirror# info
----------------------------------------------
        mirror-dest 1000 type ether mirror-source-type remote create
            description "Receiving mirror traffic from .91"
            remote-source
                far-end 2.2.2.2 tldp
            exit
            sap 1/1/21:21 create
                egress
                    qos 1
                exit
            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-A>config>mirror#
```

The following is a sample remote mirror destination output configured on ALA-B.

Example

```
*A:ALA-B>config>mirror# info
----------------------------------------------
mirror-dest 2000 type ether mirror-source-type local create
            no description
            no service-name
            fc be
            no remote-source
            spoke-sdp 200:2000 create
                egress
                    no vc-label
                exit
                no shutdown
            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-B>config>mirror#
```

The following is a sample mirror source configuration output for ALA-B.

Example

```
*A:ALA-B# show debug mirror
debug
    mirror-source 1000
        no shutdown
    exit
    mirror-source 2000
        no shutdown
    exit
exit
*A:ALA-B#
```

The following is a sample SDP configuration output from ALA-A to ALA-B (SDP 2) and the SDP configuration output from ALA-B to ALA-A (SDP 4).

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Example

```
*A:ALA-A>config>service>sdp# info
----------------------------------------------
description "MPLS-10.10.0.91"
far-end 10.10.0.01
signalling tldp
no shutdown
----------------------------------------------
*A:ALA-A>config>service>sdp#


*A:ALA-B>config>service>sdp# info
----------------------------------------------
description "MPLS-10.10.20.92"
far-end 10.10.10.103
signalling tldp
no shutdown
----------------------------------------------
*A:ALA-B>config>service>sdp#
```

2.8 Service management tasks

This section describes the service management tasks.

The following shows the command usage to modify an existing mirrored service.

```
config>mirror#
        mirror-dest service-id [type {ether}]
            description description-string
            no description
            sap sap-id
            no sap
            [no] shutdown
```

```
debug
    [no] mirror-source service-id
        ip-filter ip-filter-id entry entry-id [entry-id...]
        no ip-filter ip-filter-id
        no ip-filter entry entry-id [entry-id...]
        ipv6-filter ip-filter-id entry entry-id [entry-id...]
        no ipv6-filter ip-filter-id
        no ipv6-filter entry entry-id [entry-id...]
        mac-filter mac-filter-id entry entry-id [entry-id...]
        no mac-filter mac-filter-id
        no mac-filter mac-filter-id entry entry-id [entry-id...]
        [no] port {port-id|lag lag-id} {[egress][ingress]}
        [no] sap sap-id {[ingress]}
        [no] shutdown
```

2.8.1 Modifying a local mirrored service

Existing mirroring parameters can be modified in the CLI. The changes are applied immediately. The service must be shut down if changes to the SAP are made.

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Example

The following shows the command usage to modify parameters for a basic local mirroring service.

```
config>mirror# mirror-dest 103
    config>mirror>mirror-dest# shutdown
    config>mirror>mirror-dest# no sap
    config>mirror>mirror-dest# sap 1/1/5 create
    config>mirror>mirror-dest>sap$ exit
    config>mirror>mirror-dest# no shutdown
    debug# mirror-source 103
    debug>mirror-source# no port 1/1/23
    debug>mirror-source# port 1/1/7 ingress egress
```

Example

The following is a sample of the local mirrored service modifications.

```
*A:ALA-A>config>mirror# info
----------------------------------------------
mirror-dest 103 create
            no shutdown
            sap 1/1/5 create
        exit

*A:ALA-A>debug>mirror-source# show debug mirror
debug
    mirror-source 103
        no shutdown
        port 1/1/7 egress ingress
    exit
*A:ALA-A>debug>mirror-source#
```

2.8.2 Deleting a local mirrored service

Existing mirroring parameters can be deleted in the CLI. A shutdown must be issued on a service level to delete the service. It is not necessary to shut down or remove SAP or port references to delete a local mirrored service.

The following shows the command usage to delete a local mirrored service.

Example

```
ALA-A>config>mirror# mirror-dest 103
    config>mirror>mirror-dest# shutdown
    config>mirror>mirror-dest# exit
    config>mirror# no mirror-dest 103
    config>mirror# exit
```

2.8.3 Modifying a remote mirrored service

Existing mirroring parameters can be modified in the CLI. The changes are applied immediately. The service must be shut down if changes to the SAP are made.

In the following example, the mirror destination is changed from 10.10.10.2 (ALA-B) to 10.10.10.3 (SR3). Note that the **mirror-dest** service ID on ALA-B must be shut down first before it can be deleted.

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Example

The following shows the command usage to modify parameters for a remote mirrored service.

```
*A:ALA-A>config>mirror# mirror-dest 104
    config>mirror>mirror-dest# remote-source
    config>mirror>mirror-dest>remote-source# no far-end 10.10.10.2
    remote-source# far-end 10.10.10.3 ing-svc-label 3500

    *A:ALA-B>config>mirror# mirror-dest 104
    config>mirror>mirror-dest# shutdown
    config>mirror>mirror-dest# exit
    config>mirror# no mirror-dest 104

    SR3>config>mirror# mirror-dest 104 create
    config>mirror>mirror-dest# sdp 4 egr-svc-label 3500
    config>mirror>mirror-dest# no shutdown
    config>mirror>mirror-dest# exit all

    SR3># debug
    debug# mirror-source 104
    debug>mirror-source# port 551/1/2 ingress egress
    debug>mirror-source# no shutdown
```

Example

```
*A:ALA-A>config>mirror# info
----------------------------------------------
mirror-dest 104 create
            remote-source
                far-end 2.2.2.2 tldp
            exit
 sap 1/1/21:21 create


                egress
                    qos 1
                exit
            exit
            no shutdown
exit

A:SR3>config>mirror# info
----------------------------------------------
        mirror-dest 104 create
spoke-sdp 200:2000 create
            no shutdown
        exit
----------------------------------------------
A:SR3>config>mirror#

A:SR3# show debug mirror
debug
    mirror-source 104
        no shutdown
```


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2.8.4 Deleting a remote mirrored service

Existing mirroring parameters can be deleted in the CLI. A shut down must be issued on a service level to delete the service. It is not necessary to shut down or remove SAP, or far-end references to delete a remote mirrored service.

Example

To delete a mirror service, the spoke-SDP service has to be deleted from the service. Mirror destinations must be shut down first before they are deleted.

```
*A:ALA-A>config>mirror# mirror-dest 105
    config>mirror>mirror-dest# shutdown
    config>mirror>mirror-dest# exit
    config>mirror# no mirror-dest 105
    config>mirror# exit

    *A:ALA-B>config>mirror# mirror-dest 105
    config>mirror>mirror-dest# shutdown
    config>mirror>mirror-dest# exit
    config>mirror# no mirror-dest 105
    config>mirror# exit
```

The mirror destination service ID 105 was removed from the configuration on ALA-A and ALA-B, therefore, does not appear in the **info** command output.

Output example

```
*A:ALA-A>config>mirror# info
----------------------------------------------

----------------------------------------------
*A:ALA-A>config>mirror# exit


*A:ALA-B>config>mirror# info
----------------------------------------------

----------------------------------------------
*A:ALA-B>config>mirror# exit
```

Because the mirror destination was removed from the configuration on ALA-B, the port information was automatically removed from the **debug mirror-source** configuration.

Example

```
*A:ALA-B# show debug mirror
debug
exit
*A:ALA-B#
```


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2.9 Mirror service command reference

2.9.1 Command hierarchies

- Mirror configuration commands for 7210 SAS devices configured in access-uplink mode
- Mirror configuration commands for 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12 in network and standalone mode
- Show commands
- Debug commands

2.9.1.1 Mirror configuration commands for 7210 SAS devices configured in access-uplink mode

```
config
    - mirror
        - mirror-dest service-id [type mirror-type] [create]
        - no mirror-dest service-id
            - description description-string
            - no description
            - [no] fc [fc-name] profile {profile}
            - sap sap-id [create]
            - no sap
            - service-name service-name
            - [no]service-name
            - [no] shutdown
```

2.9.1.2 Mirror configuration commands for 7210 SAS-T, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12 in network and standalone mode

```
config
    - mirror
        - mirror-dest service-id   [type encap-type] [mirror-source-type mirror-source-type]
 [create]
        - no mirror-dest service-id
            - description description-string
            - no description
            - [no] fc [fc-name] profile profile
            - no remote-source
            - remote-source
                - far-end ip-address [vc-id vc-id] [ing-svc-label ingress-vc-label| tldp]
                - no far-end ip-address
                - spoke-sdp sdp-id:vc-id  [create]
                - no spoke-sdp sdp-id:vc-id
            - sap sap-id [create]
            - no sap
                - [no] egress
                    - [no] qos policy-id
            - service-name service-name
            - [no]service-name
```


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```
            - [no] shutdown
            - no spoke-sdp sdp-id:vc-id
            - spoke-sdp sdp-id:vc-id [create]
                - egress
                    - no vc-label [egress-vc-label]
                    - vc-label egress-vc-label
                    - no shutdown
                    - shutdown
```

2.9.1.3 Show commands

```
show
    - debug [application]
    - mirror mirror-dest [service-id]
    - service
        - service-using mirror
```

2.9.1.4 Debug commands

```
debug
    - [no] mirror-source service-id
        - [no] ip-filter ip-filter-id [entry entry-id]
        - [no] ipv6-filter ipv6-filter-id [entry entry-id]
        - [no] mac-filter mac-filter-id [entry entry-id...]
        - [no] port {port-id | lag lag-id} [egress] [ingress]
        - [no] sap sap-id {[ingress] [egress]}
        - [no] shutdown
```

2.9.2 Command descriptions

- Configuration commands
- Show commands

2.9.2.1 Configuration commands

- Generic commands
- Mirror destination configuration commands
- Mirror source configuration commands

2.9.2.1.1 Generic commands

description

Syntax

description *description-string*

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no description

Context

config>mirror>mirror-dest

Platforms

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

Description

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

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

Parameters

description-string

Specifies the description character string. Allowed values are any string up to 80 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed within double quotes.

shutdown

Syntax

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

Context

config>mirror>mirror-dest

config>mirror>mirror-dest>spoke-sdp>egress (not supported in the access-uplink operating mode)

debug>mirror-source

Platforms

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

Description

This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics. Many entities must be explicitly enabled using the **no shutdown** command.

Unlike other commands and parameters where the default state is not indicated in the configuration file, **shutdown** and **no shutdown** are always indicated in system generated configuration files.

The **no** form of this command puts an entity into the administratively enabled state.

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Default

See the following Special Cases.

Special Cases

Mirror Destination

When a mirror destination service ID is shutdown, mirrored packets associated with the service ID are not accepted from the mirror source device. The associated mirror source is put into an operationally down mode. Mirrored packets are not transmitted out of the SAP. Each mirrored packet is silently discarded. If the mirror destination is a SAP, the SAP's discard counters are increased.

The **shutdown** command places the mirror destination service or mirror source into an administratively down state. The **mirror-dest** service ID must be shut down to delete the service ID, SAP association from the system.

The default state for a mirror destination service ID is **shutdown**. A **no shutdown** command is required to enable the service.

Mirror Source

Mirror sources do not need to be shutdown to remove them from the system.

When a mirror source is **shutdown**, mirroring is terminated for all sources defined locally for the mirror-dest service ID.

The default state for a mirror source for a specific mirror-dest service ID is **no shutdown**. A **shutdown** command is required to disable mirroring from that mirror-source.

2.9.2.1.2 Mirror destination configuration commands

mirror-dest

Syntax

mirror-dest *service-id* [**type** *encap-type*] [**mirror-source-type mirror-source-type**] [**create**]

no mirror-dest

Context

config>mirror

Platforms

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

Description

This command sets up a service that is intended for packet mirroring. It is configured as a service to allow mirrored packets to be directed locally (within the same device), over the core of the network and have a far end device decode the mirror encapsulation.

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The mirror-dest service comprises destination parameters that define where the mirrored packets are to be sent. It also specifies whether the defined *service-id* receives mirrored packets from far end devices over the network core.

The mirror-dest service IDs are persistent between boots of the router and are included in the configuration backups. The local sources of mirrored packets for the service ID are defined within the **debug mirror** mirror-source command that references the same *service-id*.

The mirror-dest command is used to create or edit a service ID for mirroring purposes. If the *service-id* does not exist within the context of all defined services, the mirror-dest service is created and the context of the CLI is changed to that service ID. If the *service-id* exists within the context of defined mirror-dest services, the CLI context is changed for editing parameters on that service ID. If the *service-id* exists within the context of another service type, an error message is returned and CLI context is not changed from the current context.

The **no** form of this command removes a mirror destination from the system. The mirror-source associations with the mirror-dest *service-id* do not need to be removed or shutdown first. The mirror-dest *service-id* must be shutdown before the service ID can be removed. When the service ID is removed, all mirror-source commands that have the service ID defined are also removed from the system.

Parameters

service-id

Specifies the service ID that identifies the service in the service domain. This ID is unique to this service and cannot be used by any other service, regardless of service type. The same service ID must be configured on every device that this particular service is defined on.

If a particular service ID already exists for a service, the same value cannot be used to create a mirror destination service ID with the same value.

For example:

If an Epipe service-ID 11 exists, a mirror destination service-ID 11 cannot be created. If a VPLS service-ID 12 exists, a mirror destination service-ID 12 cannot be created.

If an IES service-ID 13 exists, a mirror destination service-ID 13 cannot be created.

Values *service-id*: 1 — 2147483647

type *encap-type*

Specifies the type describes the encapsulation supported by the mirror service.

Values ether

mirror-source-type

Allows scaling of mirror services that can be used only with remote mirror sources, while limiting the mirror services that can be used by local mirror sources or by both local and remote mirror sources. For more information, see Table 5: Combinations of SAPs, spoke-SDPs, and remote sources allowed in a mirror service. This parameter is not supported in the access-uplink operating mode.

Values local | remote | both

local

Indicates that the mirror service can only be used by local mirror sources.

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remote

Indicates that the mirror service can only be used by remote mirror sources.

both

Indicates that the mirror service can be used by both local and remote mirror sources.

Default local

fc

Syntax

fc *fc-name*

no fc

Context

config>mirror>mirror-dest

Platforms

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

Description

This command specifies a forwarding class for all mirrored copies of the packets transmitted to the destination SAP overriding the default (be) forwarding class. All packets are sent with the same class of service to minimize out-of-sequence issues. The mirrored copy of the packet does not inherit the forwarding class of the original packet.

When the destination is on a SAP, it pulls buffers from the queue associated with the FC name and the shaping and scheduling treatment given to the packet is as per the user configuration for that queue.

The FC can be assigned only when the mirror source is local. When the mirror source is remote, the network QoS ingress policies that are applied to all the traffic received on the network port and network IP interface are also applied to mirror traffic.

Note:

- On the 7210 SAS-T, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE, all SAPs configured on a port use the port-based egress queues. If the mirror destination SAP (that is, dot1q SAP or a Q1.* SAP) is configured to share an uplink with service traffic, the mirrored copy of the traffic sent out of the Dot1q or Q1.* SAP shares the port-based egress queues with the other service traffic. The user is provided an option to assign the profile mirrored copy to the packet, so that during congestion, the mirrored copy of the packets marked as out-of-profile is dropped before in-profile service traffic (and possibly in-profile mirrored traffic, if the user has configured mirrored traffic to be in-profile). The profile is used to determine the slope policy to use for the packet and determines the packet drop precedence. Additionally, if marking is enabled, it determines the marking value to be used in the packet header.
- On the 7210 SAS-Mxp, 7210 SAS-R6 and 7210 SAS-R12, SAP-based egress queue QoS policy is used when the port-based egress queuing is disabled on the mirrored destination

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SAP, allowing users to control the amount of bandwidth allocated for mirrored traffic. If port-based queuing is enabled, all SAPs configured on a port use the port-based egress queues.

The **no** form of this command returns the **mirror-dest** service ID forwarding class to the default forwarding class.

Default

The best effort (be) forwarding class is associated with the mirror-dest service ID and profile is out.

Parameters

fc-name

Specifies the name of the forwarding class with which to associate mirrored service traffic. The forwarding class name must already be defined within the system. If the FC name does not exist, an error is returned and the **fc** command has no effect. If the FC name does exist, the forwarding class associated with *fc-name* overrides the default forwarding class.

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

profile

Specifies the profile to assign to the mirrored copy of the service traffic. The profile is used to determine the slope policy to use for the packet and determines the packet's drop precedence. Additionally, if marking is enabled, it determines the marking value to be used in the packet header. A value of **in** marks the traffic as in-profile traffic and results in the use of high slope parameters. A value of **out** marks the traffic as out-of-profile and results in the use of low slope parameters.

Values **in**, **out**

Default **out**

far-end

Syntax

far-end *ip-address* [**vc-id** *vc-id*] [**ing-svc-label** *ing-vc-label* | **tldp**]

no far-end *ip-addr*

Context

config>mirror>mirror-dest>remote-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command defines the remote device and configures parameters for mirror destination services on other devices that are allowed to mirror to the mirror destination service ID.

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The **far-end** command is used within the context of the remote-source node. It allows the definition of accepted remote sources for mirrored packets to this mirror destination service ID. If a far-end router is not specified, packets sent to the router are discarded.

The **far-end** command is used to define a remote source that may send mirrored packets to this 7210 SAS for handling by this mirror-dest *service-id*.

When using LDP IPv6 LSP SDPs in the remote mirroring solution, the user must configure the destination node with **config**>**mirror**>**mirror-dest**>**remote-source**>**spoke-sdp** entries. For all other types of SDPs, **config**>**mirror**>**mirror-dest**>**remote-source**>**far-end** entries are used.

The **ing-svc-label** keyword must be entered to manually define the expected ingress service label. This ingress label must also be manually defined on the far-end address through the mirror-dest SDP binding keyword **egr-svc-label**.

The **no** form of this command deletes a far-end address from the allowed remote senders to this mirror-dest service. All far-end addresses are removed when **no remote-source** is executed. All signaled ingress service labels are withdrawn from the far-end address affected. All manually defined **ing-svc-label** configurations are removed.

Parameters

ip-address

Specifies the service IP address (system IP address) of the remote device sending mirrored traffic to this mirror destination service. If 0.0.0.0 is specified, any remote is allowed to send to this service.

Values a.b.c.d

The ingress service label must be manually defined using the **ing-svc-label** keyword. On the far end 7210 SAS, the associated SDP **egr-svc-label** must be manually set and equal to the label defined in **ing-svc-label**.

vc-id *vc-id*

Specifies the virtual circuit identifier.

Values 1 to 4294967295

ing-svc-label *ing-vc-label*

Specifies the ingress service label for mirrored service traffic on the far-end device for manually configured mirror service labels.

The defined **ing-svc-label** is entered into the ingress service label table which causes ingress packet with that service label to be handled by this mirror-dest service.

The specified **ing-svc-label** must not have been used for any other service ID and must match the far end expected specific *egr-svc-label* for this 7210 SAS. It must be within the range specified for manually configured service labels defined on this 7210 SAS. It may be reused for other far end addresses on this *mirror-dest-service-id*.

Values 2048 to 18431

tldp

Specifies that the label is obtained through signaling via the LDP.

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remote-source

Syntax

[**no**] **remote-source**

Context

config>mirror>mirror-dest

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures remote devices to mirror traffic to this device for mirror service egress. Optionally, this command deletes all previously defined remote mirror ingress devices.

The **remote-source** context allows the creation of a 'sniffer farm' to consolidate expensive packet capture and diagnostic tools to a central location. Remote areas of the access network can be monitored via normal service provisioning techniques.

Specific far-end routers can be specified with the far-end command allowing them to use this router as the destination for the same *mirror-dest-service-id*.

The **remote-source** node allows the source of mirrored packets to be on remote 7210 SAS devices. The local 7210 SAS configures its network ports to forward packets associated with the *service-id* to the destination SAP. When **remote-source** far-end addresses are configured, an SDP is not allowed as a destination.

By default, the **remote-source** context contains no far-end addresses. When no far-end addresses have been specified, network remote devices are not allowed to mirror packets to the local 7210 SAS as a mirror destination. Packets received from unspecified far-end addresses are discarded at network ingress.

The **no** form of this command restores the *service-id* to the default condition to not allow a remote 7210 SAS access to the mirror destination. The far-end addresses are removed without warning.

sap

Syntax

sap *sap-id* [**create**]

no sap

Context

config>mirror>mirror-dest

Platforms

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

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Description

This command creates a service access point (SAP) within a mirror destination service. The SAP is owned by the mirror destination service ID.

The SAP is defined with port and encapsulation parameters to uniquely identify the (mirror) SAP on the interface and within the box. The specified SAP must define an Ethernet port with a null SAP or a Dot1q SAP or a Q1.* SAP.

Only one SAP can be created within a mirror-dest service ID. If the defined SAP has not been created on any service within the system, the SAP is created and the context of the CLI changes to the newly created SAP. In addition, the port cannot be a member of a multi-link bundle, LAG, APS group or IMA bundle.

If the defined SAP exists in the context of another service ID, mirror-dest or any other type, an error is generated.

Mirror destination SAPs can be created on Ethernet interfaces that have been defined as an access port or access-uplink port. If the interface is defined as network, the SAP creation returns an error.

Note:
When using a dot1q SAP or a Q1.* SAP as a mirror destination, users must allocated resources of another port for use by this features. Refer the mirror configuration notes preceding Configuration notes.

The **no** form of this command used on a SAP created by a mirror destination service ID, deletes the SAP with the specified port and encapsulation parameters.

Parameters

sap-id

Specifies the physical port identifier portion of the SAP definition. See Common CLI command descriptions for command syntax.

service-name

Syntax

service-name *service-name*

no service-name

Context

config>mirror>mirror-dest

Platforms

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

Description

This command configures an optional service name, up to 64 characters, which adds a name identifier to a specific service to use that service name in configuration references as well as display and use service names in show commands throughout the system. This helps the service provider/administrator to identify and manage services within the 7210 SAS platforms.

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All services are required to assign a service ID to initially create a service. However, either the service ID or the service name can be used to identify and reference a specific service when it is initially created.

Parameters

service-name

Specifies a unique service name to identify the service. Service names may not begin with an integer (0-9).

spoke-sdp

Syntax

spoke-sdp *sdp-id:vc-id* [**create**] [**no-endpoint**]

spoke-sdp *sdp-id:vc-id* [**create**] **endpoint** *name*

spoke-sdp *sdp-id:vc-id* [**create**]

no sdp *sdp-id:vc-id*

Context

config>mirror>mirror-dest

config>mirror>mirror-dest>remote-source (only supported on the 7210 SAS-Mxp (standalone mode))

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command binds an existing (mirror) service distribution path (SDP) to the mirror destination service ID.

The operational state of the SDP dictates the operational state of the SDP binding to the mirror destination. If the SDP is shutdown or operationally down, SDP binding is down. When the binding is defined and the service and SDP are operational, the far-end router defined in the **config service sdp** *sdp-id* **far-end** parameter is considered part of the service ID.

Only one SDP can be associated with a mirror destination service ID. If a second **sdp** command is executed after a successful SDP binding, an error occurs and the command has no effect on the existing configuration. A **no sdp** command must be issued before a new SDP binding can be attempted.

An SDP is a logical mechanism that ties a far end router to a specific service without having to define the far-end SAP. Each SDP represents a method to reach a router.

The other method is Multi-Protocol Label Switching (MPLS) encapsulation. Routers support both signaled and non-signaled LSPs (Label Switched Path) though the network. Non-signaled paths are defined at each hop through the network. Signaled paths are protocol communicated from end to end using RSVP. Paths may be manually defined or a constraint based routing protocol (OSPF-TE or CSPF) can be used to determine the best path with specific constraints.

SDPs are created and then bound to services. Many services can be bound to a single SDP. The operational and administrative state of the SDP controls the state of the SDP binding to the service.

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An egress service label (Martini VC-Label), used by the SDP to differentiate each service bound to the SDP to the far-end router, must be obtained manually or though signaling with the far end. If manually configured, it must match the **ing-svc-label** defined for the local router.

No default SDP ID is bound to a mirror destination service ID. If no SDP is bound to the service, the mirror destination is local and cannot be to another router over the core network.

Note:
When using remote mirroring with spoke-SDP configured as a mirror destination, users must allocated resources of another port for use by this features. Refer the mirror configuration notes preceding Configuration notes.

The **no** form of this command removes the SDP binding from the mirror destination service. When removed, no packets are forwarded to the far-end (destination) router from that mirror destination service ID.

Parameters

sdp-id[:vc-id]

Specifies a locally unique SDP identification (ID) number. The SDP ID must exist. If the SDP ID does not exist, an error occurs and the command does not execute.

For mirror services, the *vc-id* defaults to the *service-id*. However, there are scenarios where the *vc-id* is being used by another service. In this case, the SDP binding cannot be created. So, to avoid this, the mirror service SDP bindings now accepts *vc-ids*.

Values 1 to 17407

vc-id

Specifies the virtual circuit identifier.

Values 1 to 4294967295

endpoint *name*

Specifies the name of the endpoint associated with the SAP.

no endpoint

Removes the association of a SAP or a SDP with an explicit endpoint name.

egress

Syntax

egress

Context

config>mirror>mirror-dest>spoke-sdp

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

Commands in this context configure spoke SDP egress parameters.

vc-label

Syntax

vc-label *egress-vc-label*

no vc-label [*egress-vc-label*]

Context

config>mirror>mirror-dest>spoke-sdp>egress

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the spoke-SDP egress VC label.

Parameters

egress-vc-label

Specifies a VC egress value that indicates a specific connection.

Values 16 to 1048575

egress

Syntax

egress

Context

config>mirror>sap

Platforms

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

Description

Commands in this context configure QoS egress policies for this SAP.

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qos

Syntax

[**no**] **qos** *policy-id*

Context

config>mirror>sap>egress

Platforms

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

Description

This command configures the QoS policy for the mirror destination SAP egress. The SAP egress QoS policy to use is specified using the policy ID and must have been configured before associating this policy with the SAP. The SAP egress policy can be configured using the commands under the context **config**>**qos**>**sap-egress**.

When a SAP egress policy is associated with the SAP configured as a mirror destination, the queue associated with FC specified with the CLI command **config**>**mirror**>**mirror-dest**>**fc** is used for traffic sent out of the mirror destination SAP. The policy allows the user to specify the amount of buffers, the WRED policy, the shaping rate and the marking values to use for the mirrored copy.

Note:
On the 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12, this command is available only when SAP-based egress queuing is configured. The command is not available when port-based egress queuing is configured.

The **no** form of this command associates the default SAP egress QoS policy with the SAP.

Default

no qos

Parameters

policy-id

Specifies the QoS policy to be associated with SAP egress. The QoS policy referred to by the *policy-id* is configured using the commands under **config**>**qos**>**sap-egress**.

2.9.2.1.3 Mirror source configuration commands

mirror-source

Syntax

[**no**] **mirror-source** *service-id*

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Context

debug

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures mirror source parameters for a mirrored service.

The **mirror-source** command is used to enable mirroring of packets specified by the association of the **mirror-source** to sources of packets defined within the context of the *mirror-dest-service-id*. The mirror destination service must already exist within the system.

A mirrored packet cannot be mirrored to multiple destinations. If a mirrored packet is correctly referenced by multiple mirror sources (for example, a SAP on one **mirror-source** and a port on another **mirror-source**), the packet is mirrored to a single *mirror-dest-service-id* based on the following hierarchy:

1. Filter entry
2. Service access port (SAP)
3. Physical port

The hierarchy is structured so the most specific match criteria has precedence over a less specific match. For example, if a **mirror-source** defines a port and a SAP on that port, the SAP mirror-source is accepted and the mirror-source for the port is ignored because of the hierarchical order of precedence.

The **mirror-source** configuration is not saved when a configuration is saved. A **mirror-source** manually configured within an ASCII configuration file is not preserved if that file is overwritten by a **save** command. Define the **mirror-source** within a file associated with a **config exec** command to make a **mirror-source** persistent between system reboots.

By default, all mirror-dest service IDs have a **mirror-source** associated with them. The **mirror-source** is not technically created with this command. Instead the service ID provides a contextual node for storing the current mirroring sources for the associated mirror-dest service ID. The **mirror-source** is created for the mirror service when the operator enters the **debug>mirror-source** *svcId* for the first time. The **mirror-source** is also automatically removed when the mirror-dest service ID is deleted from the system.

The **no** form of this command deletes all related source commands within the context of the **mirror-source** *service-id*. The command does not remove the service ID from the system.

Parameters

service-id

Specifies the mirror destination service ID for which match criteria is defined. The *service-id* must already exist within the system.

Values *service-id*: 1 to 2147483647

ip-filter

Syntax

ip-filter *ip-filter-id* **entry** *entry-id* [*entry-id* …]

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no ip-filter *ip-filter-id* **entry** *entry-id*

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables mirroring of packets that match specific entries in an existing IP filter.

The **ip-filter** command directs packets which match the defined list of entry IDs to be mirrored to the mirror destination referenced by the *mirror-dest-service-id* of the **mirror-source**.

The IP filter must already exist in order for the command to execute. Filters are configured in the **config>filter** context. If the IP filter does not exist, an error occurs. If the filter exists but has not been associated with a SAP or IP interface, an error is not generated but mirroring is not enabled (there are no packets to mirror). When the IP filter is defined to a SAP or IP interface, mirroring is enabled.

If the IP filter is defined as ingress, only ingress packets are mirrored. Ingress mirrored packets are mirrored to the mirror destination before any ingress packet modifications.

If the IP filter is defined as egress, only egress packets are mirrored. Egress mirrored packets are mirrored to the mirror destination after all egress packet modifications.

An *entry-id* within an IP filter can only be mirrored to a single mirror destination. If the same *entry-id* is defined multiple times, an error occurs and only the first **mirror-source** definition is in effect.

By default, no packets matching any IP filters are mirrored. Mirroring of IP filter entries must be explicitly defined.

The **no ip-filter** command, without the **entry** keyword, removes mirroring on all *entry-id*'s within the *ip-filter-id*.

The **no** command executed with the **entry** keyword and one or more *entry-id*'s, terminates mirroring of that list of *entry-id*s within the *ip-filter-id*. If an *entry-id* is listed that does not exist, an error occurs and the command does not execute. If an *entry-id* is listed that is not currently being mirrored, no error occurs for that *entry-id* and the command executes.

Parameters

ip-filter-id

Specifies the IP filter ID whose entries are mirrored. If the *ip-filter-id* does not exist, an error occurs and the command does not execute. Mirroring of packets commences when the *ip-filter-id* is defined on a SAP or IP interface.

Values 1 to 65535

entry ***entry-id*** **[*entry-id…*]**

Specifies the IP filter entries to use as match criteria for packet mirroring. The **entry** keyword begins a list of *entry-id*s for mirroring. Multiple *entry-id* entries may be specified with a single command. Each *entry-id* must be separated by a space.

If an *entry-id* does not exist within the IP filter, an error occurs and the command does not execute.

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If the filter's *entry-id* is renumbered within the IP filter definition, the old *entry-id* is removed but the new *entry-id* must be manually added to the configuration to include the new (renumbered) entry's criteria.

Values 1 to 65535

ipv6-filter

Syntax

ipv6-filter *ip-filter-id* **entry** *entry-id* [*entry-id …*]

no ipv6-filter *ip-filter-id* **entry** *entry-id*

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables mirroring of packets that match specific entries in an existing IPv6 filter.

The **ipv6-filter** command directs packets which match the defined list of entry IDs to be mirrored to the mirror destination referenced by the *mirror-dest-service-id* of the **mirror-source**.

The IPv6 filter must already exist in order for the command to execute. Filters are configured in the **config>filter** context. If the IPv6 filter does not exist, an error occurs. If the filter exists but has not been associated with a SAP or IP interface, an error is not generated but mirroring is not enabled (there are no packets to mirror). When the IPv6 filter is defined to a SAP or IP interface, mirroring is enabled.

If the IPv6 filter is defined as ingress, only ingress packets are mirrored. Ingress mirrored packets are mirrored to the mirror destination before any ingress packet modifications.

If the IPv6 filter is defined as egress, only egress packets are mirrored. Egress mirrored packets are mirrored to the mirror destination after all egress packet modifications.

An *entry-id* within an IPv6 filter can only be mirrored to a single mirror destination. If the same *entry-id* is defined multiple times, an error occurs and only the first **mirror-source** definition is in effect.

By default, no packets matching any IPv6 filters are mirrored. Mirroring of IPv6 filter entries must be explicitly defined.

The **no ipv6-filter** command, without the **entry** keyword, removes mirroring on all *entry-id*s within the *ipv6-filter-id*.

When the **no** command is executed with the **entry** keyword and one or more *entry-id*s, mirroring of that list of *entry-id*s is terminated within the *ipv6-filter-id*. If an *entry-id* is listed that does not exist, an error occurs and the command does not execute. If an *entry-id* is listed that is not currently being mirrored, no error occurs for that *entry-id* and the command executes.

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Parameters

ipv6-filter-id

The IPv6 filter ID whose entries are mirrored. If the *ipv6-filter-id* does not exist, an error occurs and the command does not execute. Mirroring of packets commences when the *ipv6-filter-id* is defined on a SAP or IP interface.

Values 1 to 65535

entry *entry-id* [*entry-id…*]

Specifies the IPv6 filter entries to use as match criteria for packet mirroring. The entry keyword begins a list of *entry-id*s for mirroring. Multiple *entry-id* entries may be specified with a single command. Each *entry-id* must be separated by a space.

If an *entry-id* does not exist within the IPv6 filter, an error occurs and the command does not execute.

If the filter's *entry-id* is renumbered within the IPv6 filter definition, the old *entry-id* is removed but the new *entry-id* must be manually added to the configuration to include the new (renumbered) entry's criteria.

Values 1 to 65535

mac-filter

Syntax

mac-filter *mac-filter-id* **entry** *entry-id* [*entry-id …*]

no mac-filter *mac-filter-id*

no mac-filter *mac-filter-id* **entry** *entry-id* [*entry-id …*]

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables mirroring of packets that match specific entries in an existing MAC filter.

The **mac-filter** command directs packets which match the defined list of entry IDs to be mirrored to the mirror destination referenced by the *mirror-dest-service-id* of the **mirror-source**.

The MAC filter must already exist in order for the command to execute. Filters are configured in the config>filter context. If the MAC filter does not exist, an error occurs. If the filter exists but has not been associated with a SAP or IP interface, an error is not generated but mirroring is not enabled (there are no packets to mirror). When the filter is defined to a SAP or MAC interface, mirroring is enabled.

If the MAC filter is defined as ingress, only ingress packets are mirrored. Ingress mirrored packets are mirrored to the mirror destination before any ingress packet modifications.

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The **no mac-filter** command, without the **entry** keyword, removes mirroring on all *entry-id*s within the *mac-filter-id*.

When the **no** command is executed with the **entry** keyword and one or more *entry-id*s, mirroring of that list of *entry-id*'s is terminated within the *mac-filter-id*. If an *entry-id* is listed that does not exist, an error occurs and the command does not execute. If an *entry-id* is listed that is not currently being mirrored, no error occurs for that *entry-id* and the command executes.

Parameters

mac-filter-id

Specifies the MAC filter ID whose entries are mirrored. If the *mac-filter-id* does not exist, an error occurs and the command does not execute. Mirroring of packets commences when the *mac-filter-id* is defined on a SAP.

Values 1 to 65535

entry *entry-id* [*entry-id…*]

Specifies the MAC filter entries to use as match criteria for packet mirroring. The **entry** keyword begins a list of *entry-id*'s for mirroring. Multiple *entry-id* entries may be specified with a single command. Each *entry-id* must be separated by a space. Up to 8 entry IDs may be specified in a single command.

Each *entry-id* must exist within the *mac-filter-id*. If the *entry-id* is renumbered within the MAC filter definition, the old *entry-id* is removed from the list and the new *entry-id* needs to be manually added to the list if mirroring is still wanted.

If no *entry-id* entries are specified in the command, mirroring does not occur for that MAC filter ID. The command has no effect.

Values 1 to 65535

port

Syntax

port {*port-id* | **lag** *lag-id*} {[**egress**] [**ingress**]}

no port {*port-id* | **lag** *lag-id*} [**egress**] [**ingress**]

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables mirroring of traffic ingressing or egressing a port (Ethernet port, or Link Aggregation Group (LAG)).

The **port** command associates a port or LAG to a mirror source. The port is identified by the *port-id*. The defined port may be Ethernet, access or access uplink. access. A port may be a single port or a Link

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Aggregation Group (LAG) ID. When a LAG ID is specified as the *port-id*, mirroring is enabled on all ports making up the LAG. Either a LAG port member or the LAG port can be mirrored.

The port is only referenced in the mirror source for mirroring purposes. If the port is removed from the system, the mirroring association is removed from the mirror source.

The same port may not be associated with multiple mirror source definitions with the **ingress** parameter defined. The same port may not be associated with multiple mirror source definitions with the **egress** parameter defined.

If a SAP is mirrored on an access port, the SAP mirroring has precedence over the access port mirroring when a packet matches the SAP mirroring criteria. Filter and label mirroring destinations have precedence over a port-mirroring destination.

If the port is not associated with a **mirror-source**, packets on that port are not mirrored. Mirroring may still be defined for a SAP or filter entry, which mirrors based on a more specific criteria.

The **no** form of this command disables port mirroring for the specified port. Mirroring of packets on the port may continue because of more specific mirror criteria. If the **egress** or **ingress** parameter keywords are specified in the **no** command, only the ingress or egress mirroring condition are removed.

Parameters

port-id

Specifies the port ID.

Values 7210 SAS-Mxp: 1 to 28

7210 SAS-R6 and 7210 SAS-R12: values depend on the type of IMM card used



Note:
See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information about the number of ports supported on different IMMs.

7210 SAS-Sx/S 1/10GE: for 24 port variant: 1/1/25 and 1/1/26; for 48 port variant: 1/1/49 and 1/1/50.

7210 SAS-Sx 10/100GE: port variant: 1/1/68

lag-id

Specifies the LAG identifier, expressed as a decimal integer.

Values 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-S 1/10GE: 1 to 25

7210 SAS-R6 and 7210 SAS-R12: 1 to 63

7210 SAS-Sx 1/10GE and 7210 SAS-Sx 10/100GE: 1 to 56

egress

Specifies that packets egressing the port should be mirrored. Egress packets are mirrored to the mirror destination after egress packet modification.

ingress

Specifies that packets ingressing the port should be mirrored. Ingress packets are mirrored to the mirror destination before ingress packet modification.

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sap

Syntax

no sap *sap-id* {[**ingress**]}

no sap *sap-id* {[**ingress**]}

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables mirroring of traffic ingressing or egressing a service access port (SAP). A SAP that is defined within a mirror destination cannot be used in a mirror source. The mirror source SAP referenced by the *sap-id* is owned by the service ID of the service in which it was created. The SAP is only referenced in the mirror source name for mirroring purposes. The mirror source association does not need to be removed before deleting the SAP from its service ID. If the SAP is deleted from its service ID, the mirror association is removed from the mirror source.

More than one SAP can be associated within a single **mirror-source**. Each SAP has its own **ingress** parameter keywords to define which packets are mirrored to the mirror destination.

The SAP must be valid and correctly configured. If the associated SAP does not exist, an error occurs and the command does not execute.

The same SAP cannot be associated with multiple mirror source definitions for ingress packets.

If a particular SAP is not associated with a mirror source name, that SAP does not have mirroring enabled for that mirror source.

The **no** form of this command disables mirroring for the specified SAP. All mirroring for that SAP on ingress and egress is terminated. Mirroring of packets on the SAP can continue if more specific mirror criteria is configured. If the **egress** or **ingress** parameter keywords are specified in the **no** command, only the ingress or egress mirroring condition is removed.

Parameters

sap-id

Specifies the physical port identifier portion of the SAP definition. See Common CLI command descriptions for command syntax.

ingress

Specifies that packets ingressing the SAP should be mirrored. Ingress packets are mirrored to the mirror destination before ingress packet modification.

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2.9.2.2 Show commands

debug

Syntax

debug [*application*]

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays set debug points.

Parameters

application

Displays which debug points have been set.

Values service, ip, ospf, ospf3, mtrace, isis, mpls, rsvp, ldp, mirror, system, filter, subscriber-mgmt, radius, lag, oam

Output

The following output is an example of debug point information.

Sample output

```
*A:alu1# show debug
debug
    mirror-source 101
        port 1/1/1 ingress
        no shutdown
    exit
    mirror-source 102
        port 1/1/3 egress
        no shutdown
    exit
exit
*A:alu1#
```

service-using

Syntax

service-using [**mirror**]

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Context

show>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays mirror services.

If no optional parameters are specified, all services defined on the system are displayed.

Parameters

mirror

Displays mirror services.

Output

The following output is an example of mirror services information, and Table 9: Output Fields: service-using describes the output fields.

Sample output

```
A:ALA-48# show service service-using mirror
===============================================================================
Services [mirror]
===============================================================================
ServiceId    Type      Adm    Opr        CustomerId        Last Mgmt Change
-------------------------------------------------------------------------------
218          Mirror    Up     Down       1                 04/08/2007 13:49:57
318          Mirror    Down   Down       1                 04/08/2007 13:49:57
319          Mirror    Up     Down       1                 04/08/2007 13:49:57
320          Mirror    Up     Down       1                 04/08/2007 13:49:57
1000         Mirror    Down   Down       1                 04/08/2007 13:49:57
1216         Mirror    Up     Down       1                 04/08/2007 13:49:57
1412412      Mirror    Down   Down       1                 04/08/2007 13:49:57
-------------------------------------------------------------------------------
Matching Services : 7
===============================================================================
A:ALA-48#
```

Table 9: Output Fields: service-using

Label	Description
Service Id	The service identifier.
Type	Specifies the service type configured for the service ID.
Adm	The desired state of the service.
Opr	The operating state of the service.
CustomerID	The ID of the customer who owns this service.

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Label	Description
Last Mgmt Change	The date and time of the most recent management-initiated change to this service.

mirror

Syntax

mirror mirror-dest *service-id*

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays mirror configuration and operation information.

Parameters

service-id

Specifies the mirror service ID.

Values [1..2147483648]| svc-name:64 char max

Output

The following outputs are examples of mirroring information, and Table 10: Output fields: mirror describes the output fields.

Sample output

```
*A:7210SAS>config>mirror>mirror-dest$ show mirror mirror-dest

===============================================================================
Mirror Services
===============================================================================
Id   Type   Adm    Opr    Destination               SDP Lbl/
                                                    SAP QoS          Src
                                                                     Allowed
-------------------------------------------------------------------------------
1    Ether  Down   Down   None                      n/a        0     Local
1000 Ether  Up     Down   SDP 400 (1.1.1.1)         Pending    0     Local
2000 Ether  Up     Up     SAP 1/1/17:17             1          0     Remote
===============================================================================
*A:7210SAS>config>mirror>mirror-dest$
```

Sample output for network mode

```
*A:7210SAS>config>mirror>mirror-dest$ show mirror mirror-dest 1
```


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```
===============================================================================
Mirror Service
===============================================================================
Service Id       : 1                    Type          : Ether
Description      : (Not Specified)
Admin State      : Down                 Oper State    : Down
Mirror Sources Allowed          : Local
Forwarding Class : be                   Remote Sources: No
Profile          : out

============================================================
Mirror Services SDP
============================================================
SdpId       IP Addr         CfgLabel    Signal    EgrLabel
------------------------------------------------------------
No Matching Entries
============================================================

-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up

No Mirror Sources configured
===============================================================================
*A:7210SAS>config>mirror>mirror-dest$
```

Sample output for access-uplink mode

```
*A:7210SAS# show mirror mirror-dest 1000

===============================================================================
Mirror Service
===============================================================================
Service Id       : 1000                 Type          : Ether
Description      : (Not Specified)
Admin State      : Up                   Oper State    : Down
Mirror Sources Allowed          : Local
Profile          : out
Destination SAP  : 1/1/1

-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up

-Port                                   1/1/1                               Ing
===============================================================================
*A:7210SAS#
```

Table 10: Output fields: mirror

Label	Description
Service Id	The service ID associated with this mirror destination.
Type	Entries in this table have an implied storage type of “volatile”. The configured mirror source information is not persistent.

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Label	Description
Admin State	Up — The mirror destination is administratively enabled.
	Down — The mirror destination is administratively disabled.
Oper State	Up — The mirror destination is operationally enabled.
	Down — The mirror destination is operationally disabled.
Forwarding Class	The forwarding class for all packets transmitted to the mirror destination.
Remote Sources	Yes — A remote source is configured.
	No — A remote source is not configured.
Destination SAP	The ID of the access port where the Service Access Point (SAP) associated with this mirror destination service is defined.
Egr QoS Policy	This value indicates the egress QoS policy ID. A value of 0 indicates that no QoS policy is specified.
mirror sources allowed	This value tells the user the type of mirror sources allowed to be configured.

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3 OAM and SAA

This chapter provides information about the Operations, Administration, and Management (OAM) and Service Assurance Agent (SAA) commands available in the CLI for troubleshooting services.

3.1 OAM overview

Delivery of services requires a number of operations occur correctly and at different levels in the service delivery model. For example, operations such as the association of packets to a service, must be performed correctly in the forwarding plane for the service to function correctly. To verify that a service is operational, a set of in-band, packet-based Operation, Administration, and Maintenance (OAM) tools is required, with the ability to test each of the individual packet operations.

For in-band testing, the OAM packets closely resemble customer packets to effectively test the customer forwarding path, but they are distinguishable from customer packets so they are kept within the service provider network and not forwarded to the customer.

The suite of OAM diagnostics supplement the basic IP ping and traceroute operations with diagnostics specialized for the different levels in the service delivery model. There are diagnostics for services.

Note:
The following OAM features are supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode:

- LSP Diagnostics
- SDP Diagnostics
- Service Diagnostics
- VPLS MAC Diagnostics
- VLL Diagnostics

3.1.1 LSP diagnostics: LSP ping and trace

Note:
P2MP LSP references in this section apply only to the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC mode), and 7210 SAS-T.

This section provides a generalized description of the LSP diagnostics tools. Users should take into account the following restrictions when reading the information contained in this section:

- The 7210 SAS does not support LDP LER ECMP. Descriptions of LDP ECMP as an LER node in LSP diagnostics: LSP ping and trace do not apply to 7210 SAS platforms.
- LDP LSR ECMP is only supported on 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-R6, and 7210 SAS-R12. The description on LDP ECMP as LSR node applies only to these platforms.

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- 7210 SAS platforms support LDP and BGP 3107 labeled routes. The 7210 SAS does not support LDP FEC stitching to BGP 3107 labeled route to LDP FEC stitching and vice-versa. The following description about stitching of BGP 3107 labeled routes to LDP FEC is provided to describe the behavior in an end-to-end network solution deployed using 7210 SAS and 7x50 nodes, with 7210 SAS nodes acting as the LER node.

Note:
7210 SAS platforms do not support the use of ECMP routes for BGP 3107 labeled routes. The feature description is provided in this section for completeness and better understanding of the behavior in the end-to-end network solution deployed using 7210 SAS and 7750 nodes.

The router LSP diagnostics are implementations of LSP ping and LSP trace based on RFC 4379, Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures. LSP ping provides a mechanism to detect data plane failures in MPLS LSPs. LSP ping and LSP trace are modeled after the ICMP echo request/reply used by ping and trace to detect and localize faults in IP networks.

For a specific LDP FEC, RSVP P2P LSP, or BGP IPv4 Label Router, LSP ping verifies whether the packet reaches the egress label edge router (LER), while in LSP trace mode, the packet is sent to the control plane of each transit label switched router (LSR) which performs various checks to see if it is actually a transit LSR for the path.

The downstream mapping TLV is used in LSP ping and LSP trace to provide a mechanism for the sender and responder nodes to exchange and validate interface and label stack information for each downstream of an LDP FEC or an RSVP LSP and at each hop in the path of the LDP FEC or RSVP LSP.

Two downstream mapping TLVs are supported: the original Downstream Mapping (DSMAP) TLV defined in RFC 4379 and the new Downstream Detailed Mapping (DDMAP) TLV defined in RFC 6424.

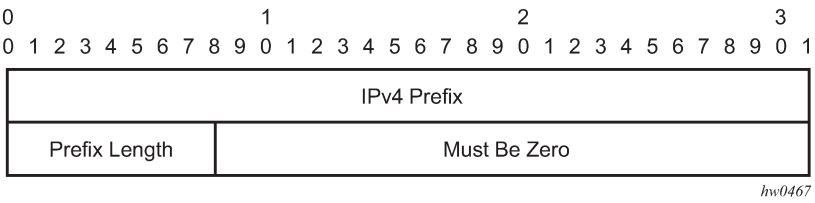
When the responder node has multiple equal cost next-hops for an LDP FEC prefix, the downstream mapping TLV can further be used to exercise a specific path of the ECMP set using the **path-destination** option. The behavior in this case is described in the following ECMP subsection.

3.1.1.1 LSP ping/trace for an LSP using a BGP IPv4 label route

This feature adds support of the target FEC stack TLV of type BGP Labeled IPv4 /32 Prefix as defined in RFC 4379.

The new TLV is structured as shown in the following figure.

Figure 7: Target FEC stack TLV for a BGP labeled IPv4 prefix



The user issues a LSP ping using the existing CLI command and specifying a new type of prefix:

oam lsp-ping bgp-label prefix *ip-prefix*/*mask* [**src-ip-address** *ip-address*] [**fc** *fc-name*] [**size** *octets*] [**ttl** *label-ttl*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]] [**detail**]

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The path-destination option is used for exercising specific ECMP paths in the network when the LSR performs hashing on the MPLS packet.

Similarly, the user issues a LSP trace using the following command:

oam lsp-trace bgp-label prefix *ip-prefix*/*mask* [**src-ip-address** *ip-address*] [**fc** *fc-name*] [**max-fail** *no-response-count*] [**probe-count** *probes-per-hop*] [**size** *octets*] [**min-ttl** *min-label-ttl*] [**max-ttl** *max-label-ttl*] [**timeout** *timeout*] [**interval** *interval*] [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]] [**detail**]

The following are the procedures for sending and responding to an LSP ping or LSP trace packet. These procedures are valid when the downstream mapping is set to the DSMAP TLV. The detailed procedures with the DDMAP TLV are presented in Using DDMAP TLV in LSP stitching and LSP hierarchy:

1. The next-hop of a BGP label route for a core IPv4 /32 prefix is always resolved to an LDP FEC or an RSVP LSP. Therefore, the sender node encapsulates the packet of the echo request message with a label stack which consists of the LDP/RSVP outer label and the BGP inner label.

   If the packet expires on an RSVP or LDP LSR node which does not have context for the BGP label IPv4 /32 prefix, it validates the outer label in the stack and if the validation is successful it replies the same way as it does today when it receives an echo request message for an LDP FEC which is stitched to a BGP IPv4 label route. That is, it replies with return code 8 "Label switched at stack-depth <RSC>."
2. The LSR node that is the next-hop for the BGP label IPv4 /32 prefix as well as the LER node that originated the BGP label IPv4 prefix both have full context for the BGP IPv4 target FEC stack and, as a result, can perform full validation of it.
3. If the BGP IPv4 label route is stitched to an LDP FEC, the egress LER for the resulting LDP FEC will not have context for the BGP IPv4 target FEC stack in the echo request message and replies with return code 4 "Replying router has no mapping for the FEC at stack- depth <RSC>." This is the same behavior as that of an LDP FEC which is stitched to a BGP IPv4 label route when the echo request message reaches the egress LER for the BGP prefix.

Note:
Only BGP label IPv4 /32 prefixes are supported because these are usable as tunnels on nodes. BGP label IPv6 /128 prefixes are not currently usable as tunnels on a node and are not supported in LSP ping or trace.

3.1.1.2 ECMP considerations

Note:
BGP 3107 labelled route ECMP is not supported on 7210 SAS platforms. References to BGP 3107 labelled route ECMP are included in this section only for completeness of the feature description.

When the responder node has multiple equal cost next-hops for an LDP FEC or a BGP label IPv4 prefix, it replies in the DSMAP TLV with the downstream information of the outgoing interface that is part of the ECMP next-hop set for the prefix.

However, when a BGP label route is resolved to an LDP FEC (of the BGP next-hop of the BGP label route), ECMP can exist at both the BGP and LDP levels. The following next-hop selection is performed in this case:

1. For each BGP ECMP next hop of the label route, a single LDP next hop is selected even if multiple LDP ECMP next hops exist. Therefore, the number of ECMP next hops for the BGP IPv4 label route is equal to the number of BGP next-hops.

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2. ECMP for a BGP IPv4 label route is only supported at the provider edge (PE) router (BGP label push operation) and not at ABR and ASBR (BGP label swap operation). Therefore, at an LSR, a BGP IPv4 label route is resolved to a single BGP next hop, which is resolved to a single LDP next hop.
3. LSP trace will return one downstream mapping TLV for each next-hop of the BGP IPv4 label route. It will also return the exact LDP next-hop that the datapath programmed for each BGP next-hop.

In the following description of LSP ping and LSP trace behavior, generic references are made to specific terms as follows: FEC can represent either an LDP FEC or a BGP IPv4 label router, and a Downstream Mapping TLV can represent either the DSMAP TLV or the DDMAP TLV:

1. If the user initiates an LSP trace of the FEC without the **path-destination** option specified, the sender node does not include multi-path information in the Downstream Mapping TLV in the echo request message (multipath type=0). In this case, the responder node replies with a Downstream Mapping TLV for each outgoing interface that is part of the ECMP next-hop set for the FEC. The sender node will select the first Downstream Mapping TLV only for the subsequent echo request message with incrementing TTL.
2. If the user initiates an LSP ping of the FEC with the **path-destination** option specified, the sender does not include the Downstream Mapping TLV. However, the user can configure the **interface** option, part of the same **path-destination** option, to direct the echo request message at the sender node to be sent from a specific outgoing interface that is part of an ECMP path set for the FEC.
3. If the user initiates an LSP trace of the FEC with the **path-destination** option specified but configured to exclude a Downstream Mapping TLV in the MPLS echo request message using the CLI command **downstream-map-tlv** {**none**}, the sender node does not include the Downstream Mapping TLV. However, the user can configure the **interface** option, part of the same **path-destination** option, to direct the echo request message at the sender node to be sent out a specific outgoing interface that is part of an ECMP path set for the FEC.
4. If the user initiates an LSP trace of the FEC with the **path-destination** option specified, the sender node includes the multipath information in the Downstream Mapping TLV in the echo request message (multipath type=8). The **path-destination** option allows the user to exercise a specific path of a FEC in the presence of ECMP. The user enters a specific address from the 127/8 range, which is then inserted in the multipath type 8 information field of the Downstream Mapping TLV. The CPM code at each LSR in the path of the target FEC runs the same hash routine as the datapath and replies in the Downstream Mapping TLV with the specific outgoing interface the packet would have been forwarded to if it had not expired at this node and if the DEST IP field in the packet's header was set to the 127/8 address value inserted in the multipath type 8 information.
5. The **ldp-treetrace** tool always uses the multipath type=8 value and inserts a range of 127/8 addresses instead of a single address to exercise multiple ECMP paths of an LDP FEC. The behavior is the same as the **lsp-trace** command with the **path-destination** option enabled.
6. The **path-destination** option can also be used to exercise a specific ECMP path of an LDP FEC tunneled over an RSVP LSP or ECMP path of an LDP FEC stitched to a BGP FEC in the presence of BGP ECMP paths. The user must enable the use of the DDMAP TLV either globally (**config**>**test-oam**>**mpls-echo-request-downstream-map ddmap**) or within the specific **ldp-treetrace** or LSP trace test (**downstream-map-tlv ddmap** option).

3.1.1.3 LSP ping and LSP trace over unnumbered IP interface

LSP ping and P2MP LSP ping operate over a network using unnumbered links without any changes. LSP trace, P2MP LSP trace and LDP treetrace are modified such that the unnumbered interface is correctly encoded in the downstream mapping (DSMAP/DDMAP) TLV.

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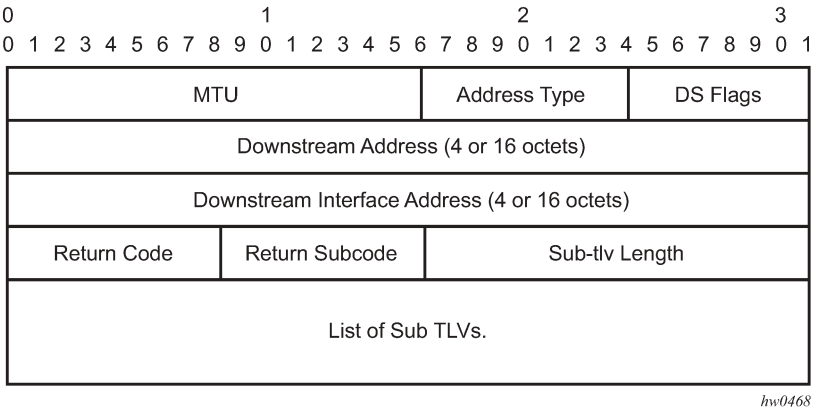
In a RSVP P2P or P2MP LSP, the upstream LSR encodes the downstream router ID in the Downstream IP Address field and the local unnumbered interface index value in the Downstream Interface Address field of the DSMAP/DDMAP TLV as per RFC 4379. Both values are taken from the TE database.

In a LDP unicast FEC or mLDP P2MP FEC, the interface index assigned by the peer LSR is not readily available to the LDP control plane. In this case, the alternative method described in RFC 4379 is used. The upstream LSR sets the Address Type to IPv4 Unnumbered, the Downstream IP Address to a value of 127.0.0.1, and the interface index is set to 0. If an LSR receives an echo-request packet with this encoding in the DSMAP/DDMAP TLV, it will bypass interface verification but continue with label validation.

3.1.1.4 Downstream Detailed Mapping (DDMAP) TLV

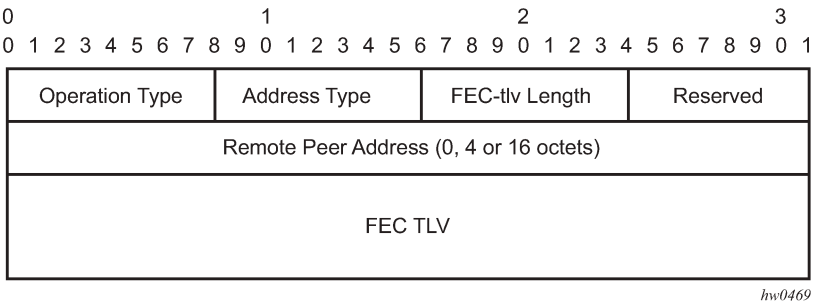
The DDMAP TLV provides with exactly the same features as the existing DSMAP TLV, plus the enhancements to trace the details of LSP stitching and LSP hierarchy. The latter is achieved using a new sub-TLV of the DDMAP TLV called the FEC stack change sub-TLV. The following figures show the structures of these two objects as defined in RFC 6424.

Figure 8: DDMAP TLV



The DDMAP TLV format is derived from the DSMAP TLV format. The key change is that variable length and optional fields have been converted into sub-TLVs. The fields have the same use and meaning as in RFC 4379.

Figure 9: FEC stack change sub-TLV



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The operation type specifies the action associated with the FEC stack change. The following operation types are defined.

```
Type #     Operation
------     ---------
1          Push
2          Pop
```

More details on the processing of the fields of the FEC stack change sub-TLV are provided later in this section.

The user can configure which downstream mapping TLV to use globally on a system by using the following command:

configure test-oam mpls-echo-request-downstream-map {**dsmap** | **ddmap**}

This command specifies which format of the downstream mapping TLV to use in all LSP trace packets and LDP tree trace packets originated on this node. The Downstream Mapping (DSMAP) TLV is the original format in RFC 4379 and is the default value. The Downstream Detailed Mapping (DDMAP) TLV is the new enhanced format specified in RFC 6424.

This command applies to LSP trace of an RSVP P2P LSP, a MPLS-TP LSP, a BGP IPv4 Label Route, or LDP unicast FEC, and to LDP tree trace of a unicast LDP FEC. It does not apply to LSP trace of an RSVP P2MP LSP which always uses the DDMAP TLV.

The global DSMAP/DDMAP setting impacts the behavior of both OAM LSP trace packets and SAA test packets of type **lsp-trace** and is used by the sender node when one of the following events occurs:

1. An SAA test of type **lsp-trace** is created (not modified) and no value is specified for the per-test **downstream-map-tlv** {**dsmap** | **ddmap** | **none**} option. In this case the SAA test **downstream-map-tlv** value defaults to the global **mpls-echo-request-downstream-map** value.
2. An OAM test of type **lsp-trace** test is executed and no value is specified for the per-test **downstream-map-tlv** {**dsmap** | **ddmap** | **none**} option. In this case, the OAM test **downstream-map-tlv** value defaults to the global **mpls-echo-request-downstream-map** value.

A consequence of the preceding rules is that a change to the value of **mpls-echo-request-downstream-map** option does not affect the value inserted in the downstream mapping TLV of existing tests.

The following are the details of the processing of the new DDMAP TLV:

1. When either the DSMAP TLV or the DDMAP TLV is received in an echo request message, the responder node will include the same type of TLV in the echo reply message with the correct downstream interface information and label stack information.
2. If an echo request message without a Downstream Mapping TLV (DSMAP or DDMAP) expires at a node which is not the egress for the target FEC stack, the responder node always includes the DSMAP TLV in the echo reply message. This can occur in the following cases:
   a. The user issues a LSP trace from a sender node with a **min-ttl** value higher than 1 and a **max-ttl** value lower than the number of hops to reach the egress of the target FEC stack. This is the sender node behavior when the global configuration or the per-test setting of the DSMAP/DDMAP is set to DSMAP.
   b. The user issues a LSP ping from a sender node with a **ttl** value lower than the number of hops to reach the egress of the target FEC stack. This is the sender node behavior when the global configuration of the DSMAP/DDMAP is set to DSMAP.
   c. The behavior in 2.a is changed when the global configuration or the per-test setting of the Downstream Mapping TLV is set to DDMAP. The sender node will include in this case the DDMAP

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TLV with the Downstream IP address field set to the all-routers multicast address as per Section 3.3 of RFC 4379. The responder node then bypasses the interface and label stack validation and replies with a DDMAP TLV with the correct downstream information for the target FEC stack.

3. A sender node never includes the DSMAP or DDMAP TLV in an LSP ping message.

3.1.1.5 Using DDMAP TLV in LSP stitching and LSP hierarchy

In addition to performing the same features as the DSMAP TLV, the new DDMAP TLV addresses the following scenarios:

1. Full validation of an LDP FEC stitched to a BGP IPv4 label route. In this case, the LSP trace message is inserted from the LDP LSP segment or from the stitching point.
2. Full validation of a BGP IPv4 label route stitched to an LDP FEC. The LSP trace message is inserted from the BGP LSP segment or from the stitching point.
3. Full validation of an LDP FEC which is stitched to a BGP LSP and stitched back into an LDP FEC. In this case, the LSP trace message is inserted from the LDP segments or from the stitching points.
4. Full validation of an LDP FEC tunneled over an RSVP LSP using LSP trace.
5. Full validation of a BGP IPv4 label route tunneled over an RSVP LSP or an LDP FEC.

To correctly check a target FEC which is stitched to another FEC (stitching FEC) of the same or a different type, or which is tunneled over another FEC (tunneling FEC), it is necessary for the responding nodes to provide details about the FEC manipulation back to the sender node. This is achieved via the use of the new FEC stack change sub-TLV in the Downstream Detailed Mapping TLV (DDMAP) defined in RFC 6424.

When the user configures the use of the DDMAP TLV on a trace for an LSP that does not undergo stitching or tunneling operation in the network, the procedures at the sender and responder nodes are the same as in the case of the existing DSMAP TLV.

This feature however introduces changes to the target FEC stack validation procedures at the sender and responder nodes in the case of LSP stitching and LSP hierarchy. These changes pertain to the processing of the new FEC stack change sub-TLV in the new DDMAP TLV and the new return `code 15 Label switched with FEC change`. The following is a description of the main changes which are a superset of the rules described in Section 4 of RFC 6424 to allow greater scope of interoperability with other vendor implementations.

3.1.1.5.1 Responder node procedures

The following are responder node procedures:

1. As a responder node, the node will always insert a global return code return code of either 3 `Replying router is an egress for the FEC at stack-depth` <RSC> or 14 `See DDMAP TLV for Return Code and Return Subcode`.
2. When the responder node inserts a global return code of 3, it will not include a DDMAP TLV.
3. When the responder node includes the DDMAP TLV, it inserts a global return `code 14 See DDMAP TLV for Return Code and Return Subcode` and:
   a. On a success response, include a return code of 15 in the DDMAP TLV for each downstream which has a FEC stack change TLV.

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b. On a success response, include a return `code 8 Label switched at stack-depth` <RSC> in the DDMAP TLV for each downstream if no FEC stack change sub-TLV is present.

c. On a failure response, include an appropriate error return code in the DDMAP TLV for each downstream.

4. A tunneling node indicates that it is pushing a FEC (the tunneling FEC) on top of the target FEC stack TLV by including a FEC stack change sub-TLV in the DDMAP TLV with a FEC operation type value of PUSH. It also includes a return `code 15 Label switched with FEC change`. The downstream interface address and downstream IP address fields of the DDMAP TLV are populated for the pushed FEC. The remote peer address field in the FEC stack change sub-TLV is populated with the address of the control plane peer for the pushed FEC. The Label stack sub-TLV provides the full label stack over the downstream interface.
5. A node that is stitching a FEC indicates that it is performing a POP operation for the stitched FEC followed by a PUSH operation for the stitching FEC and potentially one PUSH operation for the transport tunnel FEC. It will therefore include two or more FEC stack change sub-TLVs in the DDMAP TLV in the echo reply message. It also includes and a return `code 15 Label switched with FEC change`. The downstream interface address and downstream address fields of the DDMAP TLV are populated for the stitching FEC. The remote peer address field in the FEC stack change sub-TLV of type POP is populated with a null value (0.0.0.0). The remote peer address field in the FEC stack change sub-TLV of type PUSH is populated with the address of the control plane peer for the tunneling FEC. The Label stack sub-TLV provides the full label stack over the downstream interface.
6. If the responder node is the egress for one or more FECs in the target FEC Stack, then it must reply with no DDMAP TLV and with a return `code 3 Replying router is an egress for the FEC at stack-depth` <RSC>. RSC must be set to the depth of the topmost FEC.

   This operation is iterative in the sense that, at the receipt of the echo reply message, the sender node will pop the topmost FEC from the target stack FEC TLV and resend the echo request message with the same TTL value as described in step 5 as follows. The responder node will therefore perform exactly the same operation as described in this step until all FECs are popped or until the topmost FEC in the target FEC stack TLV matches the tunneled or stitched FEC. In the latter case, processing of the target FEC stack TLV follows again steps 1 or 2.

3.1.1.5.2 Sender node procedures

The following are sender node procedures:

1. If the echo reply message contains the return `code 14 See DDMAP TLV for Return Code and Return Subcode` and the DDMAP TLV has a return `code 15 Label switched with FEC change`, the sender node adjusts the target FEC Stack TLV in the echo request message for the next value of the TTL to reflect the operation on the current target FEC stack as indicated in the FEC stack change sub-TLV received in the DDMAP TLV of the last echo reply message. That is, one FEC is popped at most and one or more FECs are pushed as indicated.
2. If the echo reply message contains the return `code 3 Replying router is an egress for the FEC at stack-depth` <RSC>, then:

   a. If the value for the label stack depth specified in the Return Sub-Code (RSC) field is the same as the depth of current target FEC Stack TLV, then the sender node considers the trace operation complete and terminates it. A responder node will cause this case to occur as per step 6 of the Responder node procedures.

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b. If the value for the label stack depth specified in the Return Sub-Code (RSC) field is different from the depth of the current target FEC Stack TLV, the sender node must continue the LSP trace with the same TTL value after adjusting the target FEC stack TLV by removing the top FEC. Note this step will continue iteratively until the value for the label stack depth specified in the Return Sub-Code (RSC) field is the same as the depth of current target FEC Stack TLV and in which case step 2.a is performed. A responder node will cause this case to occur as per step 6 of the Responder node procedures.

c. If a DDMAP TLV with or without a FEC stack change sub-TLV is included, then the sender node must ignore it and processing is performed as per steps 2.a or 2.b preceding. A responder node will not cause this case to occur but a third party implementation may do.

3. As a sender node, the can accept an echo-reply message with the global return code of either 14 (with DDMAP TLV return code of 15 or 8), or15 and process correctly the FEC stack change TLV as per step 1 of the sender node procedures.
4. If an LSP ping is performed directly to the egress LER of the stitched FEC, there is no DDMAP TLV included in the echo request message and therefore the responder node, which is the egress node, will still reply with return `code 4 Replying router has no mapping for the FEC at stack-depth` <RSC>. This case cannot be resolved with this feature.

Note:
The following limitation applies when a BGP IPv4 label route is resolved to an LDP FEC which is resolved to an RSVP LSP all on the same node. This 2-level LSP hierarchy is not supported as a feature on SR OS but the user is not prevented from configuring it. In that case, user and OAM packets are forwarded by the sender node using two labels (T-LDP and BGP). The LSP trace will fail on the downstream node with return `code 1 Malformed echo request received` because there is no label entry for the RSVP label.

3.1.2 MPLS OAM support in segment routing

Note:
This feature is supported only on the 7210 SAS-Mxp, 7210 SAS-R6 (IMM-b and IMM-c only), 7210 SAS-R12 (IMM-b and IMM-c only), 7210 SAS-Sx/S 1/10GE (standalone mode), and 7210 SAS-Sx 10/100GE (standalone mode).

MPLS OAM supports segment routing extensions to **lsp-ping** and **lsp-trace** as defined in *draft-ietf-mpls-spring-lsp-ping*.

When the data plane uses MPLS encapsulation, MPLS OAM tools such as **lsp-ping** and **lsp-trace** can be used to check connectivity and trace the path to any midpoint or endpoint of an SR-ISIS or SR-OSPF shortest path tunnel.

The CLI options for **lsp-ping** and **lsp-trace** are under OAM and SAA for SR-ISIS and SR-OSPF node SID tunnels.

3.1.2.1 SR extensions for LSP-PING and LSP-TRACE

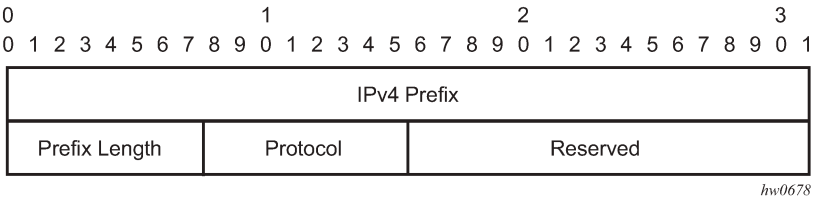
This section describes how MPLS OAM models the SR tunnel types.

An SR shortest path tunnel, SR-ISIS or SR-OSPF tunnel, uses a single FEC element in the target FEC stack TLV. The FEC corresponds to the prefix of the node SID in a specific IGP instance.

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The following figure shows the format of the IPv4 IGP-prefix segment ID.

Figure 10: IPv4 IGP-prefix SID format



In this format, the fields are as follows:

- **IPv4 prefix**

  The IPv4 Prefix field carries the IPv4 prefix to which the segment ID is assigned. For an anycast segment ID, this field carries the IPv4 anycast address. If the prefix is shorter than 32 bits, trailing bits must be set to zero.

- **Prefix length**

  The Prefix Length field is one octet. It gives the length of the prefix in bits; allowed values are 1 to 32.

- **Protocol**

  The Protocol field is set to 1 if the IGP protocol is OSPF and 2 if the IGP protocol is IS-IS.

Both **lsp-ping** and **lsp-trace** apply to the following contexts:

- SR-ISIS or SR-OSPF shortest path IPv4 tunnel
- SR-ISIS IPv4 tunnel stitched to an LDP IPv4 FEC
- BGP IPv4 LSP resolved over an SR-ISIS IPv4 tunnel or an SR-OSPF IPv4 tunnel; including support for BGP LSP across AS boundaries and for ECMP next-hops at the transport tunnel level

3.1.2.2 Operating guidelines on SR-ISIS or SR-OSPF tunnels

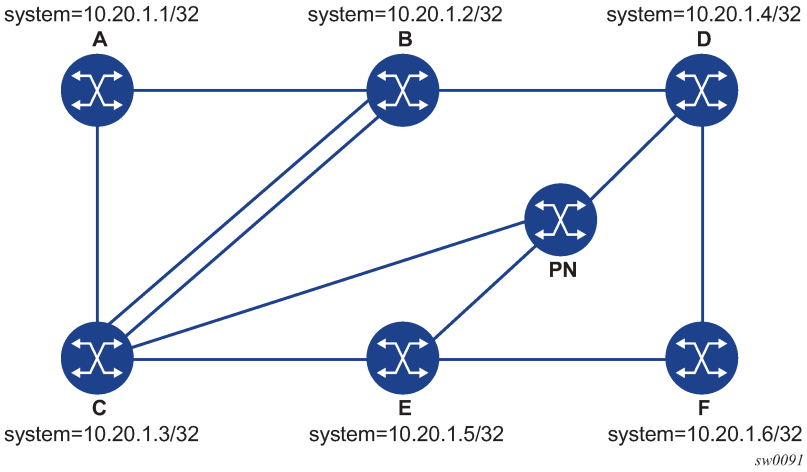
The following operating guidelines apply to **lsp-ping** and **lsp-trace**:

- The sender node builds the target FEC stack TLV with a single FEC element corresponding to the destination node SID of the SR-ISIS or SR-OSPF tunnel.
- A node SID label swapped at the LSR results in return code 8, "Label switched at stack-depth <RSC>" in accordance with RFC 4379.
- A node SID label that is popped at the LSR results in return code 3, "Replying router is an egress for the FEC at stack-depth <RSC>".
- The **lsp-trace** command is supported with the inclusion of the DSMAP TLV, the DDMAP TLV, or **none**. If **none** is configured, no map TLV is sent. The downstream interface information is returned, along with the egress label for the node SID tunnel and the protocol that resolved the node SID at the responder node.

The following figure shows a sample topology for an **lsp-ping** and **lsp-trace** for SR-ISIS node SID tunnels.

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Figure 11: Testing MPLS OAM with SR tunnels



Output example

Given this topology, the following output is an example of LSP-PING on DUT-A for target node SID on DUT-F.

```
*A:Dut-A# oam lsp-ping sr-isis prefix 10.20.1.6/32 igp-instance 0 detail
LSP-PING 10.20.1.6/32: 80 bytes MPLS payload
Seq=1, send from intf int_to_B, reply from 10.20.1.6
       udp-data-len=32 ttl=255 rtt=3.2ms rc=3 (EgressRtr)
---- LSP 10.20.1.6/32 PING Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min = 3.2ms, avg = 3.2ms, max = 3.2ms, stddev = 0.000ms
```

Output example

The following output is an example of LSP-TRACE on DUT-A for target node SID on DUT-F (DSMAP TLV).

```
*A:Dut-A# oam lsp-trace sr-isis prefix 10.20.1.6/32 igp-instance 0 detail
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 108 byte packets
1  10.20.1.2  rtt=2.29ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.4.4 ifaddr=10.10.4.4 iftype=ipv4Numbered MRU=1496
           label[1]=26406 protocol=6(ISIS)
2  10.20.1.4  rtt=3.74ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1496
           label[1]=26606 protocol=6(ISIS)
3  10.20.1.6  rtt=4.97ms rc=3(EgressRtr) rsc=1
```

Output example

The following output is an example of LSP-TRACE on DUT-A for target node SID on DUT-F (DDMAP TLV).

```
*A:Dut-A# oam lsp-trace sr-isis prefix 10.20.1.6/32 igp-instance 0 downstream-map-
tlv ddmap detail
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 108 byte packets
1  10.20.1.2  rtt=2.56ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.4.4 ifaddr=10.10.4.4 iftype=ipv4Numbered MRU=1496
           label[1]=26406 protocol=6(ISIS)
```


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```
2  10.20.1.4  rtt=3.59ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1496
           label[1]=26606 protocol=6(ISIS)
3  10.20.1.6  rtt=5.00ms rc=3(EgressRtr) rsc=1
```

3.1.2.3 Operating guidelines on SR-ISIS tunnel stitched to LDP FEC

The following operating guidelines apply to **lsp-ping** and **lsp-trace**:

- The responder and sender nodes must be in the same domain (SR or LDP) for **lsp-ping** tool operation.
- The **lsp-trace** tool can operate in both LDP and SR domains. When used with the DDMAP TLV, **lsp-trace** provides the details of the SR-LDP stitching operation at the boundary node. The boundary node as a responder node replies with the FEC stack change TLV, which contains the following operations:
  - a PUSH operation of the SR (LDP) FEC in the LDP-to-SR (SR-to-LDP) direction
  - a POP operation of the LDP (SR) FEC in the LDP-to-SR (SR-to-LDP) direction

Output example

The following is an output example of the **lsp-trace** command of the DDMAP TLV for LDP-to-SR direction (symmetric topology LDP-SR-LDP).

```
*A:Dut-E# oam lsp-trace prefix 10.20.1.2/32 detail downstream-map-tlv ddmap
lsp-trace to 10.20.1.2/32: 0 hops min, 0 hops max, 108 byte packets
1  10.20.1.3  rtt=3.25ms rc=15(LabelSwitchedWithFecChange) rsc=1
     DS 1: ipaddr=10.10.3.2 ifaddr=10.10.3.2 iftype=ipv4Numbered MRU=1496
           label[1]=26202 protocol=6(ISIS)
           fecchange[1]=POP  fectype=LDP IPv4 prefix=10.20.1.2 remotepeer=0.0.0.0
(Unknown)
           fecchange[2]=PUSH fectype=SR Ipv4 Prefix prefix=10.20.1.2 remotepeer=10.1
0.3.2
2  10.20.1.2  rtt=4.32ms rc=3(EgressRtr) rsc=1
*A:Dut-E#
```

Output example

The following output is an example of the **lsp-trace** command of the DDMAP TLV for SR-to-LDP direction (symmetric topology LDP-SR-LDP).

```
*A:Dut-B# oam lsp-trace prefix 10.20.1.5/32 detail downstream-map-tlv ddmap sr-isis
lsp-trace to 10.20.1.5/32: 0 hops min, 0 hops max, 108 byte packets
1  10.20.1.3  rtt=2.72ms rc=15(LabelSwitchedWithFecChange) rsc=1
     DS 1: ipaddr=10.11.5.5 ifaddr=10.11.5.5 iftype=ipv4Numbered MRU=1496
           label[1]=262143 protocol=3(LDP)
           fecchange[1]=POP  fectype=SR Ipv4 Prefix prefix=10.20.1.5 remotepeer=0.0.
0.0 (Unknown)
           fecchange[2]=PUSH fectype=LDP IPv4 prefix=10.20.1.5 remotepeer=10.11.5.5
2  10.20.1.5  rtt=4.43ms rc=3(EgressRtr) rsc=1
```

3.1.2.4 Operation on a BGP IPv4 LSP resolved over an SR-ISIS IPv4 tunnel or an SR-OSPF IPv4 tunnel

The 7210 SAS enhances **lsp-ping** and **lsp-trace** of a BGP IPv4 LSP resolved over an SR-ISIS IPv4 tunnel or an SR-OSPF IPv4 tunnel. The 7210 SAS enhancement reports the full set of ECMP next-hops for the

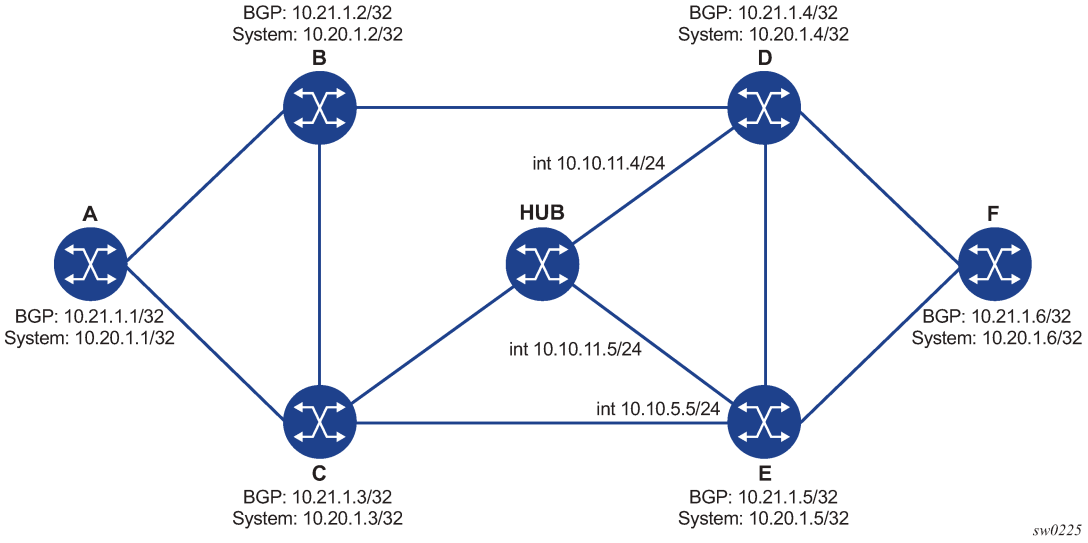
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transport tunnel at both ingress PE and at the ABR or ASBR. The list of downstream next-hops is reported in the DSMAP or DDMAP TLV.

If an **lsp-trace** of the BGP IPv4 LSP is initiated with the **path-destination** option specified, the CPM hash code at the responder node selects the outgoing interface to return in the DSMAP or DDMAP TLV. The decision is based on the modulo operation of the hash value on the label stack or the IP headers (where the DST IP is replaced by the specific 127/8 prefix address in the multipath type 8 field of the DSMAP or DDMAP) of the echo request message and the number of outgoing interfaces in the ECMP set.

The following figure shows a sample topology used in the subsequent BGP over SR-OSPF and BGP over SR-ISIS examples.

Figure 12: Sample topology for BGP over SR-OSPF and SR-ISIS



The following outputs are examples of the **lsp-trace** command for a hierarchical tunnel consisting of a BGP IPv4 LSP resolved over an SR-ISIS IPv4 tunnel or an SR-OSPF IPv4 tunnel.

Output example

The following output is an example of BGP over SR-OSPF.

```
*A:Dut-A# oam lsp-trace bgp-label prefix 10.21.1.6/32 detail downstream-map-
tlv ddmap path-destination 127.1.1.
lsp-trace to 10.21.1.6/32: 0 hops min, 0 hops max, 168 byte packets
1  10.20.1.3  rtt=2.31ms rc=8(DSRtrMatchLabel) rsc=2
     DS 1: ipaddr=10.10.5.5 ifaddr=10.10.5.5 iftype=ipv4Numbered MRU=1496
           label[1]=27506 protocol=5(OSPF)
           label[2]=262137 protocol=2(BGP)
     DS 2: ipaddr=10.10.11.4 ifaddr=10.10.11.4 iftype=ipv4Numbered MRU=1496
           label[1]=27406 protocol=5(OSPF)
           label[2]=262137 protocol=2(BGP)
     DS 3: ipaddr=10.10.11.5 ifaddr=10.10.11.5 iftype=ipv4Numbered MRU=1496
           label[1]=27506 protocol=5(OSPF)
           label[2]=262137 protocol=2(BGP)
2   10.20.1.4  rtt=4.91ms rc=8(DSRtrMatchLabel) rsc=2
     DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1492
           label[1]=27606 protocol=5(OSPF)
           label[2]=262137 protocol=2(BGP)
3  10.20.1.6  rtt=4.73ms rc=3(EgressRtr) rsc=2
3  10.20.1.6  rtt=5.44ms rc=3(EgressRtr) rsc=1
```


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```
*A:Dut-A#
```

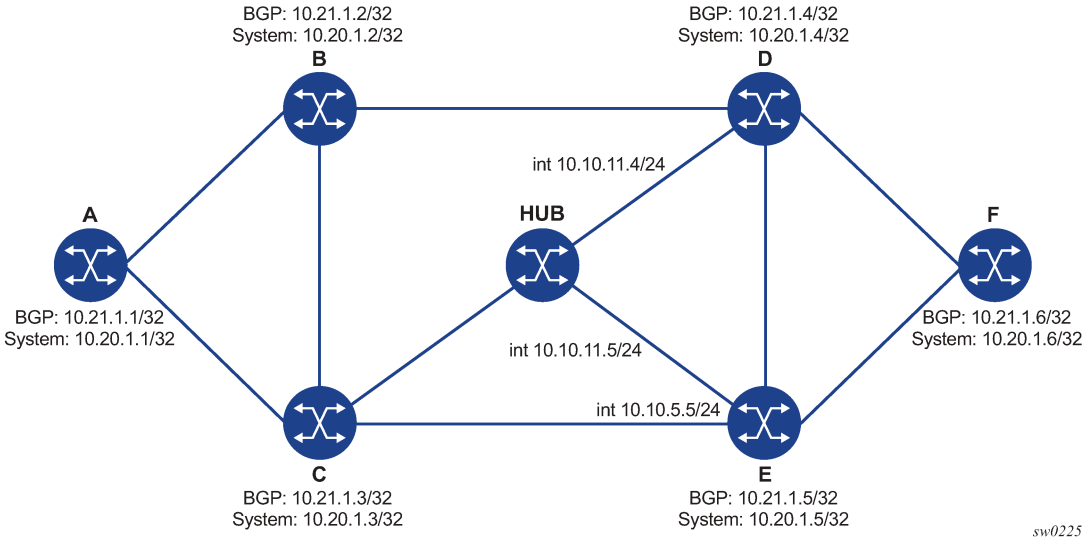
Output example

The following output is an example of BGP over SR-ISIS.

```
A:Dut-A# oam lsp-trace bgp-label prefix 10.21.1.6/32 detail downstream-map-
tlv ddmap path-destination 127.1.1.1
lsp-trace to 10.21.1.6/32: 0 hops min, 0 hops max, 168 byte packets
1  10.20.1.3  rtt=3.33ms rc=8(DSRtrMatchLabel) rsc=2
    DS 1:  ipaddr=10.10.5.5 ifaddr=10.10.5.5 iftype=ipv4Numbered MRU=1496
           label[1]=28506 protocol=6(ISIS)
           label[2]=262139 protocol=2(BGP)
     DS 2: ipaddr=10.10.11.4 ifaddr=10.10.11.4 iftype=ipv4Numbered MRU=1496
           label[1]=28406 protocol=6(ISIS)
           label[2]=262139 protocol=2(BGP)
     DS 3: ipaddr=10.10.11.5 ifaddr=10.10.11.5 iftype=ipv4Numbered MRU=1496
           label[1]=28506 protocol=6(ISIS)
           label[2]=262139 protocol=2(BGP)
2  10.20.1.4  rtt=5.12ms rc=8(DSRtrMatchLabel) rsc=2
     DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1492
           label[1]=28606 protocol=6(ISIS)
           label[2]=262139 protocol=2(BGP)
3  10.20.1.6  rtt=8.41ms rc=3(EgressRtr) rsc=2
3  10.20.1.6  rtt=6.93ms rc=3(EgressRtr) rsc=1
```

Assuming the topology in the following figure includes an eBGP peering between nodes B and C, the BGP IPv4 LSP spans the AS boundary and resolves to an SR-ISIS tunnel within each AS.

Figure 13: Sample topology for BGP over SR-ISIS in inter-AS option C



Output example

The following output is an example of BGP over SR-ISIS using inter-AS option C.

```
*A:Dut-A# oam lsp-trace bgp-label prefix 10.20.1.6/32 src-ip-
address 10.20.1.1 detail downstream-map-tlv ddmap path-destination 127.1.1.1
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 168 byte packets
1  10.20.1.2  rtt=2.69ms rc=3(EgressRtr) rsc=2
1  10.20.1.2  rtt=3.15ms rc=8(DSRtrMatchLabel) rsc=1
```


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```
     DS 1: ipaddr=10.10.3.3 ifaddr=10.10.3.3 iftype=ipv4Numbered MRU=0
           label[1]=262127 protocol=2(BGP)
2  10.20.1.3  rtt=5.26ms rc=15(LabelSwitchedWithFecChange) rsc=1
     DS 1: ipaddr=10.10.5.5 ifaddr=10.10.5.5 iftype=ipv4Numbered MRU=1496
           label[1]=26506 protocol=6(ISIS)
           label[2]=262139 protocol=2(BGP)
           fecchange[1]=PUSH fectype=SR Ipv4 Prefix prefix=10.20.1.6 remotepeer=10.1
0.5.5
3  10.20.1.5  rtt=7.08ms rc=8(DSRtrMatchLabel) rsc=2
     DS 1: ipaddr=10.10.10.6 ifaddr=10.10.10.6 iftype=ipv4Numbered MRU=1496
           label[1]=26606 protocol=6(ISIS)
       label[2]=262139 protocol=2(BGP)
4  10.20.1.6  rtt=9.41ms rc=3(EgressRtr) rsc=2
4  10.20.1.6  rtt=9.53ms rc=3(EgressRtr) rsc=1
```

3.1.3 LSP ping for RSVP P2MP LSP

Note:

- RSVP-based signaling for P2MP LSPs is only supported on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC mode), and 7210 SAS-T.
- P2MP LSP is only supported on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC mode), and 7210 SAS-T.

Enter the following OAM command to generate an LSP ping:

oam p2mp-lsp-ping *lsp-name* [**p2mp-instance** *instance-name* [**s2l-dest-addr** *ip-address* [...up to 5 max]]] [**fc** *fc-name*] [**size** *octets*] [**ttl** *label-ttl*] [**timeout** *timeout*] [**detail**]

An echo request message is sent on the active P2MP instance and replicated in the datapath over all branches of the P2MP LSP instance. By default, all egress LER nodes that are leaves of the P2MP LSP instance reply to the echo request message.

To reduce the scope of the echo reply message, explicitly enter a list of addresses specifying the egress LER nodes that must reply. A maximum of five addresses can be specified in a single execution of the **p2mp-lsp-ping** command. If all five egress LER nodes are router nodes, they will parse the list of egress LER addresses and reply. In accordance with RFC 6425, only the top address in the P2MP egress identifier TLV is inspected by an egress LER. When interoperating with other implementations, the egress LER router node responds if its address is in the list. Also, if another vendor implementation is the egress LER, only the egress LER matching the top address in the TLV responds.

If the user enters the same egress LER address more than once in a single **p2mp-lsp-ping** command, the head-end node displays a response to a single address and displays a single error warning message for the duplicates. When queried over SNMP, the head-end node issues a single response trap and issues no trap for the duplicates.

Set the value of the **timeout** parameter to the time it would take to get a response from all probed leaves under no failure conditions. For that purpose, the parameter range extends to 120 seconds for a **p2mp-lsp-ping** from a 10-second **lsp-ping** for P2P LSP. The default value is 10 seconds.

If the user explicitly lists the address of the egress LER for a specific S2L in the **ping** command, the router head-end node displays a "Send_Fail" error when a specific S2L path is down.

Similarly, if the user explicitly lists the address of the egress LER for a specific S2L in the **ping** command, the router head-end node displays the timeout error when no response is received for an S2L after the expiry of the timeout timer.

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Configure a specific value of the **ttl** parameter to force the echo request message to expire on a router branch node or a bud LSR node. The bud LSR node replies with a downstream mapping TLV for each branch of the P2MP LSP in the echo reply message. A maximum of 16 downstream mapping TLVs can be included in a single echo reply message. The multipath type is set to zero in each downstream mapping TLV and, consequently, does not include egress address information for the reachable egress LER nodes for this P2MP LSP.

If the router ingress LER node receives the new multipath type field with the list of egress LER addresses in an echo reply message from another vendor implementation, the router ignores the message, but this does not cause a processing error for the downstream mapping TLV.

If the **ping** command expires at an LSR node that is performing a remerge or crossover operation in the datapath between two or more ILMs of the same P2MP LSP, an echo reply message is generated for each copy of the echo request message received by this node.

If the **detail** parameter is omitted, the command output provides a high-level summary of error and success codes received.

If the **detail** parameter is specified, the command output displays a line for each replying node, similar to the output of the LSP ping for a P2P LSP.

The display is delayed until all responses are received or the timer configured in the *timeout* parameter expires. Entering other CLI commands while waiting for the display is not allowed. Use `control-C` (`^C`) to stop the ping operation.

3.1.4 LSP trace for RSVP P2MP LSP

Note:

- RSVP-based signaling for P2MP LSPs is only supported on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC mode), and 7210 SAS-T.
- P2MP LSP is only supported on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC mode), and 7210 SAS-T.

Generate an LSP trace by entering the following OAM command:

oam p2mp-lsp-trace *lsp-name* **p2mp-instance** *instance-name* **s2l-dest-addr** *ip-address* [**fc** *fc-name*] [**size** *octets*] [**max-fail** *no-response-count*] [**probe-count** *probes-per-hop*] [**min-ttl** *min-label-ttl*]] [**max-ttl** *max-label-ttl*] [**timeout** *timeout*] [**interval** *interval*] [**detail**]

The LSP trace capability allows the user to trace the path of a single S2L path of a P2MP LSP. Its operation is similar to that of the **p2mp-lsp-ping** command but the sender of the echo reply request message includes the downstream mapping TLV to request the downstream branch information from a branch LSR or bud LSR. The branch LSR or bud LSR will then also include the downstream mapping TLV to report the information about the downstream branches of the P2MP LSP. An egress LER does not include this TLV in the echo response message.

The operation of the **probe-count** parameter is modeled after the LSP trace on a P2P LSP. It represents the maximum number of probes sent per TTL value before the device gives up on receiving the echo reply message. If a response is received from the traced node before reaching the maximum number of probes, no additional probes are sent for that TTL. The sender of the echo request increments the TTL and uses the information received in the downstream mapping TLV to send probes to the node downstream of the last node that replied. This continues until the egress LER for the traced S2L path replies.

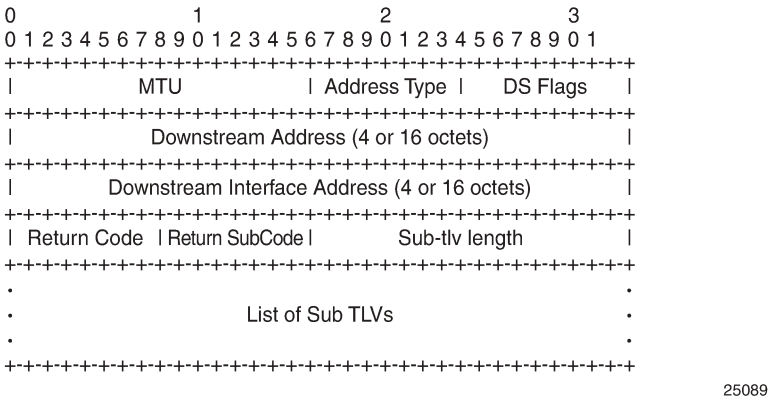
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Because the command traces a single S2L path, the **timeout** and **interval** parameters keep the same value range as the LSP trace for a P2P LSP.

The following supported options in **lsp-trace** for P2P LSP are not applicable: **path**, **prefix**, **path-destination**, and [**interface** | **next-hop**].

The P2MP LSP trace uses the Downstream Detailed Mapping (DDMAP) TLV defined in RFC 6424. The following figure shows the format of the new DDMAP TLV entered in the **path-destination** that belongs to one of the possible outgoing interfaces of the FEC.

Figure 14: DDMAP TLV



The DDMAP TLV format is derived from the Downstream Mapping (DSMAP) TLV format. The key change is that in the DDMAP TLV, the variable length and optional fields are converted into sub-TLVs. The fields have the same use and meaning as in RFC 4379.

Similar to P2MP LSP ping, an LSP trace probe results on all egress LER nodes that eventually receive the echo request message, but only the traced egress LER node replies to the last probe.

Any branch LSR node or bud LSR node in the P2MP LSP tree may receive a copy of the echo request message with the TTL in the outer label expiring at this node. However, only a branch LSR or bud LSR that has a downstream branch over which the traced egress LER is reachable must respond.

When a branch LSR or BUD LSR node responds to the sender of the echo request message, it sets the global return code in the echo response message to RC=14, "See DDMAP TLV for Return Code and Return Sub-Code" and the return code in the DDMAP TLV corresponding to the outgoing interface of the branch used by the traced S2L path to RC=8, "Label switched at stack-depth <RSC>".

Because a single egress LER address, for example an S2L path, can be traced, the branch LSR or bud LSR node sets the multipath type to zero in the downstream mapping TLV in the echo response message because including an egress LER address is not required.

3.1.4.1 LSP trace behavior when S2L path traverses a re-merge node

Note:
P2MP LSPs are supported only on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC mode), and 7210 SAS-T.

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When a node performs a re-merge of one or more ILMs of the P2MP LSP to which the traced S2L sub-LSP belongs, it may block the ILM over which the traced S2L resides. This causes the trace to either fail or to succeed with a missing hop.

The following is an example of this behavior:

S2L1 and S2L2 use ILMs that re-merge at node B. Depending of which ILM is blocked at B, the TTL=2 probe will either yield two responses or timeout.

Example

```
S2L1 = ACBDF (to leaf F)
S2L2 = ABDE (to leaf E)

   A
 /  \
B -- C
|
D
| \
F  E
```

1. Tracing S2L1 when ILM on interface C-B blocked at node B:
   - For TTL=1, A gets a response from C only as B does not have S2L1 on the ILM on interface A-B.
   - For TTL=2, assume A gets first the response from B which indicates a success. It then builds the next probe with TTL=3. B will only pass the copy of the message arriving on interface A-B and will drop the one arriving on interface C-B (treats it like a data packet since it does not expire at node B). This copy will expire at F. However F will return a "DSMappingMismatched" error because the DDMAP TLV was the one provided by node B in TTL=2 step. The trace will abort at this point in time. However, A knows it got a second response from Node D for TTL=2 with a "DSMappingMismatched" error.
   - If A gets the response from D first with the error code, it waits to see if it gets a response from B or it times out. In either case, it will log this status as `multiple replies received per probe` in the last probe history and aborts the trace.
2. Tracing S2L2 when ILM on interface A-B blocked at node B:
   - For TTL=1, B responds with a success. C does not respond as it does not have an ILM for S2L2.
   - For TTL=2, B drops the copy coming on interface A-B. It receives a copy coming on interface B-C but will drop it as the ILM does not contain S2L2. Node A times out. Next, node A generates a probe with TTL=3 without a DDMAP TLV. This time node D will respond with a success and will include its downstream DDMAP TLV to node E. The rest of the path will be discovered correctly. The traced path for S2L2 will look something like: A-B-(*)-D-E.

The router ingress LER detects a re-merge condition when it receives two or more replies to the same probe, such as the same TTL value. It displays the following message to the user regardless if the trace operation successfully reached the egress LER or was aborted earlier:

```
Probe returned multiple responses. Result may be inconsistent.
```

This warning message indicates to the user the potential of a re-merge scenario and that a **p2mp-lsp-ping** command for this S2L should be used to verify that the S2L path is not defective.

The router ingress LER behavior is to always proceed to the next ttl probe when it receives an OK response to a probe or when it times out on a probe. If however it receives replies with an error return

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code, it must wait until it receives an OK response or it times out. If it times out without receiving an OK reply, the LSP trace must be aborted.

The following are possible echo reply messages received and corresponding ingress LER behavior:

- One or more error return codes + OK: display OK return code. Proceed to next **ttl** probe. Display warning message at end of trace.
- OK + One or more error return codes: display OK return code. Proceed to next **ttl** probe right after receiving the OK reply but keep state that more replies received. Display warning message at end of trace.
- OK + OK: should not happen for re-merge but would continue trace on 1st OK reply. This is the case when one of the branches of the P2MP LSP is activating the P2P bypass LSP. In this case, the head-end node will get a reply from both a regular P2MP LSR which has the ILM for the traced S2L and from an LSR switching the P2P bypass for other S2Ls. The latter does not have context for the P2MP LSP being tunneled but will respond after doing a label stack validation.
- One error return code + timeout: abort LSP trace and display error code. Ingress LER cannot tell the error is because of a re-merge condition.
- More than one error return code + timeout: abort LSP trace and display first error code. Display warning message at end of trace.
- Timeout on probe without any reply: display "*" and proceed to next **ttl** probe.

3.1.5 SDP diagnostics

The 7210 SAS SDP diagnostics are SDP ping and SDP MTU path discovery.

3.1.5.1 SDP ping

SDP ping performs in-band unidirectional or round-trip connectivity tests on SDPs. The SDP ping OAM packets are sent in-band, in the tunnel encapsulation, so it will follow the same path as traffic within the service. The SDP ping response can be received out-of-band in the control plane, or in-band using the data plane for a round-trip test.

For a unidirectional test, SDP ping tests:

- egress SDP ID encapsulation
- ability to reach the far-end IP address of the SDP ID within the SDP encapsulation
- path MTU to the far-end IP address over the SDP ID
- forwarding class mapping between the near-end SDP ID encapsulation and the far-end tunnel termination

For a round-trip test, SDP ping uses a local egress SDP ID and an expected remote SDP ID. Since SDPs are unidirectional tunnels, the remote SDP ID must be specified and must exist as a configured SDP ID on the far-end 7210 SAS. SDP round trip testing is an extension of SDP connectivity testing with the additional ability to test:

- remote SDP ID encapsulation
- potential service round trip time
- round trip path MTU

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- round trip forwarding class mapping

3.1.5.2 SDP MTU path discovery

In a large network, network devices can support a variety of packet sizes that are transmitted across its interfaces. This capability is referred to as the Maximum Transmission Unit (MTU) of network interfaces. It is important to understand the MTU of the entire path end-to-end when provisioning services, especially for virtual leased line (VLL) services where the service must support the ability to transmit the largest customer packet.

The Path MTU discovery tool provides a powerful tool that enables service provider to get the exact MTU supported by the network's physical links between the service ingress and service termination points (accurate to one byte).

3.1.6 Service diagnostics

The Nokia service ping feature provides end-to-end connectivity testing for an individual service. Service ping operates at a higher level than the SDP diagnostics in that it verifies an individual service and not the collection of services carried within an SDP.

Service ping is initiated from a 7210 SAS router to verify round-trip connectivity and delay to the far-end of the service. -The Nokia implementation functions for MPLS tunnels and tests the following from edge-to-edge:

- tunnel connectivity
- VC label mapping verification
- service existence
- service provisioned parameter verification
- round trip path verification
- service dynamic configuration verification

3.1.7 VPLS MAC diagnostics

While the LSP ping, SDP ping and service ping tools enable transport tunnel testing and verify whether the correct transport tunnel is used, they do not provide the means to test the learning and forwarding functions on a per-VPLS-service basis.

It is conceivable, that while tunnels are operational and correctly bound to a service, an incorrect Forwarding Information Base (FIB) table for a service could cause connectivity issues in the service and not be detected by the ping tools. Nokia has developed VPLS OAM functionality to specifically test all the critical functions on a per-service basis. These tools are based primarily on the IETF document draft-stokes-vkompella-ppvpn-hvpls-oam-xx.txt, *Testing Hierarchical Virtual Private LAN Services*.

The VPLS OAM tools are:

- MAC ping

  Provides an end-to-end test to identify the egress customer-facing port where a customer MAC was learned. MAC ping can also be used with a broadcast MAC address to identify all egress points of a service for the specified broadcast MAC.

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- MAC trace

  Provides the ability to trace a specified MAC address hop-by-hop until the last node in the service domain. An SAA test with MAC trace is considered successful when there is a reply from a far-end node indicating that they have the destination MAC address on an egress SAP or the CPM.

- CPE ping

  Provides the ability to check network connectivity to the specified client device within the VPLS. CPE ping will return the MAC address of the client, as well as the SAP and PE at which it was learned.

- MAC populate

  Allows specified MAC addresses to be injected in the VPLS service domain. This triggers learning of the injected MAC address by all participating nodes in the service. This tool is generally followed by MAC ping or MAC trace to verify if correct learning occurred.

- MAC purge

  Allows MAC addresses to be flushed from all nodes in a service domain.

3.1.7.1 MAC ping

For a MAC ping test, the destination MAC address (unicast or multicast) to be tested must be specified. A MAC ping packet can be sent through the control plane or the data plane. When sent by the control plane, the ping packet goes directly to the destination IP in a UDP/IP OAM packet. If it is sent by the data plane, the ping packet goes out with the data plane format.

In the control plane, a MAC ping is forwarded along the flooding domain if no MAC address bindings exist. If MAC address bindings exist, then the packet is forwarded along those paths (if they are active). Finally, a response is generated only when there is an egress SAP binding to that MAC address. A control plane request is responded to via a control reply only.

In the data plane, a MAC ping is sent with a VC label TTL of 255. This packet traverses each hop using forwarding plane information for next hop, VC label, and so on. The VC label is swapped at each service-aware hop, and the VC TTL is decremented. If the VC TTL is decremented to 0, the packet is passed up to the management plane for processing. If the packet reaches an egress node, and would be forwarded out a customer facing port, it is identified by the following OAM label the VC label and passed to the management plane.

MAC pings are flooded when they are unknown at an intermediate node. They are responded to only by the egress nodes that have mappings for that MAC address.

3.1.7.2 MAC trace

A MAC trace functions like an LSP trace with some variations. Operations in a MAC trace are triggered when the VC TTL is decremented to 0.

Like a MAC ping, a MAC trace can be sent either by the control plane or the data plane.

For MAC trace requests sent by the control plane, the destination IP address is determined from the control plane mapping for the destination MAC. If the destination MAC is known to be at a specific remote site, then the far-end IP address of that SDP is used. If the destination MAC is not known, then the packet is sent unicast, to all SDPs in the service with the appropriate squelching.

A control plane MAC traceroute request is sent via UDP/IP. The destination UDP port is the LSP ping port. The source UDP port is whatever the system gives (note that this source UDP port is really the

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demultiplexor that identifies the particular instance that sent the request, when correlating the reply). The source IP address is the system IP of the sender.

When a traceroute request is sent via the data plane, the data plane format is used. The reply can be via the data plane or the control plane.

A data plane MAC traceroute request includes the tunnel encapsulation, the VC label, and the OAM, followed by an Ethernet DLC, a UDP and IP header. If the mapping for the MAC address is known at the sender, then the data plane request is sent down the known SDP with the appropriate tunnel encapsulation and VC label. If it is not known, then it is sent down every SDP (with the appropriate tunnel encapsulation per SDP and appropriate egress VC label per SDP binding).

The tunnel encapsulation TTL is set to 255. The VC label TTL is initially set to the **min-ttl** (default is 1). The OAM label TTL is set to 2. The destination IP address is the all-routers multicast address. The source IP address is the system IP of the sender.

The destination UDP port is the LSP ping port. The source UDP port is whatever the system gives (note that this source UDP port is really the demultiplexor that identifies the particular instance that sent the request, when correlating the reply).

The Reply Mode is either 3 (that is, reply via the control plane) or 4 (that is, reply through the data plane), depending on the reply-control option. By default, the data plane request is sent with Reply Mode 3 (control plane reply) Reply Mode 4 (data plane reply).

The Ethernet DLC header source MAC address is set to either the system MAC address (if no source MAC is specified) or to the specified source MAC. The destination MAC address is set to the specified destination MAC. The EtherType is set to IP.

3.1.7.3 CPE ping

The MAC ping OAM tool makes it possible to detect whether a particular MAC address has been learned in a VPLS.

The **cpe-ping** command extends this capability to detecting end-station IP addresses inside a VPLS. A CPE ping for a specific destination IP address within a VPLS will be translated to a MAC ping toward a broadcast MAC address. Upon receiving such a MAC ping, each peer PE within the VPLS context will trigger an ARP request for the specific IP address. The PE receiving a response to this ARP request will report back to the requesting 7210 SAS. It is encouraged to use the source IP address of 0.0.0.0 to prevent the provider’s IP address of being learned by the CE.

3.1.7.4 MAC populate

MAC populate is used to send a message through the flooding domain to learn a MAC address as if a customer packet with that source MAC address had flooded the domain from that ingress point in the service. This allows the provider to craft a learning history and engineer packets in a particular way to test forwarding plane correctness.

The MAC populate request is sent with a VC TTL of 1, which means that it is received at the forwarding plane at the first hop and passed directly up to the management plane. The packet is then responded to by populating the MAC address in the forwarding plane, like a conventional learn although the MAC will be an OAM-type MAC in the FIB to distinguish it from customer MAC addresses.

This packet is then taken by the control plane and flooded out the flooding domain (squelching appropriately, the sender and other paths that would be squelched in a typical flood).

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This controlled population of the FIB is very important to manage the expected results of an OAM test. The same functions are available by sending the OAM packet as a UDP/IP OAM packet. It is then forwarded to each hop and the management plane has to do the flooding.

Options for MAC populate are to force the MAC in the table to type OAM (in case it already existed as dynamic or static or an OAM induced learning with some other binding), to prevent new dynamic learning to over-write the existing OAM MAC entry, to allow customer packets with this MAC to either ingress or egress the network, while still using the OAM MAC entry.

Finally, an option to flood the MAC populate request causes each upstream node to learn the MAC, for example, populate the local FIB with an OAM MAC entry, and to flood the request along the data plane using the flooding domain.

An age can be provided to age a particular OAM MAC after a different interval than other MACs in a FIB.

3.1.7.5 MAC purge

MAC purge is used to clear the FIBs of any learned information for a particular MAC address. This allows one to do a controlled OAM test without learning induced by customer packets. In addition to clearing the FIB of a particular MAC address, the purge can also indicate to the control plane not to allow further learning from customer packets. This allows the FIB to be clean, and be populated only via a MAC Populate.

MAC purge follows the same flooding mechanism as the MAC populate.

A UDP/IP version of this command is also available that does not follow the forwarding notion of the flooding domain, but the control plane notion of it.

3.1.8 VLL diagnostics

3.1.8.1 VCCV ping

VCCV ping is used to check connectivity of a VLL in-band. It checks that the destination (target) PE is the egress for the Layer 2 FEC. It provides a cross-check between the data plane and the control plane. It is in-band, meaning that the VCCV ping message is sent using the same encapsulation and along the same path as user packets in that VLL. This is equivalent to the LSP ping for a VLL service. VCCV ping reuses an LSP ping message format and can be used to test a VLL configured over an MPLS SDP.

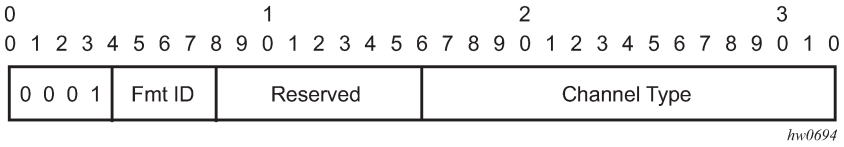
3.1.8.1.1 VCCV-ping application

VCCV effectively creates an IP control channel within the pseudowire between PE1 and PE2. PE2 should be able to distinguish on the receive side VCCV control messages from user packets on that VLL. There are three possible methods of encapsulating a VCCV message in a VLL which translates into three types of control channels:

1. Use of a Router Alert Label immediately preceding the VC label. This method has the drawback that if ECMP is applied to the outer LSP label (for example, transport label), the VCCV message will not follow the same path as the user packets. This effectively means it will not troubleshoot the appropriate path. This method is supported by the 7210 SAS.
2. Use of the OAM control word as illustrated in the following figure.

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Figure 15: OAM control word format



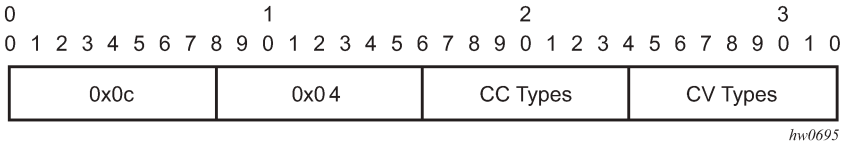
The first nibble is set to 0x1. The Format ID and the reserved fields are set to 0 and the channel type is the code point associated with the VCCV IP control channel as specified in the PWE3 IANA registry (RFC 4446). The channel type value of 0x21 indicates that the Associated Channel carries an IPv4 packet.

The use of the OAM control word assumes that the draft-martini control word is also used on the user packets. This means that if the control word is optional for a VLL and is not configured, the PE node will only advertise the router alert label as the CC capability in the Label Mapping message. This method is supported on 7210 SAS configured in the network mode of operation.

3. Set the TTL in the VC label to 1 to force PE2 control plane to process the VCCV message. This method is not guaranteed to work under all circumstances. For instance, the draft mentions some implementations of penultimate hop popping overwrite the TTL field. This method is not supported on the 7210 SAS.

When sending the label mapping message for the VLL, PE1 and PE2 must indicate which of the preceding OAM packet encapsulation methods (for example, which control channel type) they support. This is accomplished by including an optional VCCV TLV in the pseudowire FEC Interface Parameter field. The following figure shows the format of the VCCV TLV.

Figure 16: VCCV TLV format



Note that the absence of the optional VCCV TLV in the Interface parameters field of the pseudowire FEC indicates the PE has no VCCV capability.

The Control Channel (CC) Type field is a bitmask used to indicate if the PE supports none, one, or many control channel types, as follows:

- 0x00 None of the following VCCV control channel types are supported
- 0x01 PWE3 OAM control word (see Figure 15: OAM control word format)
- 0x02 MPLS Router Alert Label
- 0x04 MPLS inner label TTL = 1

If both PE nodes support more than one of the CC types, a 7210 SAS PE will make use of the one with the lowest type value. For instance, OAM control word will be used in preference to the MPLS router alert label.

The Connectivity Verification (CV) bitmask field is used to indicate the specific type of VCCV packets to be sent over the VCCV control channel. The valid values are:

0x00 None of the following VCCV packet type are supported.

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0x01 ICMP ping. Not applicable to a VLL over a MPLS SDP and therefore is not supported by the 7210 SAS.

0x02 LSP ping. This is used in VCCV-Ping application and applies to a VLL over an MPLS SDP. This is supported by the 7210 SAS.

A VCCV ping is an LSP echo request message as defined in RFC 4379. It contains an L2 FEC stack TLV which must include within the sub-TLV type 10 "FEC 128 Pseudowire". It also contains a field which indicates to the destination PE which reply mode to use. There are four reply modes defined in RFC 4379:

Reply mode, meaning:

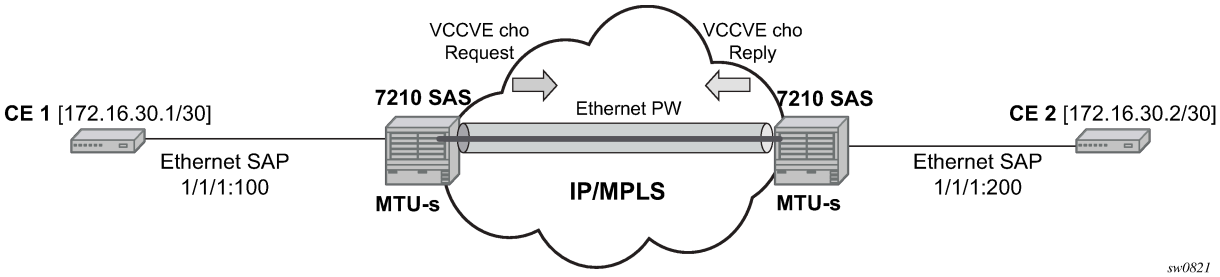
1. Do not reply. This mode is supported by the 7210 SAS.
2. Reply via an IPv4/IPv6 UDP packet. This mode is supported by the 7210 SAS.
3. Reply with an IPv4/IPv6 UDP packet with a router alert. This mode sets the router alert bit in the IP header and is not be confused with the CC type which makes use of the router alert label. This mode is not supported by the 7210 SAS.
4. Reply via application level control channel. This mode sends the reply message in-band over the pseudowire from PE2 to PE1. PE2 will encapsulate the Echo Reply message using the CC type negotiated with PE1. This mode is supported by the 7210 SAS.

The reply is an LSP echo reply message as defined in RFC 4379. The message is sent as per the reply mode requested by PE1. The return codes supported are the same as those supported in the 7210 SAS LSP ping capability.

The VCCV ping feature is in addition to the service ping OAM feature which can be used to test a service between 7210 SAS nodes. The VCCV ping feature can test connectivity of a VLL with any third party node which is compliant to RFC 5085.

The following figure shows the VCCV-ping feature application.

Figure 17: VCCV-ping application



3.1.8.1.2 VCCV-ping in a multi-segment pseudowire

Pseudowire switching is a method for scaling a large network of VLL or VPLS services by removing the need for a full mesh of T-LDP sessions between the PE nodes as the number of these nodes grow over time. Pseudowire switching is also used whenever there is a need to deploy a VLL service across two separate routing domains.

In the network, a Termination PE (T-PE) is where the pseudowire originates and terminates.

VCCV ping is extended to be able to perform the following OAM functions:

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1. VCCV ping to a destination PE. A VLL FEC ping is a message sent by T-PE1 to test the FEC at T-PE2. The operation at T-PE1 and T-PE2 is the same as in the case of a single-segment pseudowire. The pseudowire switching node, S-PE1, pops the outer label, swaps the inner (VC) label, decrements the TTL of the VC label, and pushes a new outer label. The 7210 SAS PE1 node does not process the VCCV OAM Control Word unless the VC label TTL expires. In that case, the message is sent to the CPM for further validation and processing. This is the method described in *draft-hart-pwe3-segmented-pw-vccv*.

3.1.8.2 Automated VCCV-trace capability for MS-pseudowire

Although tracing of the MS-pseudowire path is possible using the methods described in previous sections, these require multiple manual iterations and that the FEC of the last pseudowire segment to the target T-PE/S-PE be known a priori at the node originating the echo request message for each iteration. This mode of operation is referred to as a "ping" mode.

The automated VCCV-trace can trace the entire path of a pseudowire with a single command issued at the T-PE or at an S-PE. This is equivalent to LSP-trace and is an iterative process by which the ingress T-PE or T-PE sends successive VCCV-ping messages with incrementing the TTL value, starting from TTL=1.

The method is described in draft-hart-pwe3-segmented-pw-vccv, *VCCV Extensions for Segmented Pseudo-Wire*, and is pending acceptance by the PWE3 working group. In each iteration, the source T-PE or S-PE builds the MPLS echo request message in a way similar to VCCV ping. The first message with TTL=1 will have the next-hop S-PE T-LDP session source address in the Remote PE Address field in the pseudowire FEC TLV. Each S-PE which terminates and processes the message will include in the MPLS echo reply message the FEC 128 TLV corresponding the pseudowire segment to its downstream node.

The inclusion of the FEC TLV in the echo reply message is allowed in RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*. The source T-PE or S-PE can then build the next echo reply message with TTL=2 to test the next-next hop for the MS-pseudowire. It will copy the FEC TLV it received in the echo reply message into the new echo request message. The process is terminated when the reply is from the egress T-PE or when a timeout occurs. If specified, the **max-ttl** parameter in the vccv-trace command will stop on SPE before reaching T-PE.

The results VCCV-trace can be displayed for a fewer number of pseudowire segments of the end-to-end MS-pseudowire path. In this case, the **min-ttl** and **max-ttl** parameters are configured accordingly. However, the T-PE/S-PE node will still probe all hops up to the **min-ttl** to correctly build the FEC of the desired subset of segments.

Note that this method does not require the use of the downstream mapping TLV in the echo request and echo reply messages.

3.1.8.2.1 VCCV for static pseudowire segments

MS pseudowire is supported with a mix of static and signaled pseudowire segments. However, VCCV ping and VCCV-trace is allowed until at least one segment of the MS pseudowire is static. Users cannot test a static segment but also, cannot test contiguous signaled segments of the MS-pseudowire. VCCV ping and VCCV trace is not supported in static-to-dynamic configurations.

3.1.8.2.2 Detailed VCCV-trace operation

A trace can be performed on the MS-pseudowire originating from T-PE1 by a single operational command. The following process occurs:

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1. T-PE1 sends a VCCV echo request with TTL set to 1 and a FEC 128 containing the pseudowire information of the first segment (pseudowire1 between T-PE1 and S-PE) to S-PE for validation.
2. S-PE validates the echo request with the FEC 128. Since it is a switching point between the first and second segment it builds an echo reply with a return code of 8 and includes the FEC 128 of the second segment (pseudowire2 between S-PE and T-PE2) and sends the echo reply back to T-PE1.
3. T-PE1 builds a second VCCV echo request based on the FEC128 in the echo reply from the S-PE. It increments the TTL and sends the next echo request out to T-PE2. Note that the VCCV echo request packet is switched at the S-PE datapath and forwarded to the next downstream segment without any involvement from the control plane.
4. T-PE2 receives and validates the echo request with the FEC 128 of the pseudowire2 from T-PE1. Since T-PE2 is the destination node or the egress node of the MS-pseudowire it replies to T-PE1 with an echo reply with a return code of 3 (egress router) and no FEC 128 is included.
5. T-PE1 receives the echo reply from T-PE2. T-PE1 is made aware that T-PE2 is the destination of the MS pseudowire because the echo reply does not contain the FEC 128 and because its return code is 3. The trace process is completed.

3.1.8.2.3 Control plane processing of a VCCV echo message in a MS-pseudowire

3.1.8.2.3.1 Sending a VCCV echo request

When in the **ping** mode of operation, the sender of the echo request message requires the FEC of the last segment to the target S-PE/T-PE node. This information can either be configured manually or be obtained by inspecting the corresponding sub-TLVs of the pseudowire switching point TLV. However, the pseudowire switching point TLV is optional and there is no guarantee that all S-PE nodes will populate it with their system address and the pseudowire-id of the last pseudowire segment traversed by the label mapping message. Therefore, the 7210 SAS implementation will always make use of the user configuration for these parameters.

3.1.8.2.3.2 Receiving an VCCV echo request

Upon receiving a VCCV echo request the control plane on S-PEs (or the target node of each segment of the MS pseudowire) validates the request and responds to the request with an echo reply consisting of the FEC 128 of the next downstream segment and a return code of 8 (label switched at stack-depth) indicating that it is an S-PE and not the egress router for the MS-pseudowire.

If the node is the T-PE or the egress node of the MS-pseudowire, it responds to the echo request with an echo reply with a return code of 3 (egress router) and no FEC 128 is included.

3.1.8.2.3.3 Receiving an VCCV echo reply

The operation to be taken by the node that receives the echo reply in response to its echo request depends on its current mode of operation such as ping or trace.

In **ping** mode, the node may choose to ignore the target FEC 128 in the echo reply and report only the return code to the operator.

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3.1.9 MPLS-TP on-demand OAM commands

Note:
This feature is supported only on 7210 SAS-T (network operating mode), 7210 SAS-R6, and 7210 SAS-R12.

Ping and trace tools for PWs and LSPs are supported with both IP encapsulation and the MPLS-TP on demand CV channel for non-IP encapsulation (0x025).

3.1.9.1 MPLS-TP pseudowires: VCCV-ping/VCCV-trace

For **vccv-ping** and **vccv-trace** commands:

- Sub-type **static** must be specified. This indicates to the system that the rest of the command contains parameters that are applied to a static PW with a static PW FEC.
- Add the ability to specify the non-IP ACH channel type (0x0025). This is known as the **non-ip control-channel**. This is the default for type static. GAL is not supported for PWs.
- If the **ip-control-channel** is specified as the encapsulation, then the IPv4 channel type is used (0x0021). In this case, a destination IP address in the 127/8 range is used, while the source address in the UDP/IP packet is set to the system IP address, or may be explicitly configured by the user with the **src-ip-address** option. This option is only valid if the IPv4 control-channel is specified.
- The reply mode are always assumed to be the same application level control channel type for type static.
- Allow an MPLS-TP global ID and node ID specified under the spoke SDPs with a specific *sdp-id:vc-id*, used for MPLS-TP PW MEPs, or node ID (prefix) only for MIPs.
- The following CLI command description shows the options that are only allowed if the type static option is configured. All other options are blocked.
- As in the existing implementation, the downstream mapping and detailed downstream mapping TLVs (DSMAP/DDMAP TLVs) is not supported on PWs.

```
vccv-ping static <sdp-id:vc-id> [dest-global-id <global-id> dest-node-id <node-
id>] [control-channel ipv4 | non-ip] [fc <fc-
name> [profile {in | out}]] [size <octets>] [count <send-
count>] [timeout <timeout>] [interval <interval>] [ttl <vc-label-ttl>] [src-ip-
address <ip-address>]
vccv-trace static <sdp-id:vc-id> [size <octets>] [min-ttl <min-vc-label-ttl>] [max-
ttl <max-vc-label-ttl>] [max-fail <no-response-count>] [probe-count <probe-
count>] [control-channel ipv4 | non-ip] [timeout <timeout-
value>] [interval <interval-value>] [fc <fc-name> [profile {in | out}]] [src-ip-
address <ip-address>] [detail]
```

If the spoke SDP referred to by the *sdp-id:vc-id* has an MPLS-TP PW-Path-ID defined, then those parameters are used to populate the static PW TLV in the target FEC stack of the VCCV ping or VCCV trace packet. If a global ID and node ID are specified in the command, then these values are used to populate the destination node TLV in the VCCV ping or VCCV trace packet.

The global ID/node ID are only used as the target node identifiers if the vccv-ping is not end-to-end (for example, a TTL is specified in the VCCV ping/trace command and it is less than 255); otherwise, the value in the PW Path ID is used. For VCCV ping, the **dest-node-id** may be entered as a 4-octet IP address in

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the form *a.b.c.d* or as a 32-bit integer ranging from 1 to 4294967295. For VCCV trace, the destination node ID and global ID are taken from the **spoke-sdp** context.

The same command syntax is applicable for SAA tests configured under configure saa test a type.

3.1.9.2 MPLS-TP LSPs: LSP ping/LSP trace

For **lsp-ping** and **lsp-trace** commands:

- The sub-type **static** must be specified. This indicates to the system that the rest of the command contains parameters specific to a LSP identified by a static LSP FEC.
- The 7210 SAS supports the use of the G-ACh with non-IP encapsulation or labeled encapsulation with IP de-multiplexing for both the echo request and echo reply for LSP-Ping and LSP-Trace on LSPs with a static LSP FEC (such as MPLS-TP LSPs).
- It is possible to specify the target MPLS-TP MEP/MIP identifier information for LSP Ping. If the target **global-id** and **node-id** are not included in the **lsp-ping** command, then these parameters for the target MEP ID are taken from the context of the LSP. The **tunnel-number** *tunnel-num* and **lsp-num** *lsp-num* for the far-end MEP are always taken from the context of the path under test.

```
lsp-ping static <lsp-name>
[force]
[path-type [active | working | protect]]
[fc <fc-name> [profile {in | out}]]
[size <octets>]
[ttl <label-ttl>]
[send-count <send-count>]
[timeout <timeout>]
[interval <interval>]
[src-ip-address <ip-address>]
[dest-global-id <dest-global-id> dest-node-id <dest-node-id>]
[control-channel none | non-ip][detail]
lsp-trace static  <lsp-name>
[force]
[path-type [active | working | protect]
[fc <fc-name> [profile {in | out}]]
[max-fail <no-response-count>]
[probe-count <probes-per-hop>]
[size <octets>]
[min-ttl <min-label-ttl>]
[max-ttl <max-label-ttl>]
[timeout <timeout>]
[interval <interval>]
[src-ip-address <ip-address>]
 [control-channel none | non-ip]
[downstream-map-tlv <dsmap | ddmap>]
[detail]
```

The following commands are only valid if the sub-type **static** option is configured, implying that *lsp-name* refers to an MPLS-TP tunnel LSP:

path-type. Values: active, working, protect. Default: active.

dest-global-id *global-id* **dest-node-id** *node-id*: Default: the to global-id:node-id from the LSP ID.

control-channel: If this is set to none, then IP encapsulation over an LSP is used with a destination address in the 127/8 range. The source address is set to the system IP address, unless the user specifies a source address using the **src-ip-address** option. If this is set to **non-ip**, then non-IP encapsulation

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over a G-ACh with channel type 0x00025 is used. This is the default for sub-type static. Note that the encapsulation used for the echo reply is the same as the encapsulation used for the echo request.

downstream-map-tlv: LSP Trace commands with this option can only be executed if the control-channel is set to none. The DSMAP/DDMAP TLV is only included in the echo request message if the egress interface is either a numbered IP interface, or an unnumbered IP interface. The TLV will not be included if the egress interface is of type **unnumbered-mpls-tp**.

For **lsp-ping**, the **dest-node-id** may be entered as a 4-octet IP address in the form *a.b.c.d* or as a 32-bit integer ranging from 1 to 4294967295. For **lsp-trace**, the destination node ID and global ID are taken from the **spoke-sdp** context.

The send mode and reply mode are always taken to be an application level control channel for MPLS-TP.

The **force** parameter causes an LSP ping echo request to be sent on an LSP that has been brought oper-down by BFD (LSP-Ping echo requests would be dropped on oper-down LSPs). This parameter is not applicable to SAA.

The LSP ID used in the LSP Ping packet is derived from a context lookup based on lsp-name and path-type (active/working/protect).

dest-global-id and **dest-node-id** refer to the target global and node ID. They do not need to be entered for end-to-end ping and trace, and the system will use the destination global ID and node ID from the LSP ID.

The same command syntax is applicable for SAA tests configured under **configure**>**saa**>**test**.

3.1.10 MPLS-TP show commands

3.1.10.1 Static MPLS labels

The following new commands show the details of the static MPLS labels.

show>**router**>**mpls-labels**>**label** *start-label* [*end-label* [**in-use** | *label-owner*]]

show>router>mpls-labels>label-range

Output example

An example output is as follows:

```
*A:mlstp-dutA# show router mpls
mpls         mpls-labels
*A:mlstp-dutA# show router mpls label
label        label-range
*A:mlstp-dutA# show router mpls label-range

===============================================================================
Label Ranges
===============================================================================
Label Type      Start Label     End Label       Aging          Total Available
-------------------------------------------------------------------------------
Static-lsp      32              16415           -              16364
Static-svc      16416           32799           -              16376
Dynamic         32800           131071          0              98268
===============================================================================
```


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3.1.10.2 MPLS-TP tunnel configuration

The following is a sample configuration output of a specific tunnel.

show>router>mpls>tp-lsp

Output example

```
*A:mlstp-dutA# show router mpls tp-lsp
  - tp-lsp [lsp-name] [status {up | down}] [from ip-address | to ip-address]
    [detail]
  - tp-lsp [lsp-name] path [protect | working] [detail]
  - tp-lsp [lsp-name] protection

 <lsp-name>           : [32 chars max] - accepts * as wildcard char
 <path>               : keyword - Display LSP path information.
 <protection>         : keyword - Display LSP protection information.
 <up|down>            : keywords - Specify state of the LSP
 <ip-address>         : a.b.c.d
 <detail>             : keyword - Display detailed information.
*A:mlstp-dutA# show router mpls tp-lsp
path
protection
to <a.b.c.d>
<lsp-name>
 "lsp-32"  "lsp-33"  "lsp-34"  "lsp-35"  "lsp-36"  "lsp-37"  "lsp-38"  "lsp-39"
 "lsp-40"  "lsp-41"
status {up|down}
from <ip-address>
detail

*A:mlstp-dutA# show router mpls tp-lsp "lsp-
"lsp-32"  "lsp-33"  "lsp-34"  "lsp-35"  "lsp-36"  "lsp-37"  "lsp-38"  "lsp-39"
"lsp-40"  "lsp-41"
*A:mlstp-dutA# show router mpls tp-lsp "lsp-32"

===============================================================================
MPLS MPLS-TP LSPs (Originating)
===============================================================================
LSP Name                          To              Tun     Protect   Adm  Opr
                                                  Id      Path
-------------------------------------------------------------------------------
lsp-32                            10.0.3.234      32      No        Up   Up
-------------------------------------------------------------------------------
LSPs : 1
===============================================================================
*A:mlstp-dutA# show router mpls tp-lsp "lsp-32" detail

===============================================================================
MPLS MPLS-TP LSPs (Originating) (Detail)
===============================================================================
-------------------------------------------------------------------------------
Type : Originating
-------------------------------------------------------------------------------
LSP Name    : lsp-32
LSP Type    : MplsTp                          LSP Tunnel ID  : 32
From Node Id: 0.0.3.233+                      To Node Id     : 0.0.3.234
Adm State   : Up                              Oper State     : Up
LSP Up Time : 0d 04:50:47                     LSP Down Time  : 0d 00:00:00
Transitions : 1                               Path Changes   : 2

DestGlobalId: 42                              DestTunnelNum  : 32
```


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3.1.10.3 MPLS-TP path configuration

This can reuse and augment the output of the current show commands for static LSPs. They should also show if BFD is enabled on a specific path. If this referring to a transit path, this should also display (among others) the **path-id** (7 parameters) for a specific transit-path-name, or the transit-path-name for a specific the **path-id** (7 parameters)

show>router>mpls>tp-lsp>path

Output example

A sample output is as follows:

```
===============================================================================
*A:mlstp-dutA#  show router mpls tp-lsp path

===============================================================================
MPLS-TP LSP Path Information
===============================================================================
LSP Name      : lsp-32                          To           : 0.0.3.234
Admin State   : Up                              Oper State   : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       32        32        AtoB_1          Up     Down
Protect                       2080      2080      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-33                          To           : 0.0.3.234
Admin State   : Up                              Oper State   : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       33        33        AtoB_1          Up     Down
Protect                       2082      2082      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-34                          To           : 0.0.3.234
Admin State   : Up                              Oper State   : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       34        34        AtoB_1          Up     Down
Protect                       2084      2084      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-35                          To           : 0.0.3.234
Admin State   : Up                              Oper State   : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       35        35        AtoB_1          Up     Down
Protect                       2086      2086      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-36                          To           : 0.0.3.234
Admin State   : Up                              Oper State   : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       36        36        AtoB_1          Up     Down
```


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```
Protect                       2088      2088      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-37                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       37        37        AtoB_1          Up     Down
Protect                       2090      2090      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-38                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       38        38        AtoB_1          Up     Down
Protect                       2092      2092      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-39                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       39        39        AtoB_1          Up     Down
Protect                       2094      2094      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-40                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       40        40        AtoB_1          Up     Down
Protect                       2096      2096      AtoC_1          Up     Up
===============================================================================
LSP Name      : lsp-41                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       41        41        AtoB_1          Up     Down
Protect                       2098      2098      AtoC_1          Up     Up

*A:mlstp-dutA#  show router mpls tp-lsp "lsp-32" path working

===============================================================================
MPLS-TP LSP Working Path Information
    LSP: "lsp-32"
===============================================================================
LSP Name      : lsp-32                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Working                       32        32        AtoB_1          Up     Down
===============================================================================
*A:mlstp-dutA#  show router mpls tp-lsp "lsp-32" path protect

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


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```
MPLS-TP LSP Protect Path Information
    LSP: "lsp-32"
===============================================================================
LSP Name      : lsp-32                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F         Admin  Oper
-------------------------------------------------------------------------------
Protect                       2080      2080      AtoC_1          Up     Up
===============================================================================
*A:mlstp-dutA#  show router mpls tp-lsp "lsp-32" path protect detail

===============================================================================
MPLS-TP LSP Protect Path Information
    LSP: "lsp-32" (Detail)
===============================================================================
LSP Name      : lsp-32                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

Protect path information
-------------------------------------------------------------------------------
Path Type     : Protect                         LSP Num       : 2
Path Admin    : Up                              Path Oper     : Up
Out Interface : AtoC_1                          Next Hop Addr : n/a
In Label      : 2080                            Out Label     : 2080
Path Up Time  : 0d 04:52:17                     Path Dn Time  : 0d 00:00:00
Active Path   : Yes                             Active Time   : 0d 00:52:56

MEP information
MEP State     : Up                              BFD           : cc
OAM Templ     : privatebed-oam-template         CC Status     : inService
                                                CV Status     : unknown
Protect Templ : privatebed-protection-template  WTR Count Down: 0 seconds
RX PDU        : SF (1,1)                        TX PDU        : SF (1,1)
Defects       :
===============================================================================
*A:mlstp-dutA#  show router mpls tp-lsp "lsp-32" path working detail

===============================================================================
MPLS-TP LSP Working Path Information
    LSP: "lsp-32" (Detail)
===============================================================================
LSP Name      : lsp-32                          To            : 0.0.3.234
Admin State   : Up                              Oper State    : Up

Working path information
-------------------------------------------------------------------------------
Path Type     : Working                         LSP Num       : 1
Path Admin    : Up                              Path Oper     : Down
Down Reason   : ccFault ifDn
Out Interface : AtoB_1                          Next Hop Addr : n/a
In Label      : 32                              Out Label     : 32
Path Up Time  : 0d 00:00:00                     Path Dn Time  : 0d 00:53:01
Active Path   : No                              Active Time   : n/a

MEP information
MEP State     : Up                              BFD           : cc
OAM Templ     : privatebed-oam-template         CC Status     : outOfService
                                                CV Status     : unknown
===============================================================================
*A:mlstp-dutA#
```


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3.1.10.4 MPLS-TP protection

These should show the protection configuration for a specific tunnel, which path in a tunnel is currently working and which is protect, and whether the working or protect is currently active.

show>**router**>**mpls**>**tp-lsp**>**protection**

Output example

A sample output is as follows:

```
*A:mlstp-dutA#  show router mpls tp-lsp protection

===============================================================================
MPLS-TP LSP Protection Information
Legend: W-Working, P-Protect,
===============================================================================
LSP Name                      Admin Oper  Path    Ingr/Egr      Act. Rx PDU
                              State State   State Label         Path Tx PDU
-------------------------------------------------------------------------------
lsp-32                        Up    Up    W Down      32/32     No   SF (1,1)
                                          P Up      2080/2080   Yes  SF (1,1)
lsp-33                        Up    Up    W Down      33/33     No   SF (1,1)
                                          P Up      2082/2082   Yes  SF (1,1)
lsp-34                        Up    Up    W Down      34/34     No   SF (1,1)
                                          P Up      2084/2084   Yes  SF (1,1)
lsp-35                        Up    Up    W Down      35/35     No   SF (1,1)
                                          P Up      2086/2086   Yes  SF (1,1)
lsp-36                        Up    Up    W Down      36/36     No   SF (1,1)
                                          P Up      2088/2088   Yes  SF (1,1)
lsp-37                        Up    Up    W Down      37/37     No   SF (1,1)
                                          P Up      2090/2090   Yes  SF (1,1)
lsp-38                        Up    Up    W Down      38/38     No   SF (1,1)
                                          P Up      2092/2092   Yes  SF (1,1)
lsp-39                        Up    Up    W Down      39/39     No   SF (1,1)
                                          P Up      2094/2094   Yes  SF (1,1)
lsp-40                        Up    Up    W Down      40/40     No   SF (1,1)
                                          P Up      2096/2096   Yes  SF (1,1)
lsp-41                        Up    Up    W Down      41/41     No   SF (1,1)
                                          P Up      2098/2098   Yes  SF (1,1)
-------------------------------------------------------------------------------
No. of MPLS-TP LSPs: 10
===============================================================================
```

3.1.10.5 BFD

The existing **show**>**router**>**bfd** context is enhanced for MPLS-TP, as follows:

show>**router**>**bfd**>**mpls-tp-lsp**

Displays the MPLS–TP paths for which BFD is enabled.

show>**router**>**bfd**>**session** [**src** *ip-address* [**dest** *ip-address* | **detail**]] | [**mpls-tp-path** *lsp-id*… [**detail**]]

Should be enhanced to show the details of the BFD session on a particular MPLS-TP path, where *lsp-id* is the fully qualified lSP ID to which the BFD session is in associated.

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Output example

A sample output is as follows:

```
*A:mlstp-dutA# show router bfd
  - bfd

      bfd-template    - Display BFD Template information
      interface       - Display Interfaces with BFD
      session         - Display session information

*A:mlstp-dutA# show router bfd bfd-template "privatebed-bfd-template"

===============================================================================
BFD Template privatebed-bfd-template
===============================================================================
Template Name           : privatebed-* Template Type             : cpmNp
Transmit Timer          : 10 msec      Receive Timer             : 10 msec
CV Transmit Interval    : 1000 msec
Template Multiplier     : 3            Echo Receive Interval     : 100 msec

Mpls-tp Association
privatebed-oam-template
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:mlstp-dutA# show router bfd session

===============================================================================
BFD Session
===============================================================================
Interface/Lsp Name            State                Tx Intvl  Rx Intvl  Multipl
  Remote Address/Info         Protocols            Tx Pkts   Rx Pkts   Type
-------------------------------------------------------------------------------
wp::lsp-32                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-33                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-34                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-35                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-36                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-37                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-38                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-39                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-40                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
wp::lsp-41                    Down (1)             1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
pp::lsp-32                    Up (3)               1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
pp::lsp-33                    Up (3)               1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
pp::lsp-34                    Up (3)               1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
pp::lsp-35                    Up (3)               1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
pp::lsp-36                    Up (3)               1000      1000      3
    0::0.0.0.0                mplsTp               N/A       N/A       cpm-np
pp::lsp-37                    Up (3)               1000      1000      3
```


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```
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-38                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-39                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-40                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-41                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
-------------------------------------------------------------------------------
No. of BFD sessions: 20
-------------------------------------------------------------------------------
wp = Working path   pp = Protecting path
===============================================================================
```

3.1.10.6 MPLS TP node configuration

Displays the Global ID, Node ID and other general MPLS-TP configurations for the node.

show>router>mpls>mpls-tp

Output example

A sample output is as follows:

```
*A:mlstp-dutA# show router mpls mpls-tp
  - mpls-tp


      oam-template    - Display MPLS-TP OAM Template information
      protection-tem* - Display MPLS-TP Protection Template information
      status          - Display MPLS-TP system configuration
      transit-path    - Display MPLS-TP Tunnel information

*A:mlstp-dutA# show router mpls mpls-tp oam-template

===============================================================================
MPLS-TP OAM Templates
===============================================================================
Template Name : privatebed-oam-template Router ID     : 1
BFD Template  : privatebed-bfd-template Hold-Down Time: 0 centiseconds
                                        Hold-Up Time  : 20 deciseconds
===============================================================================
*A:mlstp-dutA# show router mpls mpls-tp protection-template

===============================================================================
MPLS-TP Protection Templates
===============================================================================
Template Name  : privatebed-protection-template  Router ID      : 1
Protection Mode: one2one                         Direction      : bidirectional
Revertive      : revertive                       Wait-to-Restore: 300sec
Rapid-PSC-Timer: 10ms                            Slow-PSC-Timer : 5sec
===============================================================================
*A:mlstp-dutA# show router mpls mpls-tp status

===============================================================================
MPLS-TP Status
===============================================================================
Admin Status  : Up
Global ID     : 42                               Node ID       : 0.0.3.233
Tunnel Id Min : 1                                Tunnel Id Max : 4096
===============================================================================
```


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```
*A:mlstp-dutA# show router mpls mpls-tp transit-path
  - transit-path [<path-name>] [detail]

 <path-name>          : [32 chars max]
 <detail>             : keyword - Display detailed information.




A:mplstp-dutC# show router mpls mpls-tp transit-path
  - transit-path [<path-name>] [detail]

 <path-name>          : [32 chars max]
 <detail>             : keyword - Display detailed information.


A:mplstp-dutC# show router mpls mpls-tp transit-path
<path-name>
 "tp-32"   "tp-33"   "tp-34"   "tp-35"   "tp-36"   "tp-37"   "tp-38"   "tp-39"
 "tp-40"   "tp-41"
detail

A:mplstp-dutC# show router mpls mpls-tp transit-path "tp-32"

===============================================================================
MPLS-TP Transit tp-32 Path Information
===============================================================================
Path Name     : tp-32
Admin State   : Up                              Oper State    : Up

-------------------------------------------------------------------
Path        NextHop           InLabel   OutLabel  Out I/F
-------------------------------------------------------------------
FP                            2080      2081      CtoB_1
RP                            2081      2080      CtoA_1
===============================================================================
A:mplstp-dutC# show router mpls mpls-tp transit-path "tp-32" detail

===============================================================================
MPLS-TP Transit tp-32 Path Information (Detail)
===============================================================================
Path Name     : tp-32
Admin State   : Up                              Oper State    : Up
-------------------------------------------------------------------------------
Path ID configuration
Src Global ID : 42                              Dst Global ID : 42
Src Node ID   : 0.0.3.234                       Dst Node ID   : 0.0.3.233
LSP Number    : 2                               Dst Tunnel Num: 32

Forward Path configuration
In Label      : 2080                            Out Label     : 2081
Out Interface : CtoB_1                          Next Hop Addr : n/a

Reverse Path configuration
In Label      : 2081                            Out Label     : 2080
Out Interface : CtoA_1                          Next Hop Addr : n/a
===============================================================================
A:mplstp-dutC#
```


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3.1.10.7 MPLS-TP interfaces

The existing **show>router>interface** command should be enhanced to display MPLS-TP- specific information.

Output example

The following is a sample output:

```
*A:mlstp-dutA# show router interface "AtoB_1"

===============================================================================
Interface Table (Router: Base)
===============================================================================
Interface-Name                   Adm         Opr(v4/v6)  Mode    Port/SapId
   IP-Address                                            PfxState
-------------------------------------------------------------------------------
AtoB_1                           Down        Down/--     Network 1/2/3:1
   Unnumbered If[system]                                 n/a
-------------------------------------------------------------------------------
Interfaces : 1
```

3.1.10.8 Services using MPLS-TP PWs

The **show>service** command should be updated to display MPLS-TP-specific information such as the PW path ID and control channel status signaling parameters.

Output example

The following is a sample output:

```
*A:mlstp-dutA# show service id 1 all

===============================================================================
Service Detailed Information
===============================================================================
Service Id        : 1                   Vpn Id            : 0
Service Type      : Epipe
Name              : (Not Specified)
Description       : (Not Specified)
Customer Id       : 1                   Creation Origin   : manual
Last Status Change: 12/03/2012 15:26:20
Last Mgmt Change  : 12/03/2012 15:24:57
Admin State       : Up                  Oper State        : Up
MTU               : 1514
Vc Switching      : False
SAP Count         : 1                   SDP Bind Count    : 1
Per Svc Hashing   : Disabled
Force QTag Fwd    : Disabled

-------------------------------------------------------------------------------
ETH-CFM service specifics
-------------------------------------------------------------------------------
Tunnel Faults     : ignore


-------------------------------------------------------------------------------
Service Destination Points(SDPs)
```


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```
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
 Sdp Id 32:1  -(0.0.3.234:42)
-------------------------------------------------------------------------------
Description     : (Not Specified)
SDP Id             : 32:1                     Type              : Spoke
Spoke Descr     : (Not Specified)
VC Type            : Ether                    VC Tag            : n/a
Admin Path MTU     : 0                        Oper Path MTU     : 9186
Delivery           : MPLS
Far End            : 0.0.3.234:42
Tunnel Far End     : n/a                      LSP Types         : MPLSTP
Hash Label         : Disabled                 Hash Lbl Sig Cap  : Disabled
Oper Hash Label    : Disabled

Admin State        : Up                       Oper State        : Up
Acct. Pol          : None                     Collect Stats     : Disabled
Ingress Label      : 16416                    Egress Label      : 16416
Ingr Mac Fltr-Id   : n/a                      Egr Mac Fltr-Id   : n/a
Ingr IP Fltr-Id    : n/a                      Egr IP Fltr-Id    : n/a
Ingr IPv6 Fltr-Id  : n/a                      Egr IPv6 Fltr-Id  : n/a
Admin ControlWord  : Preferred                Oper ControlWord  : True
Admin BW(Kbps)     : 0                        Oper BW(Kbps)     : 0
Last Status Change : 12/03/2012 15:26:20      Signaling         : None
Last Mgmt Change   : 12/03/2012 15:24:57      Force Vlan-Vc     : Disabled
Endpoint           : N/A                      Precedence        : 4
PW Status Sig      : Enabled
Class Fwding State : Down
Flags              : None
Local Pw Bits      : None
Peer Pw Bits       : None
Peer Fault Ip      : None
Peer Vccv CV Bits  : None
Peer Vccv CC Bits  : None
Application Profile: None
Standby Sig Slave  : False
Block On Peer Fault: False

Ingress Qos Policy : (none)                   Egress Qos Policy : (none)
Ingress FP QGrp    : (none)                   Egress Port QGrp  : (none)
Ing FP QGrp Inst   : (none)                   Egr Port QGrp Inst: (none)

Statistics            :
I. Fwd. Pkts.      : 272969957                I. Dro. Pkts.     : 0
E. Fwd. Pkts.      : 273017433                E. Fwd. Octets    : 16381033352

-------------------------------------------------------------------------------
Control Channel Status
-------------------------------------------------------------------------------
PW Status          : enabled                  Refresh Timer     : 66 secs
Peer Status Expire : false                    Clear On Timeout  : true

-------------------------------------------------------------------------------
SDP-BIND PW Path Information
-------------------------------------------------------------------------------
AGI                : 1:1
SAII Type2         : 42:0.0.3.234:1
TAII Type2         : 42:0.0.3.233:1

-------------------------------------------------------------------------------
RSVP/Static LSPs
-------------------------------------------------------------------------------
Associated LSP List :
Lsp Name           : lsp-32
```


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```
Admin State        : Up                       Oper State        : Up

*A:mlstp-dutA# show service id [1..4] all | match "Control Channel" pre-
lines 1 post-lines 5
-------------------------------------------------------------------------------
Control Channel Status
-------------------------------------------------------------------------------
PW Status          : enabled                  Refresh Timer     : 66 secs
Peer Status Expire : false                    Clear On Timeout  : true

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Control Channel Status
-------------------------------------------------------------------------------
PW Status          : enabled                  Refresh Timer     : 66 secs
Peer Status Expire : false                    Clear On Timeout  : true

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Control Channel Status
-------------------------------------------------------------------------------
PW Status          : enabled                  Refresh Timer     : 66 secs
Peer Status Expire : false                    Clear On Timeout  : true

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Control Channel Status
-------------------------------------------------------------------------------
PW Status          : enabled                  Refresh Timer     : 66 secs
Peer Status Expire : false                    Clear On Timeout  : true

-------------------------------------------------------------------------------
*A:mlstp-dutA#  show service id [1..4] all | match SDP-BIND pre-lines 1 post-lines 5
-------------------------------------------------------------------------------
SDP-BIND PW Path Information
-------------------------------------------------------------------------------
AGI                : 1:1
SAII Type2         : 42:0.0.3.234:1
TAII Type2         : 42:0.0.3.233:1

-------------------------------------------------------------------------------
SDP-BIND PW Path Information
-------------------------------------------------------------------------------
AGI                : 1:2
SAII Type2         : 42:0.0.3.234:2
TAII Type2         : 42:0.0.3.233:2

-------------------------------------------------------------------------------
SDP-BIND PW Path Information
-------------------------------------------------------------------------------
AGI                : 1:3
SAII Type2         : 42:0.0.3.234:3
TAII Type2         : 42:0.0.3.233:3

-------------------------------------------------------------------------------
SDP-BIND PW Path Information
-------------------------------------------------------------------------------
AGI                : 1:4
SAII Type2         : 42:0.0.3.234:4
TAII Type2         : 42:0.0.3.233:4
```


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3.1.11 MPLS-TP debug commands

The following command provides the debug command for an MPLS-TP tunnel:

tools>**dump**>**router**>**mpls**>**tp-tunnel** *lsp-name*[**clear**]

Output example

The following is a sample output:

```
A:mlstp-dutA# tools dump router mpls tp-tunnel
- tp-tunnel <lsp-name> [clear]
- tp-tunnel id <tunnel-id> [clear]
<lsp-name> : [32 chars max]
<tunnel-id> : [1..61440]
<clear> : keyword - clear stats after reading
*A:mlstp-dutA# tools dump router mpls tp-tunnel "lsp-
"lsp-32" "lsp-33" "lsp-34" "lsp-35" "lsp-36" "lsp-37" "lsp-38" "lsp-39"
"lsp-40" "lsp-41"
*A:mlstp-dutA# tools dump router mpls tp-tunnel "lsp-32"
Idx: 1-32 (Up/Up): pgId 4, paths 2, operChg 1, Active: Protect
TunnelId: 42::0.0.3.233::32-42::0.0.3.234::32
PgState: Dn, Cnt/Tm: Dn 1/000 04:00:48.160 Up:3/000 00:01:25.840
MplsMsg: tpDn 0/000 00:00:00.000, tunDn 0/000 00:00:00.000
wpDn 0/000 00:00:00.000, ppDn 0/000 00:00:00.000
wpDel 0/000 00:00:00.000, ppDel 0/000 00:00:00.000
tunUp 1/000 00:00:02.070
Paths:
Work (Up/Dn): Lsp 1, Lbl 32/32, If 2/128 (1/2/3 : 0.0.0.0)
Tmpl: ptc: , oam: privatebed-oam-template (bfd: privatebed-bfd-template(np)-10 ms)
Bfd: Mode CC state Dn/Up handle 160005/0
Bfd-CC (Cnt/Tm): Dn 1/000 04:00:48.160 Up:1/000 00:01:23.970
State: Admin Up (1::1::1) port Up , if Dn , operChg 2
DnReasons: ccFault ifDn
Protect (Up/Up): Lsp 2, Lbl 2080/2080, If 3/127 (5/1/1 : 0.0.0.0)
Tmpl: ptc: privatebed-protection-template, oam: privatebed-oam-
template (bfd: privatebed-
bfd-template(np)-10 ms)
Bfd: Mode CC state Up/Up handle 160006/0
Bfd-CC (Cnt/Tm): Dn 0/000 00:00:00.000 Up:1/000 00:01:25.410
State: Admin Up (1::1::1) port Up , if Up , operChg 1
Aps: Rx - 5, raw 3616, nok 0(), txRaw - 3636, revert Y
Pdu: Rx - 0x1a-21::0101 (SF), Tx - 0x1a-21::0101 (SF)
State: PF:W:L LastEvt pdu (L-SFw/R-SFw)
Tmrs: slow
Defects: None Now: 000 05:02:19.130
Seq Event state TxPdu RxPdu Dir Act Time
=== ====== ======== ========== ========== ===== ==== ================
000 start UA:P:L SF (0,0) NR (0,0) Tx--> Work 000 00:00:02.080
001 pdu UA:P:L SF (0,0) SF (0,0) Rx<-- Work 000 00:01:24.860
002 pdu UA:P:L SF (0,0) NR (0,0) Rx<-- Work 000 00:01:26.860
003 pUp NR NR (0,0) NR (0,0) Tx--> Work 000 00:01:27.440
004 pdu NR NR (0,0) NR (0,0) Rx<-- Work 000 00:01:28.760
005 wDn PF:W:L SF (1,1) NR (0,0) Tx--> Prot 000 04:00:48.160
006 pdu PF:W:L SF (1,1) NR (0,1) Rx<-- Prot 000 04:00:48.160
007 pdu PF:W:L SF (1,1) SF (1,1) Rx<-- Prot 000 04:00:51.080
```

The following command shows the free MPLS tunnel IDs.

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Example

```
A:SASR1# /tools dump router mpls  mpls-tp check-lbl-range
  - mpls-tp check-lbl-range <range1> <range2>

<check-lbl-range>    : keyword
<range1>             : [32..65520]
<range2>             : [32..65520]
```

The following command provides a debug tool to view control-channel-status signaling packets.

Example

```
*A:7210SAS# /debug service id 700 sdp 200:700 event-type ?{config-change|oper-
status-change|neighbor-discovery|control-channel-status}

*A:7210SAS# /debug service id 700 sdp 200:700 event-type control-channel-status

*A:7210SAS#
1 2012/08/31 09:56:12.09 EST MINOR: DEBUG #2001 Base PW STATUS SIG PKT (RX):
PW STATUS SIG PKT (RX)::
Sdp Bind 200:700 Instance 3
    Version          : 0x0
    PW OAM Msg Type  : 0x27
    Refresh Time     : 0xa
    Total TLV Length : 0x8
    Flags            : 0x0
    TLV Type         : 0x96a
    TLV Len          : 0x4
    PW Status Bits   : 0x0


2 2012/08/31 09:56:22.09 EST MINOR: DEBUG #2001 Base PW STATUS SIG PKT (RX):
PW STATUS SIG PKT (RX)::
Sdp Bind 200:700 Instance 3
    Version          : 0x0
    PW OAM Msg Type  : 0x27
    Refresh Time     : 0xa
    Total TLV Length : 0x8
    Flags            : 0x0
    TLV Type         : 0x96a
    TLV Len          : 0x4
    PW Status Bits   : 0x0


3 2012/08/31 09:56:29.44 EST MINOR: DEBUG #2001 Base PW STATUS SIG PKT (TX):
PW STATUS SIG PKT (TX)::
Sdp Bind 200:700 Instance 3
    Version          : 0x0
    PW OAM Msg Type  : 0x27
    Refresh Time     : 0x1e
    Total TLV Length : 0x8
    Flags            : 0x0
    TLV Type         : 0x96a
    TLV Len          : 0x4
    PW Status Bits   : 0x0
```


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3.2 IP Performance Monitoring (IP PM)

The 7210 SAS supports Two-Way Active Measurement Protocol (TWAMP) and Two-Way Active Measurement Protocol Light (TWAMP Light).

Note:
On the 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Mxp, and 7210 SAS-T, the MVR RVPLS service configured with IGMPv3 snooping shares resources with TWAMP and TWAMP Light. An increase in one decreases the amount of resources available for the other. Contact your Nokia representative for more information about scaling of these features. For more information about IGMPv3 snooping, see the *7210 SAS-Mxp, S, Sx, T Services Guide*.

3.2.1 Two-Way Active Measurement Protocol (TWAMP)

Two-Way Active Measurement Protocol (TWAMP) provides a standards-based method for measuring the round-trip IP performance (packet loss, delay and jitter) between two devices. TWAMP uses the methodology and architecture of One-Way Active Measurement Protocol (OWAMP) to define a way to measure two-way or round-trip metrics.

There are four logical entities in TWAMP:

- the control-client
- the session-sender
- the server
- the session-reflector

The control-client and session-sender are typically implemented in one physical device (the "client") and the server and session-reflector in a second physical device (the "server") with which the two-way measurements are being performed. The 7210 SAS acts as the server. The control-client and server establishes a TCP connection and exchange TWAMP-Control messages over this connection. When the control-client requires to start testing, the client communicates the test parameters to the server. If the server corresponds to conduct the described tests, the test begins as soon as the client sends a Start-Sessions message. As part of a test, the session sender sends a stream of UDP-based test packets to the session-reflector, and the session reflector responds to each received packet with a response UDP-based test packet. When the session-sender receives the response packets from the session-reflector, the information is used to calculate two-way delay, packet loss, and packet delay variation between the two devices.

3.2.1.1 Configuration notes

The following are the configuration notes:

- Unauthenticated mode is supported. Encrypted and Authenticated modes are not supported.
- TWAMP is supported only in the base router instance.
- By default, the 7210 SAS uses TCP port number 862 to listen for TWAMP control connections. This is not user configurable.

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3.2.2 Two-Way Active Measurement Protocol Light (TWAMP Light)

TWAMP Light is an optional model included in the TWAMP standard RFC5357 that uses standard TWAMP test packets but provides a lightweight approach to gathering ongoing IP delay performance data for base router and per-VPRN statistics. Full details are described in Appendix I of RFC 5357 (Active Two Way Measurement Protocol). The 7210 SAS implementation supports the TWAMP Light model for gathering delay and loss statistics.

For TWAMP Light, the TWAMP Client/Server model is replaced with the Session Controller/Responder model. In general terms, the Session Controller is the launch point for the test packets and the Responder performs the reflection function.

TWAMP Light maintains the TWAMP test packet exchange but eliminates the TWAMP TCP control connection with local configurations; however, not all negotiated control parameters are replaced with local configuration. For example, CoS parameters communicated over the TWAMP control channel are replaced with a reply-in-kind approach. The reply-in-kind model reflects back the received CoS parameters, which are influenced by the reflector's QoS policies.

The responder function is configured under the **config**>**router**>**twamp-light** command hierarchy for base router reflection, and under the **config**>**service**>**vprn**>**twamp-light** command hierarchy for per VPRN reflection. The TWAMP Light reflector function is configured per context and must be activated before reflection can occur; the function is not enabled by default for any context. The reflector requires the operator to define the TWAMP Light UDP listening port that identifies the TWAMP Light protocol and the prefixes that the reflector will accept as valid sources for a TWAMP Light request. If the configured TWAMP Light listening UDP port is in use by another application on the system, a Minor OAM message will be presented indicating that the port is unavailable and that the activation of the reflector is not allowed.

f the source IP address in the TWAMP Light packet arriving on the responder does not match a configured IP address prefix, the packet is dropped. Multiple prefix entries may be configured per context on the responder. An inactivity timeout under the **config**>**oam-test**>**twamp**>**twamp-light** hierarchy defines the amount of time the reflector will keep the individual reflector sessions active in the absence of test packets. A responder requires CPM3 or better hardware.

TWAMP Light test packet launching is controlled by the OAM Performance Monitoring (OAM-PM) architecture and adheres to those rules; this includes the assignment of a test Id. TWAMP Light does not carry the 4-byte test ID in the packet to remain locally significant and uniform with other protocols under the control of the OAM-PM architecture. The OAM-PM construct allow the various test parameters to be defined. These test parameters include the IP session-specific information which allocates the test to the specific routing instance, the source and destination IP address, the destination UDP port (which must match the listening UDP port on the reflector) and a number of other options that allow the operator to influence the packet handling. The probe interval and padding size can be configured under the specific session. The size of the all "0" padding can be included to ensure that the TWAMP packet is the same size in both directions. The TWAMP PDU definition does not accomplish symmetry by default. A pad size of 27 bytes will accomplish symmetrical TWAMP frame sizing in each direction.

The OAM-PM architecture does not perform any validation of the session information. The test will be allowed to be activated regardless of the validity of this information. For example, if the configured source IP address is not local within the router instance to which the test is allocated, the test will start sending TWAMP Light packets but will not receive any responses.

The OAM Performance Monitoring (OAM-PM) section of this guide provides more information describing the integration of TWAMP Light and the OAM-PM architecture, including hardware dependencies.

The following is a summary of supported TWAMP Light functions.

- base router instances for network interfaces and IES services:

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  - IPv6 addresses are supported only with IP interfaces that support IPv6, such as an IES IP interface in access-uplink and network mode. IPv6 is not supported for IP interfaces that do not support IPv6; for example, routed VPLS services in access-uplink mode do not support IPv6, and therefore TWAMP Light IPv6 sessions are not supported with it.
- per-VPRN service context
- IPv4 and IPv6:
  - must be unicast
  - for IPv6, addresses cannot be a reserved or link local address
- reflector prefix definition for acceptable TWAMP Light sources:
  - Prefix list may be added and removed without shutting down the reflector function.
  - If no prefixes are defined, the reflector will drop all TWAMP Light packets.
- integration with OAM-PM architecture capturing delay and loss measurement statistics:
  - Not available from interactive CLI.
  - Multiple test sessions can be configured between the same source and destination IP endpoints. The tuple of Source IP, Destination IP, Source UDP, and Destination UDP provide a unique index for each test.

The following example shows a basic configuration using TWAMP Light to monitor two IP endpoints in a VPRN, including the default TWAMP Light values that were not overridden with configuration entries.

Output example

The following is a sample reflector configuration output.

```
config>test-oam>twamp>twamp-light# info detail
----------------------------------------------------------------------------
(default)      inactivity-timeout 100
----------------------------------------------------------------------------

config>service>vprn# info
----------------------------------------------------------------------------
            route-distinguisher 65535:500
            auto-bind ldp
            vrf-target target:65535:500
            interface "to-cpe31" create
                address 10.1.1.1/30
                sap 1/1/2:500 create
                exit
            exit
            static-route 192.168.1.0/24 next-hop 10.1.1.2
            bgp
                no shutdown
            exit
            twamp-light
                reflector udp-port 15000 create
                    description "TWAMP Light reflector VPRN 500"
                    prefix 10.2.1.1/32 create
                        description "Process only 10.2.1.1 TWAMP Light Packets"
                    exit
                    prefix 172.16.1.0/24 create
                        description "Process all 172.16.1.0 TWAMP Light packets"
                    exit
                    no shutdown
                exit
```


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```
            exit
            no shutdown
-------------------------------------------------------------------------------
```

The following is a sample session controller configuration output.

Output example

```
config>service>vprn# info
----------------------------------------------------------------------
            route-distinguisher 65535:500
            auto-bind ldp
            vrf-target target:65535:500
            interface "to-cpe28" create
                address 10.2.1.1/30
                sap 1/1/4:500 create
                exit
            exit
            static-route 192.168.2.0/24 next-hop 10.2.1.2
            no shutdown
----------------------------------------------------------------------

config>oam-pm>session# info detail
----------------------------------------------------------------------
            bin-group 2
            meas-interval 15-mins create
                intervals-stored 8
            exit
            ip
                dest-udp-port 15000
                destination 10.1.1.1
                fc "l2"
(default)           no forwarding
                profile in
                router 500
                source 10.2.1.1
(default)          ttl 255
                twamp-light test-id 500 create
(default)                interval 100
(default)                pad-size 0
(default)                no test-duration
                   no shutdown
                exit
            exit
----------------------------------------------------------------------
```

3.3 Ethernet Connectivity Fault Management

The IEEE and the ITU-T have cooperated to define the protocols, procedures and managed objects to support service-based fault management. Both IEEE 802.1ag standard (Ethernet Connectivity Fault Management (ETH-CFM)) and the ITU-T Y.1731 recommendation support a common set of tools that allow operators to deploy the necessary administrative constructs, management entities and functionality. The ITU-T has also implemented a set of advanced ETH-CFM and performance management functions and features that build on the proactive and on-demand troubleshooting tools.

CFM uses Ethernet frames and is distinguishable by Ethertype 0x8902. In certain cases, the different functions use a reserved multicast address that can also be used to identify specific functions at the MAC layer. However, the multicast MAC addressing is not used for every function or in every case. The

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Operational Code (OpCode) in the common CFM header is used to identify the type of function carried in the CFM packet. CFM frames are only processed by IEEE MAC bridges. With CFM, interoperability can be achieved between different vendor equipment in the service provider network up to and including customer premise bridges.

IEEE 802.1ag and ITU-T Y.1731 functions that are implemented are available on the 7210 SAS platforms.

The following table lists the CFM-related acronyms used in this section.

Table 11: ETH-CFM acronym expansions

Acronym	Expansion
1DM	One way Delay Measurement (Y.1731)
AIS	Alarm Indication Signal
CCM	Continuity Check Message
CFM	Connectivity Fault Management
DMM	Delay Measurement Message (Y.1731)
DMR	Delay Measurement Reply (Y.1731)
LBM	Loopback Message
LBR	Loopback Reply
LTM	Linktrace Message
LTR	Linktrace Reply
ME	Maintenance Entity
MA	Maintenance Association
MA-ID	Maintenance Association Identifier
MD	Maintenance Domain
MEP	Maintenance association End Point
MEP-ID	Maintenance association End Point Identifier
MHF	MIP Half Function
MIP	Maintenance domain Intermediate Point
OpCode	Operational Code
RDI	Remote Defect Indication
TST	Ethernet Test (Y.1731)

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3.3.1 ETH-CFM building blocks

The IEEE and the ITU-T use their own nomenclature when describing administrative contexts and functions. This introduces a level of complexity to configuration, description and different vendors naming conventions. The 7210 SAS OS CLI has chosen to standardize on the IEEE 802.1ag naming where overlap exists. ITU-T naming is used when no equivalent is available in the IEEE standard. In the following definitions, both the IEEE name and ITU-T names are provided for completeness, using the format IEEE Name/ITU-T Name.

Maintenance Domain (MD)/Maintenance Entity (ME) is the administrative container that defines the scope, reach and boundary for faults. It is typically the area of ownership and management responsibility. The IEEE allows for various formats to name the domain, allowing up to 45 characters, depending on the format selected. ITU-T supports only a format of none and does not accept the IEEE naming conventions:

- **0**

  Undefined and reserved by the IEEE.

- **1**

  No domain name. It is the only format supported by Y.1731 as the ITU-T specification does not use the domain name. This is supported in the IEEE 802.1ag standard but not in currently implemented for 802.1ag defined contexts.

- **2,3,4**

  Provides the ability to input various different textual formats, up to 45 characters. The string format (2) is the default and therefore the keyword is not shown when looking at the configuration.

Maintenance Association (MA)/Maintenance Entity Group (MEG) is the construct where the different management entities will be contained. Each MA is uniquely identified by its MA-ID. The MA-ID is comprised of the by the MD level and MA name and associated format. This is another administrative context where the linkage is made between the domain and the service using the **bridging-identifier** configuration option. The IEEE and the ITU-T use their own specific formats. The MA short name formats (0-255) have been divided between the IEEE (0-31, 64-255) and the ITU-T (32-63), with five currently defined (1-4, 32). Even though the different standards bodies do not have specific support for the others formats a Y.1731 context can be configured using the following IEEE format options:

- 1 (Primary VID) - values 0 to 4094
- 2 (String) - raw ASCII, excluding 0-31 decimal/0-1F hex (which are control characters) form the ASCII table
- 3 (2-octet integer) - 0 to 65535
- 4 (VPN ID) - hex value as described in RFC 2685, *Virtual Private Networks Identifier*
- 32 (icc-format) - exactly 13 characters from the ITU-T recommendation T.50

Note:
When a VID is used as the short MA name, 802.1ag will not support VLAN translation because the MA-ID must match all the MEPs. The default format for a short MA name is an integer. Integer value 0 means the MA is not attached to a VID. This is useful for VPLS services on 7210 SAS platforms because the VID is locally significant.

Maintenance Domain Level (MD Level)/Maintenance Entity Group Level (MEG Level) is the numerical value (0-7) representing the width of the domain. The wider the domain, higher the numerical value, the farther the ETH-CFM packets can travel. It is important to understand that the level establishes the

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processing boundary for the packets. Strict rules control the flow of ETH-CFM packets and are used to ensure correct handling, forwarding, processing and dropping of these packets. To keep it simple ETH-CFM packets with higher numerical level values will flow through MEPs on MIPs on SAPs configured with lower level values. This allows the operator to implement different areas of responsibility and nest domains within each other. Maintenance association (MA) includes a set of MEPs, each configured with the same MA-ID and MD level used verify the integrity of a single service instance.

Maintenance Endpoint (MEP)/MEG Endpoint (MEP) are the workhorses of ETH-CFM. A MEP is the unique identification within the association (0-8191). Each MEP is uniquely identified by the MA-ID, MEPID tuple. This management entity is responsible for initiating, processing and terminating ETH-CFM functions, following the nesting rules. MEPs form the boundaries which prevent the ETH-CFM packets from flowing beyond the specific scope of responsibility. A MEP has direction, up or down. Each indicates the directions packets will be generated; UP toward the switch fabric, down toward the SAP away from the fabric. Each MEP has an active and passive side. Packets that enter the active point of the MEP will be compared to the existing level and processed accordingly. Packets that enter the passive side of the MEP are passed transparently through the MEP. Each MEP contained within the same maintenance association and with the same level (MA-ID) represents points within a single service. MEP creation on a SAP is allowed only for Ethernet ports with NULL, Q-tags, Q-in-Q encapsulations. MEPs may also be created on SDP bindings.

Maintenance Intermediate Point (MIP)/MEG Intermediate Point (MIP) are management entities between the terminating MEPs along the service path. These provide insight into the service path connecting the MEPs. MIPs only respond to Loopback Messages (LBM) and Linktrace Messages (LTM). All other CFM functions are transparent to these entities. Only one MIP is allowed per SAP or SDP. The creation of the MIPs can be done when the lower level domain is created (explicit). This is controlled by the use of the mhf-creation mode within the association under the bridge-identifier. MIP creation is supported on a SAP and SDP, not including Mesh SDP bindings. By default, no MIPs are created.

There are two locations in the configuration where ETH-CFM is defined. The domains, associations (including linkage to the service id), MIP creation method, common ETH-CFM functions and remote MEPs are defined under the top level **eth-cfm** command. It is important to note, when Y.1731 functions are required the context under which the MEPs are configured must follow the Y.1731 specific formats (domain format of none, MA format icc-format). When these parameters have been entered, the MEP and possibly the MIP can be defined within the service under the SAP or SDP.

Table 12: ETH-CFM support matrix for the 7210 SAS-T (network mode), Table 13: ETH-CFM support matrix for the 7210 SAS-T (access-uplink mode), Table 14: ETH-CFM support matrix for 7210 SAS-Mxp devices, Table 15: ETH-CFM support matrix for 7210 SAS-R6 and 7210 SAS-R12 devices, Table 16: ETH-CFM support matrix for 7210 SAS-Sx/S 1/10GE devices, and Table 17: ETH-CFM support matrix for 7210 SAS-Sx 10/100GE devices are general tables that indicate the ETH-CFM support for the different services and endpoints. It is not meant to indicate the services that are supported or the requirements for those services on the individual platforms.

Table 12: ETH-CFM support matrix for the 7210 SAS-T (network mode)

Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP	✓	✓	✓	✓	✓ [9]

[9] Only on Down MEP

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Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
	SDP	✓	✓	✓	✓	
VPLS	SAP	✓	✓	✓		✓ [9]
	Spoke-SDP	✓	✓	✓		
	Mesh-SDP	✓	✓			
RVPLS	SAP					
IES	IES IPv4 interface					
PBB Epipe	I-SAP		✓			
PBB VPLS	I-SAP					
PBB B-VPLS	B-SAP					
IES	SAP					
VPRN	SAP					

Table 13: ETH-CFM support matrix for the 7210 SAS-T (access-uplink mode)

Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP (Access and Access-uplink SAP)	✓	✓	✓	✓	
VPLS	SAP (Access and Access-uplink SAP)	✓	✓	✓		
RVPLS	SAP					
IES	IES IPv4 interface					
	SAP					

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Table 14: ETH-CFM support matrix for 7210 SAS-Mxp devices

Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP	✓	✓	✓	✓	✓ [9]
	SDP	✓	✓	✓	✓	
VPLS	SAP	✓	✓	✓		✓ [9]
	Spoke-SDP	✓	✓	✓		
	Mesh-SDP	✓	✓			
RVPLS	SAP					
IES	IES IPv4 interface					
PBB Epipe	I-SAP					
PBB VPLS	I-SAP					
PBB B-VPLS	B-SAP					
IES	SAP					
VPRN	SAP					

Table 15: ETH-CFM support matrix for 7210 SAS-R6 and 7210 SAS-R12 devices

Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP	✓	✓	✓	✓	✓ [10]
	SDP	✓	✓	✓	✓	
VPLS	SAP	✓	✓ [11]	✓	✓	✓ [12]
	Spoke-SDP	✓	✓ [11]	✓		

10 Supported for Down MEP only.

11 Supported for IMMv2 only.

12 Supported only for Down MEP and MIP.

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Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
	Mesh-SDP		✓ [11]			
R-VPLS	SAP					
IES	IES IPv4 interface					
PBB Epipe	I-SAP					
PBB VPLS	I-SAP					
PBB B-VPLS	B-SAP					
IES	SAP					
VPRN	SAP					

Table 16: ETH-CFM support matrix for 7210 SAS-Sx/S 1/10GE devices

Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP	✓	✓	✓	✓	✓ [9]
	SDP	✓	✓	✓	✓	
VPLS	SAP	✓	✓	✓		✓ [9]
	Spoke-SDP	✓	✓	✓		
	Mesh-SDP	✓	✓			
RVPLS	SAP					
IES	IES IPv4 interface					
PBB Epipe	I-SAP					
PBB VPLS	I-SAP					
PBB B-VPLS	B-SAP					
IES	SAP					

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Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
VPRN	SAP					

Table 17: ETH-CFM support matrix for 7210 SAS-Sx 10/100GE devices

Service	Ethernet connection type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP	✓	✓	✓	✓	✓ [9]
	SDP	✓	✓	✓	✓	
VPLS	SAP	✓	✓	✓		✓ [9]
	Spoke-SDP	✓	✓	✓		
	Mesh-SDP	✓	✓			
RVPLS	SAP					
IES	IES IPv4 interface					
PBB Epipe	I-SAP					
PBB VPLS	I-SAP					
PBB B-VPLS	B-SAP					
IES	SAP					
VPRN	SAP					

The following figures show the detailed IEEE representation of MEPs, MIPs, levels and associations, using the standards defined icons.

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Figure 18: MEP and MIP

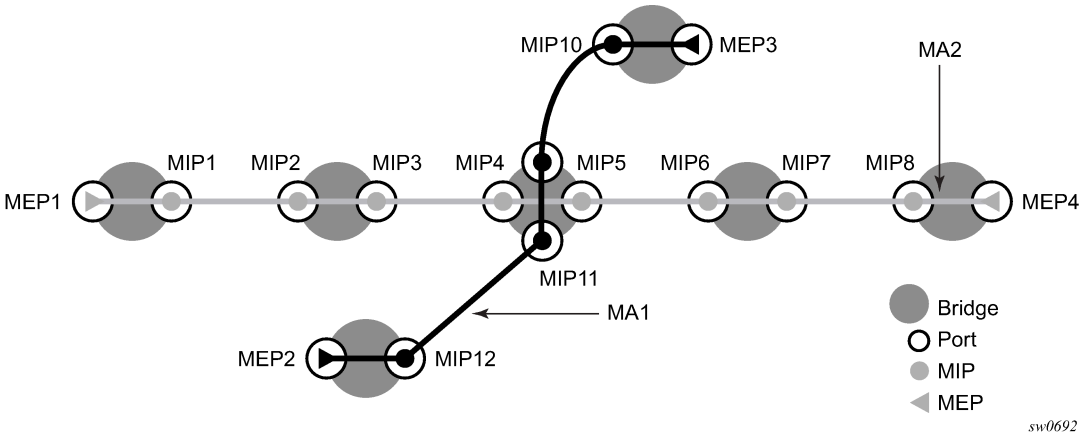
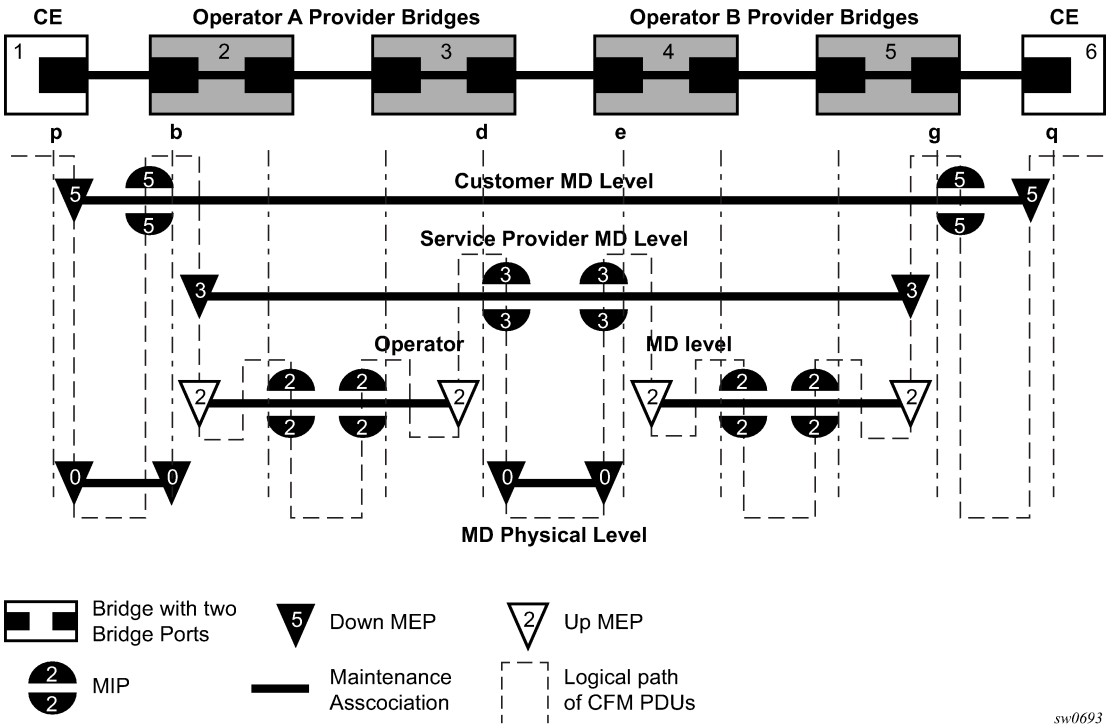


Figure 19: MEP, MIP and MD levels

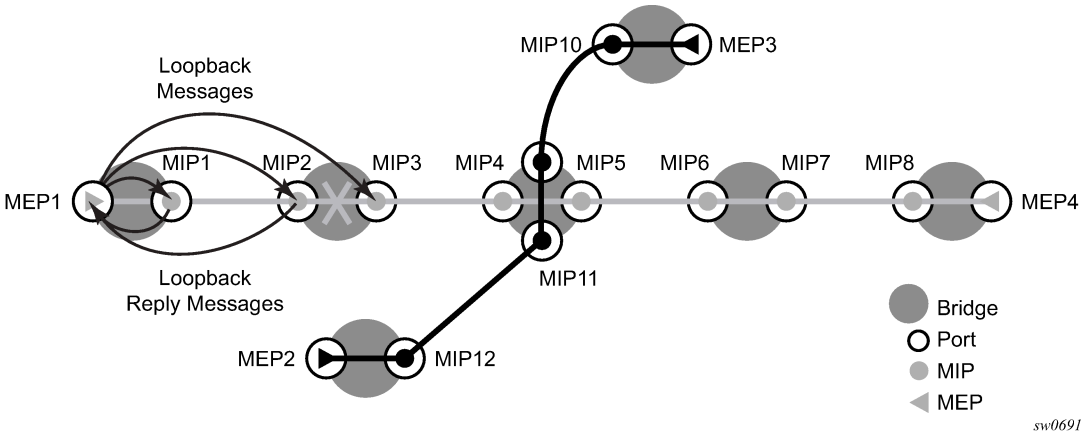


3.3.1.1 Loopback

A loopback message is generated by a MEP to its peer MEP (see the following figure). The functions are similar to an IP ping to verify Ethernet connectivity between the nodes.

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Figure 20: CFM loopback



The following loopback-related functions are supported:

- Loopback message functionality on a MEP or MIP can be enabled or disabled.
- A MEP supports generating loopback messages and responding to loopback messages with loopback reply messages.
- A MIP supports responding to loopback messages with loopback reply messages when loopback messages are targeted to itself.
- The Sender ID TLV may optionally be configured to carry the Chassis ID. When configured, the following information will be included in LBM messages:
  - Only the Chassis ID portion of the TLV will be included.
  - The Management Domain and Management Address fields are not supported on transmission.
  - As per the specification, the LBR function copies and returns any TLVs received in the LBM message. This means that the LBR message will include the original Sender ID TLV.
  - The Sender ID TLV is supported for service (**id-permission**) MEPs.
  - The Sender ID TLV is supported for both MEPs and MIPs.
- Loopback test results are displayed on the originating MEP. There is a limit of 10 outstanding tests per node.

3.3.1.2 Linktrace

A linktrace message is originated by an MEP and targeted to a peer MEP in the same MA and within the same MD level (see Figure 21: CFM linktrace). Its function is similar to IP traceroute. Linktrace traces a specific MAC address through the service. The peer MEP responds with a linktrace reply message after successful inspection of the linktrace message. The MIPs along the path also process the linktrace message and respond with linktrace replies to the originating MEP if the received linktrace message that has a TTL greater than 1; the MIPs also forward the linktrace message if a lookup of the target MAC address in the Layer 2 FIB is successful. The originating MEP will receive multiple linktrace replies and from processing the linktrace replies, it can put together the route to the target bridge.

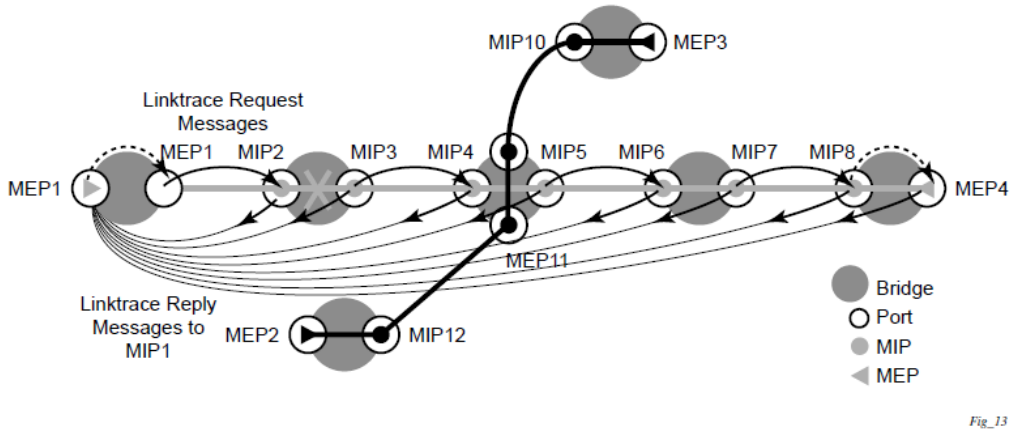
A traced MAC address (the targeted MAC address) is carried in the payload of the linktrace message. Each MIP and MEP receiving the linktrace message checks whether it has learned the target MAC

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address. To use linktrace, the target MAC address must have been learned by the nodes in the network. If the address has been learned, a linktrace message is sent back to the originating MEP. A MIP forwards the linktrace message out of the port where the target MAC address was learned.

The linktrace message has a multicast destination address. On a broadcast LAN, it can be received by multiple nodes connected to that LAN; However, only one node will send a reply.

Figure 21: CFM linktrace



The following linktrace-related functions are supported:

- Linktrace functions can be enabled or disabled on an MEP.
- A MEP supports generating linktrace messages and responding with linktrace reply messages.
- A MIP supports responding to linktrace messages with linktrace reply messages when encoded TTL is greater than 1; The MIPs forward the linktrace messages accordingly if a lookup of the target MAC address in the Layer 2 FIB is successful.
- The Sender ID TLV may optionally be configured to carry the Chassis ID. When configured, the following information will be included in LTM and LTR messages:
  - Only the Chassis ID portion of the TLV will be included.
  - The Management Domain and Management Address fields are not supported on transmission.
  - The LBM message will include the Sender ID TLV that is configured on the launch point. The LBR message will include the Sender ID TLV information from the reflector (MIP or MEP) if it is supported.
  - The Sender ID TLV is supported for service (**id-permission**) MEPs.
  - The Sender ID TLV is supported for both MEPs and MIPs.

The display output has been updated to include the Sender ID TLV contents if they are included in the LBR.

Output example

```
oam eth-cfm linktrace 00:00:00:00:00:30 mep 28 domain 14 association 2
Index Ingress Mac          Egress Mac           Relay     Action
----- -------------------- -------------------- ---------- ----------
1     00:00:00:00:00:00    00:00:00:00:00:30    n/a       terminate
SenderId TLV: ChassisId (local)
```


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```
              access-012-west
----- ------------------- ------------------- ---------- ----------
No more responses received in the last 6 seconds.
```

- Linktrace test results are displayed on the originating MEP. There is a limit of 10 outstanding tests per node. Storage is provided for up to 10 MEPs and for the last 10 responses. If more than 10 responses are received older entries will be overwritten.

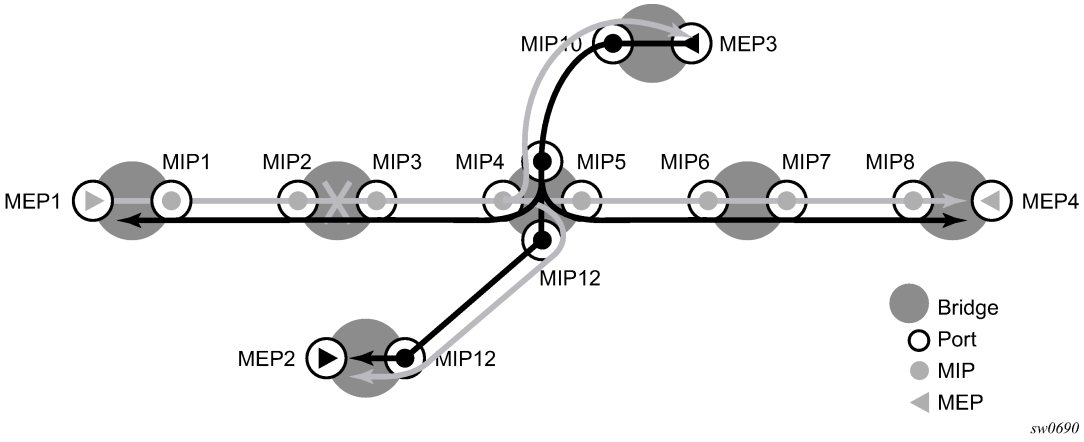
3.3.1.3 Continuity Check (CC)

A Continuity Check Message (CCM) is a multicast frame that is generated by a MEP and multicast to all other MEPs in the same MA. The CCM does not require a reply message. To identify faults, the receiving MEP maintains an internal list of remote MEPs it should be receiving CCM messages from.

This list is based on the remote MEP ID configuration within the association the MEP is created in. When the local MEP does not receive a CCM from one of the configured remote MEPs within a preconfigured period, the local MEP raises an alarm.

The following figure shows a CFM continuity check.

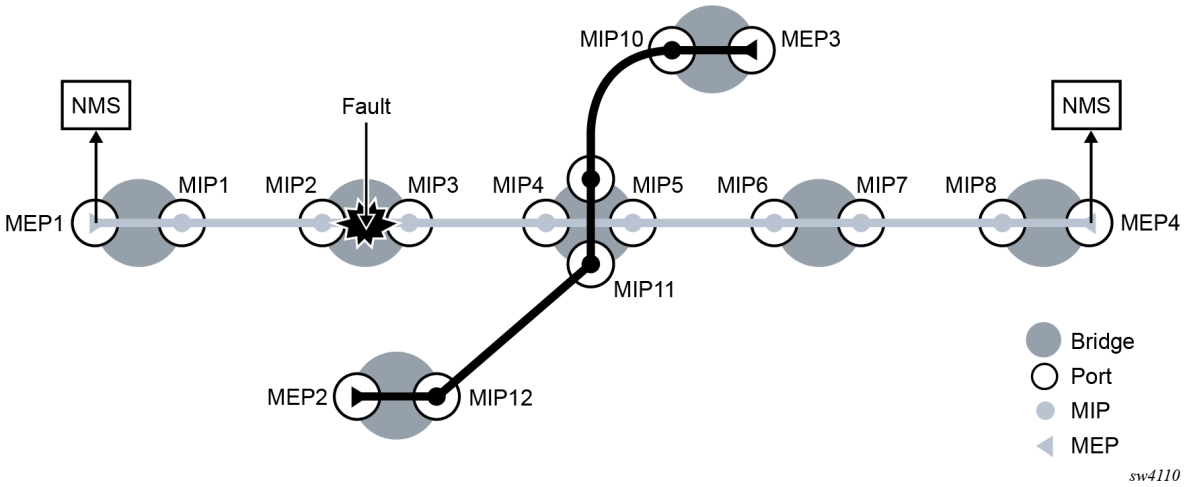
Figure 22: CFM Continuity Check



The following figure shows a CFM CC failure scenario.

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Figure 23: CFM CC failure scenario



The following functions are supported:

- CC can be enabled and disabled for an MEP.
- MEP entries can be configured and deleted in the CC MEP monitoring database manually. Only remote MEPs must be configured. Local MEPs are automatically added to the database when they are created.
- The CCM transmit interval is configurable. See the Diagnostics command reference for more information about supported timer intervals on different platforms for MEPs used in the service context and G.8032 control instance context.
- CCM will declare a fault, when:
  - the CCM stops hearing from one of the remote MEPs for 3.5 times CC interval
  - the CCM hears from a MEP with a LOWER MD level
  - the CCM hears from a MEP that is not part of the local MEP's MA
  - the CCM hears from a MEP that is in the same MA but not in the configured MEP list
  - the CCM hears from a MEP that is in the same MA with the same MEP ID as the receiving MEP
  - the CC interval of the remote MEP does not match the local configured CC interval
  - the remote MEP is declaring a fault
- An alarm is raised and a trap is sent if the defect is greater than or equal to the configured **low-priority-defect** value.
- Remote Defect Indication (RDI) is supported but by default is not recognized as a defect condition because the **low-priority-defect** setting default does not include RDI.
- The Sender ID TLV may optionally be configured to carry the Chassis ID. When configured, the following information will be included in CCM messages:
  - Only the Chassis ID portion of the TLV will be included.
  - The Management Domain and Management Address fields are not supported on transmission.
  - The Sender ID TLV is not supported with subsecond CCM-enabled MEPs.
  - The Sender ID TLV is supported for service (**id-permission**) MEPs.

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3.3.1.4 Alarm Indication Signal (ETH-AIS Y.1731)

Alarm Indication Signal (AIS) provides an Y.1731 capable MEP the ability to signal a fault condition in the reverse direction of the MEP, out the passive side. When a fault condition is detected the MEP will generate AIS packets at the configured client levels and at the specified AIS interval until the condition is cleared. Currently a MEP configured to generate AIS must do so at a level higher than its own. The MEP configured on the service receiving the AIS packets is required to have the active side facing the receipt of the AIS packet and must be at the same level the AIS, The absence of an AIS packet for 3.5 times the AIS interval set by the sending node will clear the condition on the receiving MEP.

It is important to note that AIS generation is not supported to an explicitly configured endpoint. An explicitly configured endpoint is an object that contains multiple individual endpoints, as in PW redundancy.

3.3.1.5 Test (ETH-TST Y.1731)

Ethernet test affords operators an Y.1731 capable MEP the ability to send an in service on demand function to test connectivity between two MEPs. The test is generated on the local MEP and the results are verified on the destination MEP. Any ETH-TST packet generated that exceeds the MTU will be silently dropped by the lower level processing of the node.

3.3.2 Y.1731 time stamp capability

Accurate results for one-way and two-way delay measurement tests using Y.1731 messages are obtained if the nodes are capable of time stamping packets in hardware:

- 7210 SAS-Sx 10/100GE support is as follows:
  - Y.1731 2-DM messages for both Down MEPs and UP MEPs, 1-DM for both Down MEPs and UP MEPs, and 2-SLM for both Down MEPs and UP MEPs use software-based timestamps on Tx and hardware based timestamp on Rx. It uses the system clock (free-running or synchronized to NTP) to obtain the timestamps.
- 7210 SAS-T (network mode), 7210 SAS-Sx 1/10GE, 7210 SAS-Mxp, 7210 SAS-R6 and 7210 SAS-R12 support is as follows:
  - Y.1731 2-DM messages for both Down MEPs and UP MEPs, 1-DM for both Down MEPs and UP MEPs, and 2-SLM for both Down MEPs and UP MEPs use software-based timestamps on transmission and hardware-based timestamps on receipt. The timestamps are obtained as follows:
  - from NTP, when NTP is enabled and PTP is disabled
  - from PTP, when PTP is enabled (irrespective of whether NTP is disabled or enabled)
  - from PTP, when PTP is enabled and NTP is configured to use PTP for system time
  - from free-running system time, when both NTP and PTP are disabled.
- The 7210 SAS-T (access-uplink mode) support is as follows:
  - Y.1731 2-DM messages for Down MEPs uses hardware timestamps for both Rx (packets received by the node) and Tx (packets sent out of the node). The timestamps is obtained from a free-running hardware clock. It provides accurate 2-way delay measurements and it is not recommended to use it for computing 1-way delay.

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– Y.1731 2-DM messages for UP MEPs, 1-DM for both Down MEPs and UP MEPs, and 2-SLM for both Down MEPs and UP MEPs use software based timestamps on Tx and hardware based timestamp on Rx. The timestamps are obtained as follows:
– from NTP, when NTP is enabled and PTP is disabled
– from PTP, when PTP is enabled (irrespective of whether NTP is disabled or enabled)
– from PTP, when PTP is enabled and NTP is configured to use PTP for system time
– from free-running system time, when both NTP and PTP are disabled.

Note:
On the 7210 SAS-T, 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12 after PTP is enabled once, if the user needs to go back to NTP time scale, or system free-run time scale, a node reboot is required.

3.3.3 ITU-T Y.1731 Ethernet Bandwidth Notification

Note:
This feature is only supported on the 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12.

The Ethernet Bandwidth Notification (ETH-BN) function is used by a server MEP to signal link bandwidth changes to a client MEP.

This functionality is for point-to-point microwave radios. When a microwave radio uses adaptive modulation, the capacity of the radio can change based on the condition of the microwave link. For example, in adverse weather conditions that cause link degradation, the radio can change its modulation scheme to a more robust one (which will reduce the link bandwidth) to continue transmitting.

This change in bandwidth is communicated from the server MEP on the radio, using an Ethernet Bandwidth Notification Message (ETH-BNM), to the client MEP on the connected router. The server MEP transmits periodic frames with ETH-BN information, including the interval, the nominal and currently available bandwidth. A port MEP with the ETH-BN feature enabled will process the information contained in the CFM PDU and appropriately adjust the rate of traffic sent to the radio.

A port MEP that is not a LAG member port supports the client side reception and processing of the ETH-BN CFM PDU sent by the server MEP. By default, processing is disabled. The **config>port>ethernet>eth-cfm>mep eth-bn>receive** CLI command sets the ETH-BN processing state on the port MEP. A port MEP supports untagged packet processing of ETH-CFM PDUs at domain levels 0 and 1 only. The port client MEP sends the ETH-BN rate information received to be applied to the port egress rate in a QoS update. A pacing mechanism limits the number of QoS updates sent. The **config>port>ethernet>eth-cfm>mep>eth-bn>rx-update-pacing** CLI command allows the updates to be paced using a configurable range of 1 to 600 seconds (the default is 5 seconds). The pacing timer begins to count down following the most recent QoS update sent to the system for processing. When the timer expires, the most recent update that arrived from the server MEP is compared to the most recent value sent for system processing. If the value of the current bandwidth is different from the previously processed value, the update is sent and the process begins again. Updates with a different current bandwidth that arrive when the pacing timer has already expired are not subject to a timer delay. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide* for more information about these CLI commands.

A complimentary QoS configuration is required to allow the system to process current bandwidth updates from the CFM engine. The **config>port>ethernet>eth-bn-egress-rate-changes** CLI command is required to enable the QoS function to update the port egress rates based on the current available bandwidth updates from the CFM engine. By default, the function is disabled.

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Both the CFM and QoS functions must be enabled for the changes in current bandwidth to dynamically update the egress rate.

When the MEP enters a state that prevents it from receiving the ETH-BNM, the current bandwidth last sent for processing is cleared and the egress rate reverts to the configured rate. Under these conditions, the last update cannot be guaranteed as current. Explicit notification is required to dynamically update the port egress rate. The following types of conditions lead to ambiguity:

- administrative MEP shut down
- port admin down
- port link down
- **eth-bn no receive** transitioning the ETH-BN function to disable

If the **eth-bn-egress-rate-changes** command is disabled using the **no** option, CFM continues to send updates, but the updates are held without affecting the port egress rate.

The ports supporting ETH-BN MEPs can be configured for the network, access, hybrid, and access-uplink modes. When ETH-BN is enabled on a port MEP and the **config**>**port**>**ethernet**>**eth-cfm**>**mep**>**eth-bn**>**receive** and the QoS **config**>**port**>**ethernet**>**eth-bn-egress-rate-changes** contexts are configured, the egress rate is dynamically changed based on the current available bandwidth indicated by the ETH-BN server.



Note:
For SAPs configured on an access port or hybrid port, changes in port bandwidth on reception of ETH-BNM messages will result in changes to the port egress rate, but the SAP egress aggregate shaper rate and queue egress shaper rate provisioned by the user are unchanged, which may result in an oversubscription of the committed bandwidth. Consequently, Nokia recommends that the user should change the SAP egress aggregate shaper rate and queue egress shaper rate for all SAPs configured on the port from an external management station after egress rate changes are detected on the port.

The port egress rate is capped by the minimum of the configured **egress-rate**, and the maximum port rate. The minimum egress rate using ETH-BN is 1024 kb/s. If a current bandwidth of zero is received, it does not affect the egress port rate and the previously processed current bandwidth will continue to be used.

The client MEP requires explicit notification of changes to update the port egress rate. The system does not timeout any previously processed current bandwidth rates using a timeout condition. The specification does allow a timeout of the current bandwidth if a frame has not been received in 3.5 times the ETH-BNM interval. However, the implicit approach can lead to misrepresented conditions and has not been implemented.

When you start or restart the system, the configured egress rate is used until an ETH-BNM arrives on the port with a new bandwidth request from the ETH-BN server MEP.

An event log is generated each time the egress rate is changed based on reception of a BNM. If a BNM is received that does not result in a bandwidth change, no event log is generated.

The destination MAC address can be a Class 1 multicast MAC address (that is, 01-80-C2-00-0x) or the MAC address of the port MEP configured. Standard CFM validation and identification must be successful to process CFM PDUs.

For information about the **eth-bn-egress-rate-changes** command, see the *7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide*.

The Bandwidth Notification Message (BNM) PDU used for ETH-BN information is a sub-OpCode within the Ethernet Generic Notification Message (ETH-GNM).

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The following table shows the BNM PDU format fields.

Table 18: BNM PDU format fields

Label	Description
MEG Level	Carries the MEG level of the client MEP (0 to 7). This field must be set to either 0 or 1 to be recognized as a port MEP.
Version	The current version is 0
OpCode	The value for this PDU type is GNM (32)
Flags	Contains one information element: Period (3 bits), which indicates how often ETH-BN messages are transmitted by the server MEP. The following are the valid values: • 100 (1 frame/s) • 101 (1 frame/10 s) • 110 (1 frame/min)
TLV Offset	This value is set to 13
Sub-OpCode	The value for this PDU type is BNM (1)
Nominal Bandwidth	The nominal full bandwidth of the link, in Mb/s. This information is reported in the display but not used to influence QoS egress rates.
Current Bandwidth	The current bandwidth of the link in Mb/s. The value is used to influence the egress rate.
Port ID	A non-zero unique identifier for the port associated with the ETH-BN information, or zero if not used. This information is reported in the display, but is not used to influence QoS egress rates.
End TLV	An all zeros octet value On the 7210 SAS, port-level MEPs with level 0 or 1 should be implemented to support this application. A port-level MEP must support CCM, LBM, LTM, RDI, and ETH-BN, but can be used for ETH-BN only.

The **show eth-cfm mep eth-bandwidth-notification** display output includes the ETH-BN values received and extracted from the PDU, including a last reported value and the pacing timer. If the `n/a` value appears in the field, it indicates that field has not been processed.

The base **show eth-cfm mep** output is expanded to include the disposition of the ETH-BN receive function and the configured pacing timer.

The **show port** *port-id* **detail** is expanded to include an Ethernet Bandwidth Notification Message Information section. This section includes the ETH-BN Egress Rate disposition and the current Egress BN rate being used.

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3.3.3.1 ETH-BN configuration guidelines

The following guidelines apply to the ETH-BN configuration:

- In a committed information rate (CIR) loop, scheduling is packet-based round robin with weight 1. This scheduling applies to SAP and port queues, and between SAP aggregates and network aggregates when the node is operating in the SAP scheduler mode. Refer to the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* for more information about schedulers.
- When the node is operating in the **port-scheduler-mode**, the access egress QoS policy is attached to the access port. Users can configure queue rates for the access egress QoS policy using either the **rate** or **percent-rate** command. The **percent-rate** command configures queue rates as a percentage of the port shaper rate that is currently in effect.

  When using the ETH-BN feature, Nokia recommends using the **percent-rate** command to configure queue rates in the access egress QoS policy so that the system can update queue rates based on the ETH-BN port egress rate changes and oversubscription of the port scheduler is avoided.
- To implement port-level policy attachment changes or queue mode changes for access egress or network queue policies, Nokia recommends shutting down the ports to which the policy is attached and waiting until the queues clear before modifying the QoS policy.
- When modifying the queue mode on a queue for a SAP egress QoS policy that is already attached to SAPs, or when modifying a SAP egress QoS policy attached to any SAP, Nokia recommends shutting down the SAPs that the policy is attached to and waiting until the queues clear before modifying the QoS policy. Use the **show pools access-egress** and **network-egress** commands to check for zero queue depth.
- Egress rate changes because of ETH-BN may lead to CIR oversubscription, which is not supported on the 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12. Use the following guidelines to avoid CIR oversubscription:
  - To use SAP scheduler mode for access or hybrid port mode, configure the CIR on queues in the SAP egress policy and SAP aggregates or network aggregates based on the lower ETH-BN expected rate, and ensure that the CIR is not oversubscribed. A change in the ETH-BN rate will not cause CIR oversubscription because the values are based on the lowest ETH-BN rate.
  - After an ETH-BN rate change is detected, update the QoS policy CIR and PIR values, and SAP and network aggregate rates from the management station to prevent CIR oversubscription.

3.3.4 Port-based MEPs

The 7210 SAS supports port-based MEPs for use with CFM ETH-BN. The port MEP must be configured at level 0 or 1 and can be used for ETH-BN message reception and processing as described in ITU-T Y.1731 Ethernet Bandwidth Notification. Port-based MEPs only support CFM CC, LT, LS, and RDI message processing; other CFM and Y.1731 messages are not supported.

Note:
Port-based MEPs are designed for the ETH-BN application. Nokia does not recommend the use of port-based MEPs with other applications.

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3.3.5 ETH-CFM statistics

Note:
This feature is supported on all 7210 SAS platforms as described in this document, including those operating in access-uplink mode.

A number of statistics are available to view the current processing requirements for CFM. Any packet that is counted against the CFM resource is included in the statistics counters. The counters do not include sub-second CCM and ETH-CFM PDUs generated by non-ETH-CFM functions (which include OAM-PM and SAA) or filtered by a security configuration.

SAA and OAM-PM use standard CFM PDUs. The reception of these packets is included in the receive statistics. However, SAA and OAM-PM launch their own test packets and do not consume ETH-CFM transmission resources.

Per-system and per-MEP statistics are included with a per-OpCode breakdown. These statistics help operators determine the busiest active MEPs on the system and provide a breakdown of per-OpCode processing at the system and MEP level.

Use the **show eth-cfm statistics** command to view the statistics at the system level. Use the **show eth-cfm mep** *mep-id* **domain** *md-index* **association** *ma-index* **statistics** command to view the per-MEP statistics. Use the **clear eth-cfm mep** *mep-id* **domain** *md-index* **association** *ma-index* **statistics** command to clear statistics. The **clear** command clears the statistics for only the specified function. For example, clearing the system statistics does not clear the individual MEP statistics because each MEP maintains its own unique counters.

All known OpCodes are listed in the transmit and receive columns. Different versions for the same OpCode are not displayed. This does not imply that the network element supports all functions listed in the table. Unknown OpCodes are dropped.

Use the **tools dump eth-cfm top-active-meps** command to display the top ten active MEPs in the system. This command provides a nearly real-time view of the busiest active MEPS by displaying the active (not shutdown) MEPs and inactive (shutdown) MEPs in the system. ETH-CFM MEPs that are shutdown continue to consume CPM resources because the main task is syncing the PDUs. The counts begin from the last time that the command was issued using the **clear** option.

Example

```
tools dump eth-cfm top-active-meps
Calculating most active MEPs in both direction without clear ...

MEP                  Rx Stats     Tx Stats     Total Stats
-------------------- ------------ ------------ ------------
12/4/28              3504497      296649       3801146
14/1/28              171544       85775        257319
14/2/28              150942       79990        230932

tools dump eth-cfm top-active-meps clear
Calculating most active MEPs in both direction with clear ...

MEP                  Rx Stats     Tx Stats     Total Stats
-------------------- ------------ ------------ ------------
12/4/28              3504582      296656       3801238
14/1/28              171558       85782        257340
14/2/28              150949       79997        230946

tools dump eth-cfm top-active-meps clear
Calculating most active MEPs in both direction with clear ...
```


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```
MEP                 Rx Stats     Tx Stats     Total Stats
------------------- ------------ ------------ ------------
12/4/28             28           2            30
14/1/28             5            2            7
14/2/28             3            2            5
```

3.3.6 Synthetic Loss Measurement (ETH-SL)

Nokia applied pre-standard OpCodes 53 (Synthetic Loss Reply) and 54 (Synthetic Loss Message) for the purpose of measuring loss using synthetic packets.

Note:
These will be changes to the assigned standard values in a future release. This means that the Release 4.0R6 is prestandard and will not interoperate with future releases of SLM or SLR that supports the standard OpCode values.

This synthetic loss measurement approach is a single-ended feature that allows the operator to run on-demand and proactive tests to determine "in", "out" loss and "unacknowledged" packets. This approach can be used between peer MEPs in both point to point and multipoint services. Only remote MEP peers within the association and matching the unicast destination will respond to the SLM packet.

The specification uses various sequence numbers to determine in which direction the loss occurred. Alcatel-Lucent has implemented the required counters to determine loss in each direction. To correctly use the information that is gathered the following terms are defined:

- **count**

  The count is the number of probes that are sent when the last frame is not lost. When the last frames is or are lost, the count and unacknowledged equals the number of probes sent.

- **out-loss (far-end)**

  Out-loss packets are lost on the way to the remote node, from test initiator to the test destination.

- **in-loss (near-end)**

  In-loss packets are lost on the way back from the remote node to the test initiator.

- **unacknowledged**

  Unacknowledged number of packets are at the end of the test that were not responded to.

The per probe specific loss indicators are available when looking at the on-demand test runs, or the individual probe information stored in the MIB. When tests are scheduled by Service Assurance Application (SAA) the per probe data is summarized and per probe information is not maintained. Any "unacknowledged" packets will be recorded as "in-loss" when summarized.

The on-demand function can be executed from CLI or SNMP. The on demand tests are meant to provide the carrier a way to perform on the spot testing. However, this approach is not meant as a method for storing archived data for later processing. The probe count for on demand SLM has a range of one to 100 with configurable probe spacing between one second and ten seconds. This means it is possible that a single test run can be up to 1000 seconds.

Although possible, it is more likely the majority of on demand case can increase to 100 probes or less at a one second interval. A node may only initiate and maintain a single active on demand SLM test at any specific time. A maximum of one storage entry per remote MEP is maintained in the results table.

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Subsequent runs to the same peer can overwrite the results for that peer. This means, when using on demand testing the test should be run and the results checked before starting another test.

The proactive measurement functions are linked to SAA. This backend provides the scheduling, storage and summarization capabilities. Scheduling may be either continuous or periodic. It also allows for the interpretation and representation of data that may enhance the specification. As an example, an optional TVL has been included to allow for the measurement of both loss and delay or jitter with a single test. The implementation does not cause any interoperability because the optional TVL is ignored by equipment that does not support this. In mixed vendor environments loss measurement continues to be tracked but delay and jitter can only report round trip times. It is important to point out that the round trip times in this mixed vendor environments include the remote nodes processing time because only two time stamps will be included in the packet. In an environment where both nodes support the optional TLV to include time stamps unidirectional and round trip times is reported. Because all four time stamps are included in the packet the round trip time in this case does not include remote node processing time. Of course, those operators that want to run delay measurement and loss measurement at different frequencies are free to run both ETH-SL and ETH-DM functions. ETH-SL is not replacing ETH-DM. Service Assurance is only briefly described here to provide some background on the basic functionality. To know more about SAA functions see Service Assurance Agent overview.

The ETH-SL packet format contains a test-id that is internally generated and not configurable. The test-id is visible for the on demand test in the display summary. It is possible for a remote node processing the SLM frames receives overlapping test-ids as a result of multiple MEPs measuring loss between the same remote MEP. For this reason, the uniqueness of the test is based on remote MEP-ID, test-id and Source MAC of the packet.

ETH-SL is applicable to up and down MEPs and as per the recommendation transparent to MIPs. There is no coordination between various fault conditions that could impact loss measurement. This is also true for conditions where MEPs are placed in shutdown state as a result of linkage to a redundancy scheme like MC-LAG. Loss measurement is based on the ETH-SL and not coordinated across different functional aspects on the network element. ETH-SL is supported on service based MEPs.

It is possible that two MEPs may be configured with the same MAC on different remote nodes. This causes various issues in the FDB for multipoint services and is considered a misconfiguration for most services. It is possible to have a valid configuration where multiple MEPs on the same remote node have the same MAC. In fact, this is likely to happen. In this release, only the first responder is used to measure packet loss. The second responder is dropped. Because the same MAC for multiple MEPs is only truly valid on the same remote node this should is an acceptable approach.

There is no way for the responding node to understand when a test is completed. For this reason a configurable "inactivity-timer" determines the length of time a test is valid. The timer will maintain an active test as long as it is receiving packets for that specific test, defined by the test-id, remote MEP Id and source MAC. When there is a gap between the packets that exceeds the inactivity-timer the responding node responds with a sequence number of one regardless of what the sequence number was the instantiating node sent. This means the remote MEP accepts that the previous test has expired and these probes are part of a new test. The default for the inactivity timer is 100 second and has a range of 10 to 100 seconds.

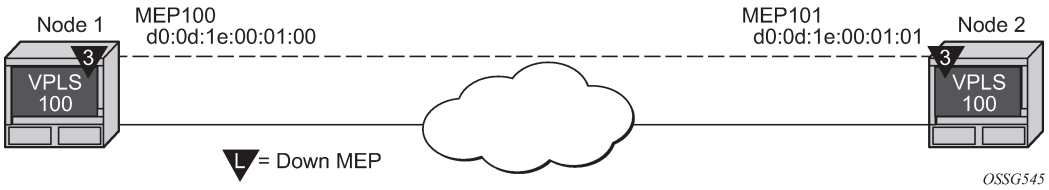
The responding node is limited to a fixed number of SLM tests per platform. Any test that attempts to involve a node that is already actively processing more than the system limit of the SLM tests shows up as "out loss" or "unacknowledged" packets on the node that instantiated the test because the packets are silently discarded at the responder. It is important for the operator to understand this is silent and no log entries or alarms is raised. It is also important to keep in mind that these packets are ETH-CFM based and the different platforms stated receive rate for ETH-CFM must not be exceeded. ETH-SL provides a mechanism for operators to pro-actively trend packet loss for service based MEPs.

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3.3.6.1 Configuration example

The following figure shows the configuration required for proactive SLM test using SAA.

Figure 24: SLM example



The output from the MIB is shown as follows as an example of an on-demand test. Node 1 is tested for this example. The SAA configuration does not include the accounting policy required to collect the statistics before they are overwritten. NODE2 does not have an SAA configuration. NODE2 includes the configuration to build the MEP in the VPLS service context.

Example

```
config>eth-cfm# info
----------------------------------------------
     domain 3 format none level 3
          association 1 format icc-based name "03-0000000100"
               bridge-identifier 100
               exit
               ccm-interval 1
               remote-mepid 101
          exit
     exit
```

Output example

```
----------------------------------------------
*A:7210SAS>config>service>vpls# info
----------------------------------------------
stp
shutdown
exit
sap 1/1/3:100.100 create
exit
sap lag-1:100.100 create
eth-cfm
mep 100 domain 3 association 1 direction down
ccm-enable
mac-address d0:0d:1e:00:01:00
no shutdown
exit
exit
exit
no shutdown
----------------------------------------------
*A:7210SAS>config>service>vpls

*A:7210SAS>config>saa# info detail
----------------------------------------------
        test "SLM" owner "TiMOS CLI"
            no description
```


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```
            type
                eth-cfm-two-way-
slm 00:01:22:22:33:34 mep 1 domain 1 association 1 size 0 fc "nc" count 100 timeout
1 interval 1
            exit
            trap-gen
                no probe-fail-enable
                probe-fail-threshold 1
                no test-completion-enable
                no test-fail-enable
                test-fail-threshold 1
exit
continuous
no shutdown
exit
-----------------------------------------------
*A:7210SAS>config>saa#

*A:7210SAS# show saa SLM42

===============================================================================
SAA Test Information
===============================================================================
Test name                    : SLM42
Owner name                   : TiMOS CLI
Description                  : N/A
Accounting policy            : None
Continuous                   : Yes
Administrative status        : Enabled
Test type                    : eth-cfm-two-way-slm 00:25:ba:02:a6:50 mep 4
                               domain 1 association 1 fc "h1" count 100
                               timeout 1 interval 1
Trap generation              : None
Test runs since last clear   : 117
Number of failed test runs   : 1
Last test result             : Success
-------------------------------------------------------------------------------
Threshold
Type        Direction Threshold  Value      Last Event          Run #
-------------------------------------------------------------------------------
Jitter-in   Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-out  Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-rt   Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-in  Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-out Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-rt  Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-in     Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-out    Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-rt     Rising    None       None       Never               None
            Falling   None       None       Never               None

===============================================================================
Test Run: 116
Total number of attempts: 100
Number of requests that failed to be sent out: 0
Number of responses that were received: 100
```


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```
Number of requests that did not receive any response: 0
Total number of failures: 0, Percentage: 0
 (in ms)            Min          Max      Average       Jitter
Outbound  :         8.07         8.18         8.10        0.014
Inbound   :        -7.84        -5.46        -7.77        0.016
Roundtrip :        0.245         2.65        0.334        0.025
Per test packet:
  Sequence     Outbound      Inbound    RoundTrip Result
         1         8.12        -7.82        0.306 Response Received
         2         8.09        -7.81        0.272 Response Received
         3         8.08        -7.81        0.266 Response Received
         4         8.09        -7.82        0.270 Response Received
         5         8.10        -7.82        0.286 Response Received
         6         8.09        -7.81        0.275 Response Received
         7         8.09        -7.81        0.271 Response Received
         8         8.09        -7.82        0.277 Response Received
         9         8.11        -7.81        0.293 Response Received
        10         8.10        -7.82        0.280 Response Received
        11         8.11        -7.82        0.293 Response Received
        12         8.10        -7.82        0.287 Response Received
        13         8.10        -7.82        0.286 Response Received
        14         8.09        -7.82        0.276 Response Received
        15         8.10        -7.82        0.284 Response Received
        16         8.09        -7.82        0.271 Response Received
        17         8.11        -7.81        0.292 Response Received
===============================================================================
#oam eth-cfm two-way-slm-test 00:25:ba:04:39:0c mep 4 domain 1 association 1 send-
count
10 interval 1 timeout 1
Sending 10 packets to 00:25:ba:04:39:0c from MEP 4/1/1 (Test-id: 143
Sent 10 packets, 10 packets received from MEP ID 3, (Test-id: 143)
(0 out-loss, 0 in-loss, 0 unacknowledged)

*A:7210SAS>show# eth-cfm mep 4 domain 1 association 1 two-way-slm-test

===============================================================================
Eth CFM Two-way SLM Test Result Table (Test-id: 143)
===============================================================================
Peer Mac Addr      Remote MEP       Count     In Loss    Out Loss         Unack
-------------------------------------------------------------------------------
00:25:ba:04:39:0c           3          10           0           0            0
===============================================================================
*A:7210SAS>show#
```

3.3.7 ETH-CFM QoS considerations

UP MEPs and DOWN MEPs have been aligned as of this release to better emulate service data. When an UP MEP or DOWN MEP is the source of the ETH-CFM PDU the priority value configured, as part of the configuration of the MEP or specific test, will be treated as the Forwarding Class (FC) by the egress QoS policy. If there is no egress QoS policy the priority value will be mapped to the CoS values in the frame. However, egress QoS Policy may overwrite this original value. The Service Assurance Agent (SAA) uses **fc** *fc-name* to accomplish similar functionality.

UP MEPs and DOWN MEPs terminating an ETH-CFM PDU will use the received FC as the return priority for the appropriate response, again feeding into the egress QoS policy as the FC.

ETH-CFM PDUs received on the MPLS-SDP bindings will now correctly pass the EXP bit values to the ETH-CFM application to be used in the response.

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These are default behavioral changes without CLI options.

3.3.8 ETH-CFM configuration guidelines

The following lists ETH-CFM configuration guidelines:

- Up MEPs and bidirectional MIPs are not created by default on system bootup, and additional resources must be allocated to enable Up MEP and bidirectional MIP functionality. By default, no resources are allocated. Before Up MEPs and bidirectional MIPs can be created, the user must first use the **configure**>**system**>**resource-profile** context to explicitly allocate hardware resources for use with these features. The software will reject the configuration to create an Up MEP or bidirectional MIP and generate an error until resources are allocated. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information.
- 7210 SAS platforms support functionality for ingress and egress MIPs. In most services, only ingress MIPs are supported. Some services also support both ingress and egress MIPs, also called bidirectional MIPs. An ingress MIP or a Down MIP processes messages in the ingress direction when the OAM message is received on ingress of the SAP or port (subject to other checks). An egress MIP or an UP MIP refers to a MIP that processes messages in the egress direction when the OAM message is being sent out of the SAP/port. See Table 12: ETH-CFM support matrix for the 7210 SAS-T (network mode), Table 13: ETH-CFM support matrix for the 7210 SAS-T (access-uplink mode), Table 14: ETH-CFM support matrix for 7210 SAS-Mxp devices, Table 15: ETH-CFM support matrix for 7210 SAS-R6 and 7210 SAS-R12 devices, Table 16: ETH-CFM support matrix for 7210 SAS-Sx/S 1/10GE devices, and Table 17: ETH-CFM support matrix for 7210 SAS-Sx 10/100GE devices for more information about ingress MIP, egress MIP, and bidirectional MIP support for service entities.
- On 7210 SAS platforms, Ethernet Linktrace Response (ETH-LTR) is always sent out with priority 7.
- 7210 SAS platforms, send out all CFM packets as in-profile. Currently, there is no mechanism in the SAA tools to specify the profile of the packet.
- On the 7210 SAS-R6 and 7210 SAS-R12, and on the 7210 SAS-Sx/S 1/10GE operating in the standalone-VC mode, before configuring bidirectional MIPs for an Epipe SAP or Epipe SDP binding, resources must be allocated to both Down MEPs and Up MEPs. That is, bidirectional MIPs in an Epipe service use the resources from both the Down MEP and Up MEP resource pools. By default, no resources are allocated for bidirectional MIPs, and configuration attempts before resource allocation are not permitted by the system and will generate a system error/log. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information.
- Sender ID TLV processing (insertion and reception) is not supported for CCM messages for MEPs that are implemented in hardware; that is, on 7210 SAS-T Down MEPs in access-uplink mode. For these MEPs, Sender ID TLV processing is supported only for LTM and LBM messages.
- Sender ID TLV processing is supported only for service MEPs. It is not supported for G.8032 MEPs.
- Facility MEPs are not supported on the 7210 SAS. G8032 MEPs are supported on the 7210 SAS.
- Ethernet rings are not configurable under all service types. Any service restrictions for MEP direction or MIP support will override the generic capability of the Ethernet ring MPs. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide* for more information about Ethernet rings.
- On 7210 SAS devices, when two bidirectional MIPs are configured in an Epipe service on both the service entities and endpoints (for example, on both the SAP and SDP configured in the Epipe service), only the MIP ingressing in the direction of linktrace messages responds. This is applicable to 7210 SAS platforms that support both ingress and egress MIPs (also referred to as bidirectional MIPs).

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3.4 OAM mapping

OAM mapping is a mechanism that enables a way of deploying OAM end-to-end in a network where different OAM tools are used in different segments. For instance, an Epipe service could span across the network using Ethernet access (CFM used for OAM), pseudowire (T-LDP status signaling used for OAM), and Ethernet access (CFM used for OAM).

In the 7210 SAS implementation, the Service Manager (SMGR) is used as the central point of OAM mapping. It receives and processes the events from different OAM components, then decides the actions to take, including triggering OAM events to remote peers.

Fault propagation for CFM is by default disabled at the MEP level to maintain backward compatibility. When required, it can be explicitly enabled by configuration.

Fault propagation for a MEP can only be enabled when the MA is composed of no more than two MEPs (point-to-point).

3.4.1 CFM connectivity fault conditions

CFM MEP declares a connectivity fault when its defect flag is equal to or higher than its configured lowest defect priority. The defect can be any of the following depending on configuration:

- DefRDICCM
- DefMACstatus
- DefRemoteCCM
- DefErrorCCM
- DefXconCCM

The following additional fault condition applies to Y.1731 MEPs:

- reception of AIS for the local MEP level

Setting the lowest defect priority to allDef may cause problems when fault propagation is enabled in the MEP. In this scenario, when MEP A sends CCM to MEP B with interface status down, MEP B will respond with a CCM with RDI set. If MEP A is configured to accept RDI as a fault, then it gets into a dead lock state, where both MEPs will declare fault and never be able to recover.

The default lowest defect priority is DefMACstatus, which will not be a problem when interface status TLV is used. It is also very important that different Ethernet OAM strategies should not overlap the span of each other. In some cases, independent functions attempting to perform their normal fault handling can negatively impact the other. This interaction can lead to fault propagation in the direction toward the original fault, a false positive, or worse, a deadlock condition that may require the operator to modify the configuration to escape the condition. For example, overlapping Link Loss Forwarding (LLF) and ETH-CFM fault propagation could cause these issues.

For the DefRemoteCCM fault, it is raised when any remote MEP is down. So whenever a remote MEP fails and fault propagation is enabled, a fault is propagated to SMGR.

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3.4.2 CFM fault propagation methods

When CFM is the OAM module at the other end, it is required to use any of the following methods (depending on local configuration) to notify the remote peer:

- Generating AIS for certain MEP levels
- Sending CCM with interface status TLV “down”
- Stopping CCM transmission

Note:
7210 platforms expect that the fault notified using interface status TLV, is cleared explicitly by the remote MEP when the fault is no longer present on the remote node. On the 7210 SAS, use of CCM with interface status TLV Down is not recommended to be configured with a Down MEP, unless it is known that the remote MEP clears the fault explicitly.

User can configure UP MEPs to use Interface Status TLV with fault propagation. Special considerations apply only to Down MEPs.

When a fault is propagated by the service manager, if AIS is enabled on the SAP/SDP-binding, then AIS messages are generated for all the MEPs configured on the SAP/SDP-binding using the configured levels.

Note that the existing AIS procedure still applies even when fault propagation is disabled for the service or the MEP. For example, when a MEP loses connectivity to a configured remote MEP, it generates AIS if it is enabled. The new procedure that is defined in this document introduces a new fault condition for AIS generation, fault propagated from SMGR, that is used when fault propagation is enabled for the service and the MEP.

The transmission of CCM with interface status TLV must be done instantly without waiting for the next CCM transmit interval. This rule applies to CFM fault notification for all services.

Notifications from SMGR to the CFM MEPs for fault propagation should include a direction for the propagation (up or down: up means in the direction of coming into the SAP/SDP-binding; down means in the direction of going out of the SAP/SDP-binding), so that the MEP knows what method to use. For instance, an up fault propagation notification to a down MEP will trigger an AIS, while a down fault propagation to the same MEP can trigger a CCM with interface TLV with status down.

For a specific SAP/SDP-binding, CFM and SMGR can only propagate one single fault to each other for each direction (up or down).

When there are multiple MEPs (at different levels) on a single SAP/SDP-binding, the fault reported from CFM to SMGR will be the logical OR of results from all MEPs. Basically, the first fault from any MEP will be reported, and the fault will not be cleared as long as there is a fault in any local MEP on the SAP/SDP-binding.

3.4.3 Epipe services

Down and up MEPs are supported for Epipe services, as well as fault propagation. When there are both up and down MEPs configured in the same SAP/SDP-binding and both MEPs have fault propagation enabled, a fault detected by one of them will be propagated to the other, which in turn will propagate fault in its own direction.

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3.4.3.1 CFM detected fault

When a MEP detects a fault and fault propagation is enabled for the MEP, CFM needs to communicate the fault to SMGR, so SMGR will mark the SAP/SDP-binding faulty but still oper-up. CFM traffic can still be transmitted to or received from the SAP/SDP-binding to ensure when the fault is cleared, the SAP will go back to normal operational state. Because the operational status of the SAP/SDP-binding is not affected by the fault, no fault handling is performed. For example, applications relying on the operational status are not affected.

If the MEP is an up MEP, the fault is propagated to the OAM components on the same SAP/SDP-binding; if the MEP is a down MEP, the fault is propagated to the OAM components on the mate SAP/SDP-binding at the other side of the service.

3.4.3.2 SAP/SDP-binding failure (including pseudowire status)

When a SAP/SDP-binding becomes faulty (oper-down, admin-down, or pseudowire status faulty), SMGR needs to propagate the fault to up MEPs on the same SAP/SDP-bindings about the fault, as well as to OAM components (such as down MEPs) on the mate SAP/SDP-binding.

3.4.3.3 Service down

This section describes procedures for the scenario where an Epipe service is down because of the following:

- Service is administratively shutdown. When service is administratively shutdown, the fault is propagated to the SAP/SDP-bindings in the service.
- If the Epipe service is used as a PBB tunnel into a B-VPLS, the Epipe service is also considered operationally down when the B-VPLS service is administratively shutdown or operationally down. If this is the case, fault is propagated to the Epipe SAP.

In addition, one or more SAPs/SDP-bindings in the B-VPLS can be configured to propagate fault to this Epipe (see the following fault-propagation-bmac). If the B-VPLS is operationally up but all of these entities have detected fault or are down, the fault is propagated to this Epipe's SAP.

3.4.3.4 Interaction with pseudowire redundancy

When a fault occurs on the SAP side, the pseudowire status bit is set for both active and standby pseudowires. When only one of the pseudowire is faulty, SMGR does not notify CFM. The notification occurs only when both pseudowire becomes faulty. The SMGR propagates the fault to CFM.

Because there is no fault handling in the pipe service, any CFM fault detected on an SDP binding is not used in the pseudowire redundancy's algorithm to choose the most suitable SDP binding to transmit on.

3.4.3.5 LLF and CFM fault propagation

LLF and CFM fault propagation are mutually exclusive. CLI protection is in place to prevent enabling both LLF and CFM fault propagation in the same service, on the same node and at the same time. However, there are still instances where irresolvable fault loops can occur when the two schemes are deployed

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within the same service on different nodes. This is not preventable by the CLI. At no time should these two fault propagation schemes be enabled within the same service.

3.4.3.6 802.3ah EFM OAM mapping and interaction with service manager

802.3ah EFM OAM declares a link fault when any of the following occurs:

- loss of OAMPDU for a certain period of time
- receiving OAMPDU with link fault flags from the peer

When 802.3ah EFM OAM declares a fault, the port goes into operation state down. The SMGR communicates the fault to CFM MEPs in the service. OAM fault propagation in the opposite direction (SMGR to EFM OAM) is not supported.

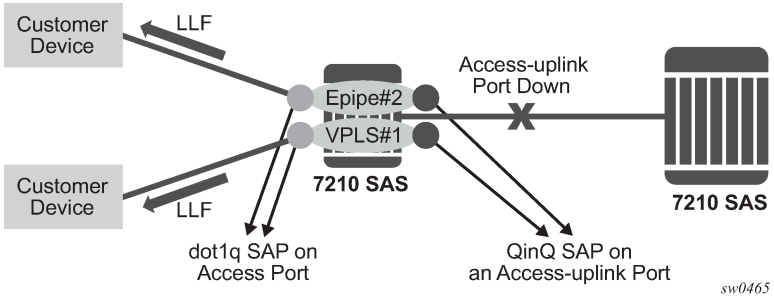
3.4.4 Fault propagation to access dot1q/QinQ ports on the 7210 SAS-T in access-uplink mode

A fault on the access-uplink port brings down all access ports with services independent of the encapsulation type of the access port (null, dot1q, or QinQ), that is, support Link Loss Forwarding (LLF). A fault propagated from the access-uplink port to access ports is based on configuration. A fault is propagated only in a single direction from the access-uplink port to access port.

A fault on the access-uplink port is detected using Loss of Signal (LoS) and EFM-OAM.

The following figure shows local fault propagation.

Figure 25: Local fault propagation



3.4.4.1 Configuring fault propagation

The operational group functionality, also referred to as oper-group, is used to detect faults on access-uplink ports and propagate them to all interested access ports regardless of their encapsulation. On the 7210 SAS operating in access-uplink mode, ports can be associated with oper-groups. Perform the following procedure to configure the use of the oper-group functionality for fault detection on a port and **monitor-oper-group** to track the oper-group status and propagate the fault based on the operational state of the oper-group.

1. Create an oper-group (for example, "uplink-to-7210").
2. Configure an access-uplink port to track its operational state (for example, 1/1/20) and associate it with the oper-group created in step 1 (that is, uplink-to-7210).

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3. Configure dot1q access ports for which the operational state must be driven by the operational state of the access-uplink port (for example, 1/1/1 and 1/1/5) as the monitor-oper-group.
4. To detect a fault on the access-uplink port and change the operational state, use either the LoS or EFM OAM feature.
5. When the operational state of the access-uplink port changes from up to down, the state of all access ports configured to monitor the group changes to down. Similarly, a change in state from down to up changes the operational state of the access port to up. When the operational state of the access port is brought down, the laser of the port is also shut down. The **hold-timers** command is supported to avoid the flapping of links.

3.4.4.1.1 Configuration example for fault propagation using oper-group

Output example: oper-group system configuration output

```
*A:7210SAS>config>system>oper-group# info detail
----------------------------------------------
            hold-time
                group-down 0
                group-up 4
            exit
----------------------------------------------
*A:7210SAS>config>system>oper-group#
```

Note:
See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information about this CLI.

3.4.5 Fault propagation to access dot1q/QinQ ports on the 7210 SAS-Sx/S 1/10GE and 7210 SAS-Sx 10/100GE in standalone mode

Note:
An uplink port refers to an access port or LAG or hybrid port or LAG that is facing the network core.

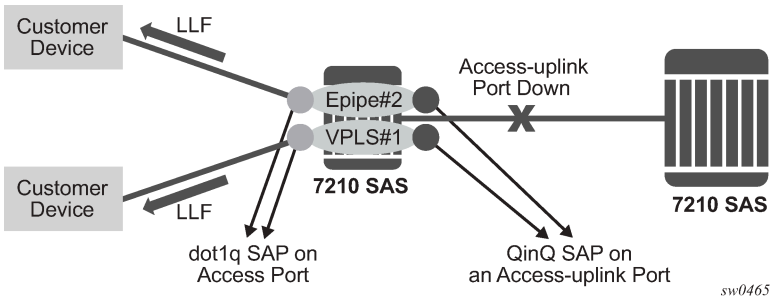
A fault on the uplink port or LAG brings down all access ports with services independent of the encapsulation type of the access port (null, dot1q, or QinQ), that is, support Link Loss Forwarding (LLF). A fault propagated from the uplink port or LAG to access ports is based on configuration. A fault is propagated only in a single direction from the uplink port or LAG to access port.

A fault on the uplink port or LAG is detected using Loss of Signal (LoS) and EFM-OAM.

The following figure show local fault propagation.

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Figure 26: Local fault propagation



3.4.5.1 Configuring fault propagation

The oper-group functionality is used to detect faults on uplink ports or LAGs and propagate them to all interested access ports regardless of their encapsulation. On the 7210 SAS, ports or LAGs can be associated with oper-groups. Perform the following procedure to configure the use of the oper-group functionality for fault detection on a port or LAG and **monitor-oper-group** to track the oper-group status and propagate the fault based on the operational state of the oper-group:

1. Create an oper-group (for example, "uplink-to-7210").
2. Configure an uplink port or LAG to track its operational state (for example, 1/1/20) and associate it with the oper-group created in1 (that is, uplink-to-7210).
3. Configure dot1q access ports for which the operational state must be driven by the operational state of the uplink port or LAG (for example, 1/1/1 and 1/1/5) as the monitor-oper-group.
4. To detect a fault on the uplink port or LAG and change the operational state, use either the LoS or EFM OAM feature.
5. When the operational state of the uplink port or LAG changes from up to down, the state of all access ports configured to monitor the group changes to down. Similarly, a change in state from down to up changes the operational state of the access port to up. When the operational state of the access port is brought down, the laser of the port is also shut down. The **hold-timers** command is supported to avoid the flapping of links.

3.4.5.1.1 Configuration example for fault propagation using oper-group

Output example: oper-group system configuration output

```
*A:7210SAS>config>system>oper-group# info detail
----------------------------------------------
            hold-time
                group-down 0
                group-up 4
            exit
----------------------------------------------
*A:7210SAS>config>system>oper-group#
```


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Note:
See the *7210 SAS-Mxp, R6, R12, S, Sx, T Basic System Configuration Guide* for more information about this CLI.

3.5 Service Assurance Agent overview

In the last few years, service delivery to customers has drastically changed. Services such as VPLS and VPRN are offered. The introduction of Broadband Service Termination Architecture (BSTA) applications such as Voice over IP (VoIP), TV delivery, video and high speed Internet services force carriers to produce services where the health and quality of Service Level Agreement (SLA) commitments are verifiable to the customer and internally within the carrier.

SAA is a feature that monitors network operations using statistics such as jitter, latency, response time, and packet loss. The information can be used to troubleshoot network problems, problem prevention, and network topology planning.

The results are saved in SNMP tables are queried by either the CLI or a management system. Threshold monitors allow for both rising and falling threshold events to alert the provider if SLA performance statistics deviate from the required parameters.

3.5.1 SAA two-way timing

SAA allows two-way timing for several applications. This provides the carrier and their customers with data to verify that the SLA agreements are being correctly enforced.

3.5.1.1 Traceroute implementation

The 7210 SAS devices insert the timestamp in software (by control CPU).

When interpreting these timestamps care must be taken that some nodes are not capable of providing timestamps, therefore timestamps must be associated with the same IP address that is being returned to the originator to indicate what hop is being measured.

3.5.1.2 NTP

Because NTP precision can vary (+/- 1.5ms between nodes even under best case conditions), SAA one-way latency measurements may display negative values, especially when testing network segments with very low latencies. The one-way time measurement relies on the accuracy of NTP between the sending and responding nodes.

3.5.1.3 Writing SAA results to accounting files

SAA statistics enables writing statistics to an accounting file. When results are calculated an accounting record is generated.

To write the SAA results to an accounting file in a compressed XML format at the termination of every test, the results must be collected, and, in addition to creating the entry in the appropriate MIB table for this SAA test, a record must be generated in the appropriate accounting file.

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3.5.1.3.1 Accounting file management

Because the SAA accounting files have a similar role to existing accounting files that are used for billing purposes, existing file management information is leveraged for these accounting (billing) files.

3.5.1.3.2 Assigning SAA to an accounting file ID

When an accounting file has been created, accounting information can be specified and will be collected by the **config**>**log**>**acct-policy**>**to file** *log-file-id* context.

3.5.1.3.3 Continuous testing

When you configure a test, use the **config**>**saa**>**test**>**continuous** command to make the test run continuously. Use the **no continuous** command to disable continuous testing and **shutdown** to disable the test completely. When you have configured a test as continuous, you cannot start or stop it by using the **saa** *test-name* [**owner** *test-owner*] {**start** | **stop**} [**no-accounting**] command.

3.5.2 Configuring SAA test parameters

Output example

The following is a sample SAA configuration output.

```
*A:Dut-A>config>saa# info
----------------------------------------------------------------------
....
        test "Dut-A:1413:1501" owner "TiMOS"
description "Dut-A:1413:1501"
            type
                vccv-ping 1413:1501 fc "nc" timeout 10 size 200 count 2
            exit
            loss-event rising-threshold 2
            latency-event rising-threshold 100
no jitter-event
            no shutdown
        exit
....
----------------------------------------------------------------------
*A:Dut-A#
```

3.6 Y.1564 testhead OAM tool

Note:
Port loopback with mac-swap and Y.1564 testhead is supported only for Epipe and VPLS services.

ITU-T Y.1564 defines the out-of-service test methodology to be used and parameters to be measured to test service SLA conformance during service turn up. It primarily defines 2 test phases. The first test phase defines service configuration test, which consists of validating whether the service is configured correctly.

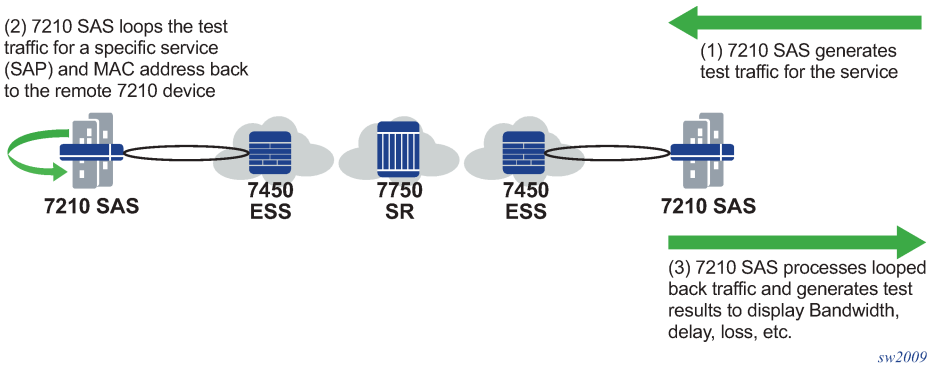
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As part of this test the throughput, Frame Delay, Frame Delay Variation (FDV), and Frame Loss Ratio (FLR) is measured for each service. This test is typically run for a short duration. The second test phase consists of validating the quality of services delivered to the end customer and is referred to as the service performance test. These tests are typically run for a longer duration and all traffic is generated up to the configured CIR for all the services simultaneously and the service performance parameters are measured for each the service.

The 7210 SAS supports service configuration test for user configured rate and measurement of delay, delay variation and frame loss ratio with the testhead OAM tool. The 7210 SAS testhead OAM tool supports bidirectional measurement and it can generate test traffic for only one service at a specific time. It can validate if the user specified rate is available and compute the delay, delay variation and frame loss ratio for the service under test at the specified rate. It is capable of generating traffic up to 1G rate. On some 7210 SAS devices, the user needs to configure the resources of the front-panel port for use with this feature and some other 7210 SAS platforms resources needed for this feature is automatically allocated by software from the internal ports. For more information, see the following Configuration guidelines, to which 7210 SAS platforms need user configuration and on which 7210 SAS platforms software allocates it automatically.

The following figure shows the remote loopback required and the flow of the frame through the network generated by the testhead tool.

Figure 27: 7210 acting as traffic generator and traffic analyzer



The tool allows the user to specify the frame payload header parameters independent of the test SAP configuration parameters to allow the user flexibility to test for different possible frame header encapsulations. This allows user to specify the appropriate VLAN tags, Ethertype, and Dot1p values, independent of the SAP configuration like with actual service testing. That is, the software does not use the parameters (For example: SAP ID, Source MAC, and Destination MAC) during the invocation of the testhead tool to build the test frames. Instead it uses the parameters specified using the frame-payload CLI command tree. The software does not verify that the parameters specified match the service configuration used for testing, for example, software does not match if the VLAN tags specified matches the SAP tags, the Ethertype specified matches the user configured port Ethertype, and so on. It is expected that the user configures the frame-payload appropriately so that the traffic matches the SAP configuration.

The 7210 SAS supports Y.1564 testhead for performing CIR or PIR tests in color-aware mode. With this functionality, users can perform service turn-up tests to validate the performance characteristics (delay, jitter, and loss) for committed rate (CIR) and excess rate above CIR (that is, PIR rate). The testhead OAM tool uses the in-profile packet marking value and out-of-profile packet marking value, to differentiate between committed traffic and PIR traffic in excess of CIR traffic. Traffic within CIR (that is, committed traffic) is expected to be treated as in-profile traffic in the network and traffic in excess of CIR (that is, PIR traffic) is expected to be treated as out-of-profile traffic in the network, allowing the network to prioritize

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committed traffic over PIR traffic. The testhead OAM tool allows the user to configure individual thresholds for green or in-profile packets and out-of-profile or yellow packets. It is used by the testhead OAM tool to compare the measured value for green or in-profile packets and out-of-profile or yellow packets against the configured thresholds and report success or failure.

The functionality listed as follows is supported by the testhead OAM tool:

- Supports configuration of only access SAPs as the test measurement point.
- Supports all port encapsulation supported on all service SAP types, with some exceptions as noted in the following Configuration guidelines.
- Supported for only VPLS and Epipe service.
- Supports two-way measurement of service performance metrics. The tests measure throughput, frame delay, frame delay variation, and frame loss ratio.
- For two-way measurement of the service performance metrics, such as frame delay and frame delay variation, test frames (also called as marker packets) are injected at a low rate at periodic intervals. Frame delay and Frame delay variation is computed for these frames. Hardware-based timestamps are used for delay computation.
- The 7210 SAS supports configuration of a rate value and provides an option to measure the performance metrics. The testhead OAM tool generates traffic up to the specified rate and measures service performance metrics such as delay, jitter, and loss for in-profile and out-of-profile traffic.
- Testhead tool can generate traffic up to about 1G rate. CIR and PIR rate can be specified by the user and is rounded off the nearest rate the hardware supports by using the adaptation rule configured by the user.
- Allows the user to specify the different frame-sizes from 64 bytes - 9212 bytes.
- User can configure the following frame payload types: L2 payload, IP payload, and IP/TCP/UDP payload. Testhead tool will use the configured values for the IP header fields and TCP header fields based on the payload type configured. User is provided with an option to specify the data pattern to used in the payload field of the frame/packet.
- Allows the user to configure the duration of the test up to a maximum of 24 hours, 60 minutes, and 60 seconds. The test performance measurements by are done after the specified rate is achieved. At any time user can probe the system to know the current status and progress of the test.
- Supports configuration of the Forwarding Class (FC). It is expected that user will define consistent QoS classification policies to map the packet header fields to the FC specified on the test SAP ingress on the local node, in the network on the nodes through which the service transits, and on the SAP ingress in the remote node.
- Allows the user to configure a test-profile, also known as, a policy template that defines the test configuration parameters. User can start a test using a preconfigured test policy for a specific SAP and service. The test profile allows the user to configure the acceptance criteria. The acceptance criteria allows user to configure the thresholds that indicates the acceptable range for the service performance metrics. An event is generated if the test results exceed the configured thresholds. For more information, see the following CLI section.

  At the end of the test, the measured values for FD, FDV, and FLR are compared against the configured thresholds to determine the PASS or FAIL criteria and to generate a trap to the management station. If the acceptance criteria is not configured, the test result is declared to be PASS, if the throughput is achieved and frame-loss is 0 (zero).
- ITU-T Y.1564 specifies different test procedures as follows. CIR and PIR configuration tests are supported by the testhead tool, as follows:

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  - CIR and PIR configuration test (color-aware and non-color aware).
  - Traffic policing test (color-aware and non-color aware) is supported. Traffic policing tests can be executed by the user by specifying a PIR to be 125% of the desired PIR. Traffic policing test can be executed in either color-aware mode or color-blind (non-color-aware) mode.
- ITU-T Y.1564 specifies separate test methodology for color-aware and non-color-aware tests. The standard requires a single test to provide the capability to generate both green-color/in-profile traffic for rates within CIR and yellow-color or out-of-profile traffic for rates above CIR and within EIR. The 7210 SAS testhead marks test packets appropriately when generating the traffic, as SAP ingress does not support color-aware metering, it is not possible to support EIR color-aware, and traffic policing color-aware tests end-to-end in a network (that is, from test SAP to test SAP). Instead, It is possible to use the tests to measure the performance parameters from the other endpoint (example Access-uplink SAP) in the service, through the network, to the remote test SAP, and back again to the local test SAP.
- The 7210 SAS Y.1564 testhead is applicable only for VPLS and Epipe services.

3.6.1 Prerequisites for using the testhead tool

This section describes the prerequisites for using the testhead tool.

3.6.1.1 Generic prerequisites for use of testhead tool (applicable for all 7210 SAS platforms)

The following describes the generic prerequisites for the use of the Testhead tool:

- It is expected that the user will configure the appropriate ACL and QoS policies to ensure that the testhead traffic is processed as desired by the local and remote node/SAP. In particular, QoS policies in use must ensure that the rate in use for the SAP ingress meters exceed or are equal to the user configured rate for testhead tests and the classification policies map the testhead packets to the appropriate FCs/queues (the FC classification must match the FC specified in the CLI command **testhead-test**) using the packet header fields configured in the frame-payload. Similarly, ACL policies must ensure that testhead traffic is not blocked.
- The testhead OAM tool does not check the state of the service or the SAPs on the local endpoint before initiating the tests. The operator must ensure that the service and SAPs used for the test are UP before the tests are started. If they are not, the testhead tool will report a failure.
- The port configuration of the ports used for validation (for example, access port on which the test SAP is configured and access-uplink port) must not be modified after the testhead tool is invoked. Any modifications can be made only when the testhead tool is not running.
- Testhead tool can be used to test only unicast traffic flows. It must not be used to test BUM traffic flows.
- Only out-of-service performance metrics can be measured using the testhead OAM tool. For in-service performance metrics, user has the option to use SAA based Y.1731/CFM tools.

The following describes some prerequisites to use the testhead tool:

- The configuration guidelines and prerequisites that are to be followed when the port loopback with MAC swap feature is used standalone, applies to its use along with the testhead tool. For more information, see the description in the 7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide.
- Users must configure resources for ACL MAC criteria in **ingress-internal-tcam** using the command **config**>**system**>**resource-profile**>**ingress-internal-tcam**>**cl-sap-ingress**>**mac-match-enable**.

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Additionally users must allocate resources to egress ACL MAC or IPv4 or IPv6 64-bit criteria using the command **config**>**system**>**resource-profile**>**egress-internal-tcam**>**acl-sap-egress**>**mac-ipv4-match-enable** or **mac-ipv6-64bit-enable** or **mac-ipv4-match-enable**). The testhead tool uses resources from these resource pools. If no resources are allocated to these pools or no resources are available for use in these pools, then the testhead fails to function. Testhead needs a minimum of about 6 entries from the ingress internal TCAM pool and 2 entries from the egress internal TCAM pool. If users allocate resources to egress ACLs IPv6 128-bit match criteria (using the command **config**> **system**> **resource-profile**> **egress-internal-tcam**>**acl-sap-egress**> **ipv6-128bit-match-enable**), then the testhead tool fails to function.

- For both Epipe and VPLS service, the test can be used to perform only a point-to-point test between the specific source and destination MAC address. Port loopback MAC swap functionality must be used for both Epipe and VPLS services. The configured source and destination MAC address is associated with the two SAPs configured in the service and used as the two endpoints. That is, the user configured source MAC and destination MAC addresses are used by the testhead tool on the local node to identify the packets as belonging to testhead application and are processed appropriately at the local end and at the remote end these packets are processed by the port loopback with mac-swap application.
- Configure the MACs (source and destination) statically for VPLS service.
- Port loopback must be in use on both the endpoints (that is, the local node, the port on which the test SAP is configured and the remote node, the port on which the remote SAP is configured for both Epipe and VPLS services. Port loopback with mac-swap must be setup by the user on both the local end and the remote end before invoking the testhead tool. These must match appropriately for traffic to flow, else there will be no traffic flow and the testhead tool reports a failure at the end of the completion of the test run.
- Additionally, port loopback with mac-swap must be used at both the ends and if any services/SAPs are configured on the test port, they need to be shutdown to avoid packets being dropped on the non-test SAP. The frames generated by the testhead tool will egress the access SAP and ingress back on the same port, using the resources of the 2 internal loopback ports (one for testhead and another for mac-swap functionality), before being sent out to the network side (typically an access-uplink SAP) to the remote end". At the remote end, it is expected that the frames will egress the SAP under test and ingress back in again through the same port, going through another loopback (with mac-swap) before being sent back to the local node where the testhead application is running.
- The FC specified is used to determine the queue to enqueue the marker packets generated by testhead application on the egress of the test SAP on the local node.
- The use of port loopback is service affecting. It affects all the services configured on the port. It is not recommended to use a SAP, if the port on which they are configured, is used to transport the service packets toward the core. As, a port loopback is required for the testhead to function correctly, doing so might result in loss of connectivity to the node when in-band management is in use. Additionally, all services being transported to the core will be affected.
- It also affects service being delivered on that SAP. Only out-of-service performance metrics can be measured using testhead OAM tool. For in-service performance metrics, user has the option to use SAA based Y.1731/CFM tools.
- Testhead tool uses marker packets with special header values. The QoS policies and ACL policies need to ensure that same treatment as accorded to testhead traffic is given to marker packets. Marker packets are IPv4 packet with IP option set and IP protocol set to 252. It uses the source and destination MAC addresses, Dot1p, IP ToS, IP DSCP, IP TTL, IP source address and destination address as configured in the frame-payload. It does not use the IP protocol and TCP/UDP port numbers from the frame-payload configured. If the payload-type is "l2", IP addresses are set to 0.0.0.0, IP TTL is set to 0, IP TOS is set to 0 and DSCP is set to be, if these values are not explicitly configured in the frame-

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payload. Ethertype configured in the frame-payload is not used for marker packets, it is always set to Ethertype = 0x0800 (Ethertype for IPv4) as marker packets are IPv4 packets.

QoS policies applied in the network needs to configured such that the classification for marker packets is similar to service packets. An easy way to do this is by using the header fields that are common across marker packets and service packets, such as MAC (src and dst) addresses, VLAN ID, Dot1p, IPv4 (source and destination) addresses, IP DSCP, and IP ToS. Use of other fields which are different for marker packets and service packets is not recommended. ACL policies in the network must ensure that marker packets are not dropped.

- The mac-swap loopback port, the testhead loopback port and the uplink port must not be modified after the testhead tool is invoked. Any modifications can be made only when the testhead tool is not running.
- Link-level protocols (For example: LLDP, EFM, and other protocols) must not be enabled on the port on which the test SAP is configured. In general, no other traffic must be sent out of the test SAP when the testhead tool is running.
- The frame payload must be configured such that number of tags match the number of SAP tags. For example: For 0.* SAP, the frame payload must be untagged or priority tagged and it cannot contain another tag following the priority tag.

3.6.2 Configuration guidelines

This section provides the configuration guidelines for the testhead OAM tool. It is applicable to all the platforms described in this guide unless a specific platform is called out explicitly:

- On the 7210 SAS-Sx 10/100GE platform, the following limitation must be addressed in the testhead configuration: the testhead loopback port and MAC swap loopback port must be configured with the same Ethernet speeds and have the same operational speeds. Failure to do so will cause the testhead session start to fail.
- SAPs configured on LAG cannot be configured for testing with testhead tool. Other than the test SAP, other service endpoints (For example: SAPs/SDP-Bindings) configured in the service can be over a LAG.
- The user needs to configure the resources of another port for use with the testhead OAM tool. The user can configure the resources of the internal virtual ports (if available) or configure the resources of a front-panel port for use with testhead OAM tool. Please see the CLI command **config**>**system**>**loopback-no-svc-port** in the *7210 SAS-Mxp, R6, R12, S, Sx, T Interface Configuration Guide*for more details. Interfaces to know if front-panel port resources are needed and use the command **show**>**system**>**internal-loopback-ports** [**detail**] to know if internal port resources are available in use by other applications. The port configured for testhead tool use cannot be shared with other applications that need the loopback port. The resources of the loopback port are used by the testhead tool for traffic generation.

  Note:
  On 7210 SAS-R6 and 7210 SAS-R12, the ports allocated for testhead OAM tool, the MAC swap OAM tool and the test SAP must be on the same line card and cannot be on different line cards.

- Port loopback with mac-swap is used at both ends and all services on the port on which the test SAP is configured and SAPs in the VPLS service, other than the test SAP should be shutdown or should not receive any traffic.

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- The configured CIR/PIR rate is rounded off to the nearest available hardware rates. User is provided with an option to select the adaptation rule to use (similar to support available for QoS policies).
- The 7210 SAS supports validation of different bandwidth rates with the Y.1564 testhead OAM tool. Users must configure the appropriate loopback port to achieve the desired rate. For example, to test rates to go up to 1G, the user must dedicate resources of a 1G port.

  Note:
  See the scaling guide for more information about 7210 SAS scaling limits, in particular, to know the maximum rate supported with the Y.1564 testhead OAM tool on a specific platform.

- ITU-T Y.1564 recommends to provide an option to configure the CIR step-size and the step-duration for the service configuration tests. This is not supported directly in 7210 SAS. It can be achieved by SAM or a third-party NMS system or an application with configuration of the desired rate and duration to correspond to the CIR step-size and step duration and repeating the test a second time, with a different value of the rate (that is, CIR step size) and duration (that is, step duration) and so on.
- Testhead waits for about 5 seconds at the end of the configured test duration before collecting statistics. This allows for all in-flight packets to be received by the node and accounted for in the test measurements. User cannot start another test during this period.
- When using testhead to test bandwidth available between SAPs configured in a VPLS service, operators must ensure that no other SAPs in the VPLS service are exchanging any traffic, particularly BUM traffic and unicast traffic destined for either the local test SAP or the remote SAP. BUM traffic eats into the network resources which is also used by testhead traffic.
- It is possible that test packets (both data and marker packets) remain in the loop created for testing when the tests are killed. This is highly probable when using QoS policies with very less shaper rates resulting in high latency for packets flowing through the network loop. User must remove the loop at both ends when the test is complete or when the test is stopped and wait for a suitable time before starting the next test for the same service, to ensure that packets drain out of the network for that service. If this is not done, then the subsequent tests may process and account these stale packets, resulting in incorrect results. Software cannot detect stale packets in the loop as it does not associate or check each and every packet with a test session
- Traffic received from the remote node and looped back into the test port (where the test SAP is configured) on the local end (that is, the end where the testhead tool is invoked) is dropped by hardware after processing (and is not sent back to the remote end). The SAP ingress QoS policies and SAP ingress filter policies must match the packet header fields specified by the user in the testhead profile, except that the source/destination MAC addresses are swapped.
- Latency is not be computed if marker packets are not received by the local node where the test is generated and printed as 0 (zero), in such cases. If jitter = 0 and latency > 0, it means that jitter calculated is less than the precision used for measurement. There is also a small chance that jitter was not actually calculated, that is, only one value of latency has been computed. This typically indicates a network issue, instead of a testhead issue.
- When the throughput is not met, FLR cannot be calculated. If the measured throughput is approximately +/-10% of the user configured rate, FLR value is displayed; else software prints "Not Applicable". The percentage of variance of measured bandwidth depends on the packet size in use and the configured rate.
- Users must not use the CLI command to clear statistics of the test SAP port, testhead loopback port, or MAC swap loopback port when the testhead tool is running. The port statistics are used by the tool to determine the Tx/Rx frame count.

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- Testhead tool generates traffic at a rate slightly above the CIR. The additional bandwidth is attributable to the marker packets used for latency measurements. This is not expected to affect the latency measurement or the test results in a significant way.
- If the operational throughput is 1kbps and it is achieved in the test loop, the throughput computed could still be printed as 0 if it is less than 1Kb/s (0.99 kb/s, for example). Under such cases, if FLR is PASS, the tool indicates that the throughput has been achieved.
- The testhead tool displays a failure result if the received count of frames is less than the injected count of frames, even though the FLR may be displayed as 0. This happens because of truncation of FLR results to 6 decimal places and can happen when the loss is very less.
- As the rate approaches 1Gbps or the maximum bandwidth achievable in the loop, user needs to account for the marker packet rate and the meter behavior while configuring the CIR rate. That is, if the user needs to test 1Gbps for 512 bytes frame size, then they will need to configure about 962396Kbps, instead of 962406Kbps, the maximum rate that can be achieved for this frame-size. In general, they would need to configure about 98%-99% (based on packet size) of the maximum possible rate to account for marker packets when they need to test at rates which are closer to bandwidth available in the network. The reason for this is that at the maximum rate, injection of marker packets by CPU will result in drops of either the injected data traffic or the marker packets themselves, as the net rate exceeds the capacity. These drops cause the testhead to always report a failure, unless the rate is marginally reduced.
- The testhead uses the Layer 2 rate, which is calculated by subtracting the Layer 1 overhead that is caused when the IFG and Preamble are added to every Ethernet frame (typically about 20 bytes (IFG = 12 bytes and Preamble = 8 bytes)). The testhead tool uses the user-configured frame size to compute the Layer 2 rate and does not allow the user to configure a value greater than that rate. For 512-byte Ethernet frames, the L2 rate is 962406 Kb/s and the Layer 1 rate is 1 Gb/s.
- It is not expected that the operator will use the testhead tool to measure the throughput or other performance parameters of the network during the course of network event. The network events could be affecting the other SAP/SDP-Binding/PW configured in the service. Examples are transition of a SAP because of G8032 ring failure, transition of active/ standby SDP-Binding/PW because of link or node failures.
- The 2-way delay (also known as "latency") values measured by the testhead tool is more accurate than obtained using OAM tools, as the timestamps are generated in hardware.
- The 7210 SAS does not support color-aware metering on access SAP ingress, therefore, any color-aware packets generated by the testhead is ignored on access SAP ingress. 7210 SAS service access port, access-uplink port, or network port can mark the packets appropriately on egress to allow the subsequent nodes in the network to differentiate the in-profile and out-of-profile packets and provide them with appropriate QoS treatment. The 7210 SAS access-uplink ingress and network port ingress is capable of providing appropriate QoS treatment to in-profile and out-of-profile packets.
- The marker packets are sent over and above the configured CIR or PIR rate, the tool cannot determine the number of green packets injected and the number of yellow packets injected individually. Therefore, marker packets are not accounted in the injected or received green or in-profile and yellow or out-of-profile packet counts. They are only accounted for the Total Injected and the Total Received counts. So, the FLR metric accounts for marker packet loss (if any), while green or yellow FLR metric does not account for any marker packet loss.
- Marker packets are used to measure green or in-profile packets latency and jitter and the yellow or out-of-profile packets latency and jitter. These marker packets are identified as green or yellow based on the packet marking (Example: dot1p). The latency values can be different for green and yellow packets based on the treatment provided to the packets by the network QoS configuration.

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The following table describes SAP encapsulation supported by the testhead tool.

Table 19: SAP encapsulations supported by testhead tool

Epipe service configured with svc-sap-type	Test SAP encapsulations
null-star	Null, :* , 0.* , Q.*
Any	Null , :0 , :Q , :Q1.Q2
dot1q-preserve	:Q

- The following combination of 1G and 10G port can be used, as long as the rate validated is less than or equal to 1Gb/s:
  - The test SAP is a 10G port, the uplink is 1G port and other ports (that is, uplink, MAC swap, and testhead) are 1G port.
  - The test SAP is a 10G port, the uplink is a 10G port and other ports (that is, MAC swap and testhead) are 1G port.
  - The test SAP is a 1G port, the uplink is a 10G port and other ports (that is, MAC swap and testhead) are 1G port.

3.6.3 Configuring testhead tool parameters

Output example

The following is a sample port loopback MAC swap configuration output using the service and SAP.

```
configure> system> loopback-no-svc-port testhead <port-id>
*A:7210SAS>config>system# info
----------------------------------------------
.............
resource-profile
            ingress-internal-tcam
                qos-sap-ingress-resource 5
                exit
                acl-sap-ingress 5
                exit
            exit
            egress-internal-tcam
            exit
        exit
        loopback-no-svc-port mac-swap 1/1/8 testhead 1/1/11
..............
```

Output example

The following is a sample port loopback with MAC swap configuration output on the remote end.

```
*A:7210SAS# configure system loopback-no-svc-port mac-swap 1/1/8
*A:7210SAS# configure system
*A:7210SAS>config>system# info
----------------------------------------------
        alarm-contact-input 1
```


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```
            shutdown
        exit
        alarm-contact-input 2
            shutdown
        exit
        alarm-contact-input 3
            shutdown
        exit
        alarm-contact-input 4
            shutdown
        exit
        resource-profile
            ingress-internal-tcam
                qos-sap-ingress-resource 5
                exit
                acl-sap-ingress 5
                exit
            exit
            egress-internal-tcam
            exit
        exit
        loopback-no-svc-port mac-swap 1/1/8 testhead 1/1/11
.................
```

Output example

The following is a sample testhead profile configuration output.

```
*A:7210SAS# configure test-oam testhead-profile 1
*A:7210SAS>config>test-oam>testhd-prof# info
----------------------------------------------
description "Testhead_Profile_1"
            frame-size 512
            rate cir 100 adaptation-rule max pir 200
            dot1p in-profile 2 out-profile 4
            frame-payload 1 payload-type tcp-ipv4 create
                description "Frame_Payload_1"
                dscp "af11"
                dst-ip ipv4 10.2.2.2
                dst-mac 00:00:00:00:00:02
                src-mac 00:00:00:00:00:01
                dst-port 50
                src-port 40
                ip-proto 6
                ip-tos 8
                ip-ttl 64
                src-ip ipv4 10.1.1.1
            exit
acceptance-criteria 1 create
                jitter-rising-threshold 100
                jitter-rising-threshold-in 100
                jitter-rising-threshold-out 100
                latency-rising-threshold 100
                latency-rising-threshold-in 100
                latency-rising-threshold-out 100
                loss-rising-threshold 100
                loss-rising-threshold-in 100
                loss-rising-threshold-out 100
                cir-threshold 1000
                pir-threshold 2000
            exit
```


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```
-------------------------------------------
*A:7210SAS>config>test-oam>testhd-prof#
```

The following command is used to execute the testhead profile.

```
*A:7210SAS# oam testhead testhead-profile 1 frame-payload 1 sap 1/1/2 test-
me owner ownerme color-aware enable
```

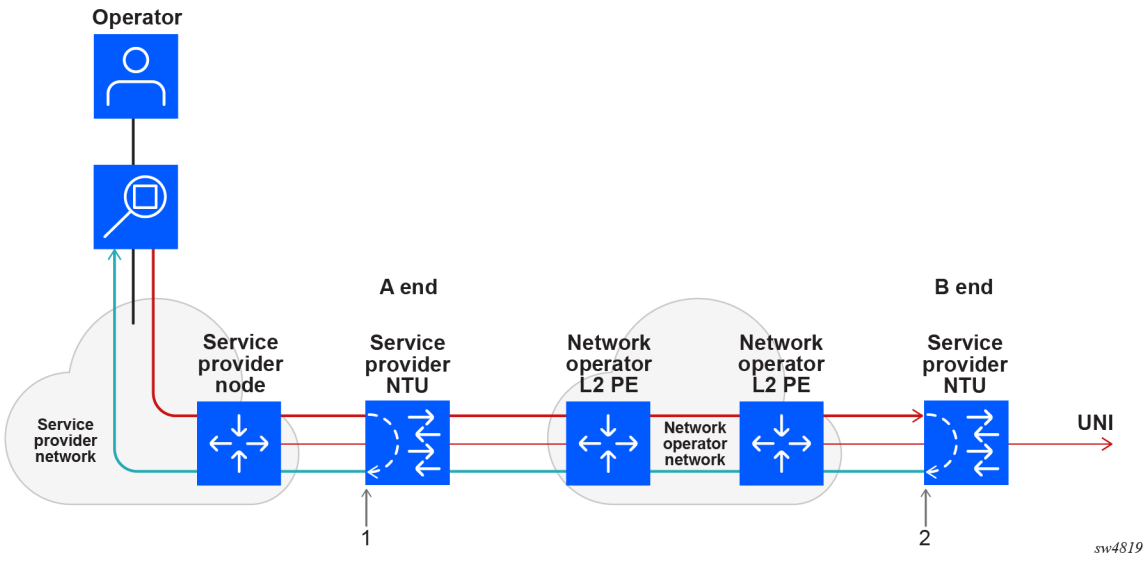
3.6.4 SAP ingress loopback for Ethernet SAPs

SAP ingress loopback, where traffic identified by destination MAC address and source MAC address, received on a SAP and service, is looped back out of the SAP on which it was received. All other traffic that does not match the source and destination MAC address is processed normally by the service and sent out of the other SAPs in the service. This feature enables validation of Ethernet circuits using test frames from a centralized location eliminating the need to coordinate with the customer for service downtime and remotely, without access to the circuit handoff location.

Figure 28: Network example of SAP ingress loopback for Ethernet SAPs shows a service provider that uses the wholesale Ethernet circuit provided by a third-party network operator to serve out-of-region customers. The service provider uses a Network Termination Unit (NTU) (for example, 7210 SAS-Sx/S 1/10GE (standalone)) at each handoff point as follows:

- The first handoff is from the service provider network to the third-party network operator's network, displayed with the “A end” label.
- The second handoff is from the third-party network operator's network to the service provider’s customer or to a different operator’s network. This is displayed with the “B end” label.

Figure 28: Network example of SAP ingress loopback for Ethernet SAPs



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These two handoff points, and the corresponding NTUs placed at these points, serve as the service demarcation points for the third-party network operator's network (referred to as "network operator"). The network operator provides performance assurance (for example, bandwidth, loss, latency, availability, and so on) in accordance with SLA targets agreed upon for the services delivered by the network identified by the demarcation points.

To aid the service provider in diagnosing potential network issues, the NTUs at the demarcation points must provide loopback functionality that allows the service provider to quickly identify the problematic segment of the network:

- without coordinating the enabling and disabling of loopback functionality across multiple demarcation points in the network
- without sending engineers to network sites where the NTUs are located to connect test equipment that provides loopback functionality to determine whether an issue exists
- without deploying additional test equipment at the network sites where the NTUs are located
- providing a means to test the network directly through a service provider network or from the service-provider's customer network

This functionality enables service providers and network operators to send technical engineers to the correct network site identified using the loopback tests to quickly rectify the issue, reducing repair time, improving service availability, and reducing operations. This functionality is enabled as follows:

- Traffic identified using the destination MAC address and source MAC address received in the context of a specific SAP and service is looped back on the ingress of the SAP. All other traffic received on the SAP is forwarded in the context of the service to other SAPs configured in the service.
- Service providers can use two different traffic streams, each with its unique, well-defined destination MAC address. One stream is configured to loop back with MAC-swap at one of the demarcation points ("A end" in Figure 28: Network example of SAP ingress loopback for Ethernet SAPs) of the network operator, and the second stream is looped back with MAC-swap at the other demarcation point ("B end" in Figure 28: Network example of SAP ingress loopback for Ethernet SAPs).
- It is expected that the service provider and network operator configure the traffic stream entries used for looping back at the demarcation points all the time, allowing test traffic streams to be sent at any time to isolate issues that impact the end service for the customer, without requiring a specific workflow to enable or disable the loopback function.

To enable this functionality, use the following **loopback** command with the **line** keyword to indicate that loopback with MAC-swap is required on SAP ingress on the 7210 SAS-Sx/S 1/10GE (standalone).

```
configure test-oam [no] loopback entry entry-id {line} port port-id service service-id sap sap-id src-mac address dst-mac address
```

The **line** keyword is used to specify that traffic is received (ingress) on the SAP (identified by the *sap-id*), and is looped back by the datapath to be sent out of the same SAP.

With the **line** keyword, traffic identified by the configured source MAC address and destination MAC address (specified using the **src-mac** and **dst-mac** parameters), received on the configured SAP (specified using *sap-id*) in the context of the configured service (specified using *service-id*) is looped back with the source and destination MAC address swapped in the datapath out of the same SAP it is received on (in other words, the SAP specified by the user with the *sap-id*). All other traffic received on the SAP, and that does not match the configured source MAC and destination MAC address, is forwarded in the context of the service (in other words, configuring loopback entries does not affect other traffic flows in the service).

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3.6.4.1 Configuration guidelines

The following configuration guidelines apply to SAP ingress loopback for Ethernet SAPs:

- On the 7210 SAS-Sx/S 1/10GE (standalone), a loopback entry for the **line** keyword can be created after the **config**>**test-oam**>**testhead-num-streams**>**multiple** command is enabled.
- The following SAPs are allowed with the **line** keyword:
  - On the 7210 SAS-Sx/S 1/10GE (standalone), access SAPs on an access port are supported.
  - A SAP can be a null SAP, dot1q (Q1, :0) SAP, or QinQ (Q1.Q2, Q1.*) SAP.
  - A service can be Epipe, VPLS with **svc-sap-type** set to **any**.
- Each loopback entry, representing a stream of traffic flow, can be configured on a different SAP, port, and service on the node. Each port and service can be configured with multiple streams. It is also allowed to configure all streams on a single port and a single service (provided the platform supports multiple SAPs on the same port belonging to the same service), with the limit of one loopback with **line** keyword per SAP.
- On the 7210 SAS-Sx/S 1/10GE (standalone), traffic across all loopback entries is not expected to exceed the capacity of the MAC-swap loopback port, so the software does not apply any QoS policies on that port.
- Users assign a higher priority to loopback packets so that, in the event of congestion, these packets are forwarded through the node and the network before other traffic. If loopback packets are not prioritized, they may be dropped because of congestion in the node or network.
- Both unicast traffic and multicast traffic are supported. When the received packets contains a destination address that matches a broadcast or multicast address, the MAC-swap uses the port MAC address as the source address in the resulting loopback packets.
- Users must add static MAC addresses for the source and destination MAC addresses configured with the **loopback** command.
- The **loopback** command is not saved in the configuration file across a reboot. To avoid manually configuring traffic streams during every reboot, users can use the `boot-on-good-exec` script to install the traffic streams after a successful bootup.
- The test SAP configuration (for example, ACLs, QoS, and so on) must not be changed when the SAP is referenced in the **loopback** command.
- On the 7210 SAS-Sx/S 1/10GE (standalone), where only a single SAP per port is allowed in a service, only a single loopback per SAP per service for a specific port is allowed. The following example displays SAPs on different port in the same service.
- On platforms such as the 7210 SAS-Sx/S 1/10GE which operate in network mode, where multiple SAPs per port are allowed in the same service, multiple loopbacks can be configured per port and per service with only a single loopback per SAP.

Example: Multiple SAPs on the same port in the same service

```
configure test-oam loopback entry 1 line port 1/1/9 service 101 sap 1/1/9:101 src-mac
 10:00:00:00:00:01 dst-mac 20:00:00:00:00:01
configure test-oam loopback entry 1 line port 1/1/9 service 101 sap 1/1/9:1001 src-mac
 10:00:00:00:00:01 dst-mac 20:00:00:00:00:01
configure test-oam loopback entry 1 line port 1/1/9 service 101 sap 1/1/9:2001 src-mac
 10:00:00:00:00:01 dst-mac 20:00:00:00:00:01
```


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3.6.4.2 Resource utilization

The system allocates internal resources for use with the **loopback line** option and users do not need to allocate any additional resources explicitly.

3.6.4.3 Configuring a loopback port for MAC-swap

On the 7210 SAS-Sx/S 1/10GE (standalone), users must configure a loopback port for use with this feature. The loopback port can be a front-panel port or virtual port. Use the following command to configure the loopback port:

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

3.7 OAM Performance Monitoring (OAM-PM)

OAM-PM provides an architecture for gathering and computing key performance indicators (KPIs) using standard protocols and a robust collection model. The architecture comprises the following foundational components:

- **session**

  The session is the overall collection of different tests, test parameters, measurement intervals, and mappings to configured storage models. It is the overall container that defines the attributes of the session.

- **standard PM packets**

  Standard PM packets are the protocols defined by various standards bodies which contains the necessary fields to collect statistical data for the performance attribute they represent. OAM-PM leverages single-ended protocols. Single-ended protocols typically follow a message response model, message sent by a launch point, response updated and reflected by a responder.

- **measurement intervals (MI)**

  MI are time-based non-overlapping windows that capture all results that are received in that window of time.

- **data structures**

  Data structures are the unique counters and measurement results that represent the specific protocol.

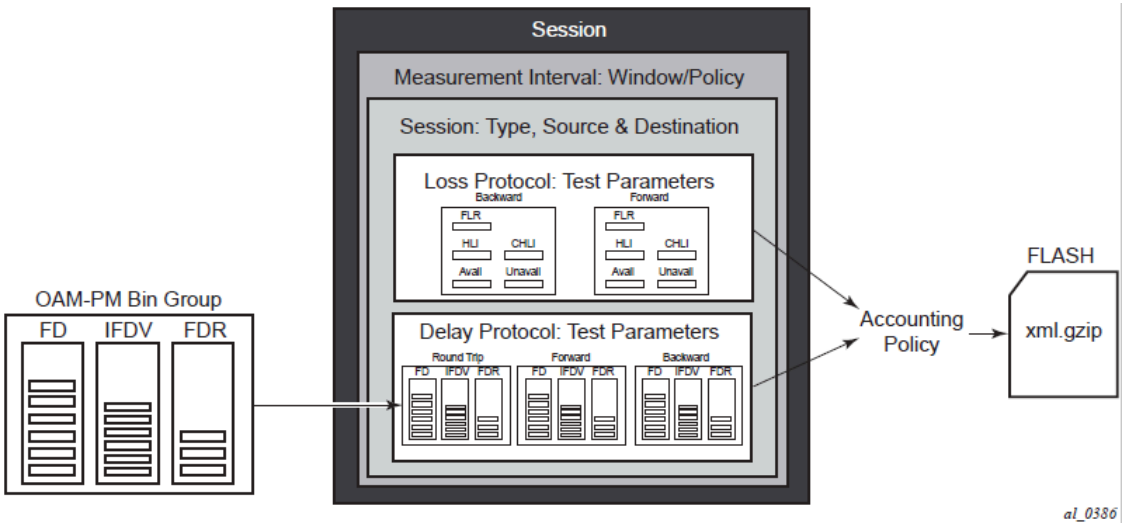
- **bin group**

  Bin groups are ranges in microseconds that count the results that fit into the range.

The following figure shows the hierarchy of the architecture. This diagram is only meant to show the relationship between the components. It is not meant to depict all details of the required parameters.

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Figure 29: OAM-PM architecture hierarchy



OAM-PM configurations are not dynamic environments. All aspects of the architecture must be carefully considered before configuring the various architectural components, making external references to other related components, or activating the OAM-PM architecture. No modifications are allowed to any components that are active or have any active sub-components. Any function being referenced by an active OAM-PM function or test cannot be modified or shut down. For example, to change any configuration element of a session, all active tests must be in a shutdown state. To change any bin group configuration (described later in this section) all sessions that reference the bin group must have every test shutdown. The description parameter is the only exception to this rule.

Session source and destination configuration parameters are not validated by the test that makes use of that information. When the test is activated with a **no shutdown** command, the test engine will attempt to send the test packets even if the session source and destination information does not accurately represent the entity that must exist to successfully transmit packets. If the entity does not exist, the transmit count for the test will be zero.

OAM-PM is not a hitless operation. If a high availability event occurs that causes the backup CPM to become the active CPM, or when ISSU functions are performed, the test data will not be correctly reported. There is no synchronization of state between the active and the backup control modules. All OAM-PM statistics stored in volatile memory will be lost. When the reload or high availability event is completed and all services are operational then the OAM-PM functions will commence.

It is possible that during times of network convergence, high CPU utilizations, or contention for resources, OAM-PM may not be able to detect changes to an egress connection or allocate the necessary resources to perform its tasks.

3.7.1 Session

This is the overall collection of different tests, the test parameters, measurement intervals, and mapping to configured storage models. It is the overall container that defines the attributes of the session:

- **session type**

  A session type is the impetus of the test, which is either proactive (default) or on-demand. Individual test timing parameters are influenced by this setting. A proactive session will start immediately following

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the execution of a **no shutdown** command for the test. A proactive test will continue to execute until a manual shutdown stops the individual test. On-demand tests will also start immediately following the **no shutdown** command. However, the operator can override the **no test-duration** default and configure a fixed amount of time that the test will execute, up to 24 hours (86400 seconds). If an on-demand test is configured with a test-duration, it is important to shut down tests when they are completed. In the event of a high availability event causing the backup CPM to become the active CPM, all on-demand tests that have a test-duration statement will restart and run for the configured amount of time regardless of their progress on the previously active CPM.

- **test family**

  The test family is the main branch of testing that addresses a specific technology. The available test for the session are based on the test family. The destination, source, and priority are common to all tests under the session and are defined separately from the individual test parameters.

- **test parameters**

  Test parameters are the parameters included in individual tests, as well as the associated parameters including start and stop times and the ability to activate and deactivate the individual test.

- **measurement interval**

  A measurement interval is the assignment of collection windows to the session with the appropriate configuration parameters and accounting policy for that specific session.

The session can be viewed as the single container that brings all aspects of individual tests and the various OAM-PM components under a single umbrella. If any aspects of the session are incomplete, the individual test cannot be activated with a **no shutdown** command, and an "Invalid Ethernet session parameters" error will occur.

3.7.2 Standard PM packets

A number of standards bodies define performance monitoring packets that can be sent from a source, processed, and responded to by a reflector. The protocols available to carry out the measurements are based on the test family type configured for the session.

Ethernet PM delay measurements are carried out using the Two Way Delay Measurement Protocol version 1 (DMMv1) defined in Y.1731 by the ITU-T. This allows for the collection of Frame Delay (FD), InterFrame Delay Variation (IFDV), Frame Delay Range (FDR), and Mean Frame Delay (MFD) measurements for round trip, forward, and backward directions.

DMMv1 adds the following to the original DMM definition:

- the Flag Field (1 bit – LSB) is defined as the Type (Proactive=1 | On-Demand=0)
- the TestID TLV (32 bits) is carried in the Optional TLV portion of the PDU

DMMv1 and DMM are backwards compatible and the interaction is defined in Y.1731 ITU-T-2011 Section 11 "OAM PDU validation and versioning".

Ethernet PM loss measurements are carried out using Synthetic Loss Measurement (SLM), which is defined in Y.1731 by the ITU-T. This allows for the calculation of Frame Loss Ratio (FLR) and availability.

A session can be configured with one or more tests. Depending on the session test type family, one or more test configurations may need to be included in the session to gather both delay and loss performance information. Each test that is configured shares the common session parameters and the common measurement intervals. However, each test can be configured with unique per-test parameters.

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Using Ethernet as an example, both DMM and SLM would be required to capture both delay and loss performance data.

Each test must be configured with a test ID as part of the test parameters, which uniquely identifies the test within the specific protocol. A test ID must be unique within the same test protocol. Again using Ethernet as an example, DMM and SLM tests within the same session can use the same test ID because they are different protocols. However, if a test ID is applied to a test protocol (like DMM or SLM) in any session, it cannot be used for the same protocol in any other session. When a test ID is carried in the protocol, as it is with DMM and SLM, this value does not have global significance. When a responding entity must index for the purpose of maintaining sequence numbers, as in the case of SLM, the test ID, Source MAC, and Destination MAC are used to maintain the uniqueness of the responder. This means that the test ID has only local, and not global, significance.

3.7.3 Measurement intervals

A measurement interval is a window of time that compartmentalizes the gathered measurements for an individual test that have occurred during that time. Allocation of measurement intervals, which equates to system memory, is based on the metrics being collected. This means that when both delay and loss metrics are being collected, they allocate their own set of measurement intervals. If the operator is executing multiple delay and loss tests under a single session, then multiple measurement intervals will be allocated, with one interval allocated per criteria per test.

Measurement intervals can be 15 minutes (**15-min**), one hour (**1-hour**) and 1 day (**1-day**) in duration. The **boundary-type** defines the start of the measurement interval and can be aligned to the local time of day clock, with or without an optional offset. The **boundary-type** can be aligned using the **test-aligned** option, which means that the start of the measurement interval coincides with the activation of the test. By default the start boundary is clock-aligned without an offset. When this configuration is deployed, the measurement interval will start at zero, in relation to the length. When a boundary is clock-aligned and an offset is configured, the specified amount of time will be applied to the measurement interval. Offsets are configured on a per-measurement interval basis and only applicable to clock-aligned measurement intervals. Only offsets less than the measurement interval duration are allowed. The following table describes some examples of the start times of each measurement interval.

Table 20: Measurement interval start times

Offset	15-min	1-hour	1-day
0 (default)	00, 15, 30, 45	00 (top of the hour)	midnight
10 minutes	10, 25, 40, 55	10 min after the hour	10 min after midnight
30 minutes	rejected	30 min after the hour	30 min after midnight
60 minutes	rejected	rejected	01:00 AM

Although test-aligned approaches may seem beneficial for simplicity, there are some drawbacks that need to be considered. The goal of the time-based and well defined collection windows allows for the comparison of measurements across common windows of time throughout the network and for relating different tests or sessions. It is suggested that proactive sessions use the default clock-aligned boundary type. On-demand sessions may make use of test-aligned boundaries. On-demand tests are typically used for troubleshooting or short term monitoring that does not require alignment or comparison to other PM data.

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The statistical data collected and the computed results from each measurement interval are maintained in volatile system memory by default. The number of intervals stored is configurable per measurement interval. Different measurement intervals will have different defaults and ranges. The **interval-stored** parameter defines the number of completed individual test runs to store in volatile memory. There is an additional allocation to account for the active measurement interval. To look at the statistical information for the individual tests and a specific measurement interval stored in volatile memory, the **show oam-pm statistics … interval-number** command can be used. If there is an active test, it can be viewed by using the interval number 1. In this case, the first completed record would be interval number 2, and previously completed records would increment up to the maximum intervals stored value plus one.

As new tests for the measurement interval are completed, the older entries are renumbered to maintain their relative position to the current test. If the retained test data for a measurement interval consumes the final entry, any subsequent entries cause the removal of the oldest data.

There are drawbacks to this storage model. Any high availability function that causes an active CPM switch will flush the results that are in volatile memory. Another consideration is the large amount of system memory consumed using this type of model. With the risks and resource consumption this model incurs, an alternate method of storage is supported.

An accounting policy can be applied to each measurement interval to write the completed data in system memory to non-volatile flash memory in an XML format. The amount of system memory consumed by historically completed test data must be balanced with an appropriate accounting policy. Nokia recommends that only necessary data be stored in non-volatile memory to avoid unacceptable risk and unnecessary resource consumption. It is further suggested that a large overlap between the data written to flash memory and stored in volatile memory is unnecessary.

The statistical information in system memory is also available through SNMP. If this method is chosen, a balance must be struck between the intervals retained and the times at which the SNMP queries collect the data. Determining the collection times through SNMP must be done with caution. If a file is completed while another file is being retrieved through SNMP, then the indexing will change to maintain the relative position to the current run. Correct spacing of the collection is key to ensuring data integrity.

The OAM-PM XML file contains the keywords and MIB references described in the following table.

Table 21: OAM-PM XML keywords and MIB reference

XML file keyword	Description	TIMETRA-OAM-PM-MIB object
oampm	—	None - header only
Keywords shared by all OAM-PM protocols		
sna	OAM-PM session name	tmnxOamPmCfgSessName
mi	Measurement interval record	None - header only
dur	Measurement interval duration (minutes)	tmnxOamPmCfgMeasIntvlDuration (enumerated)
ivl	Measurement interval number	tmnxOamPmStsIntvlNum
sta	Start timestamp	tmnxOamPmStsBaseStartTime
ela	Elapsed time (seconds)	tmnxOamPmStsBaseElapsedTime

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XML file keyword	Description	TIMETRA-OAM-PM-MIB object
ftx	Frames sent	tmnxOamPmStsBaseTestFramesTx
frx	Frames received	tmnxOamPmStsBaseTestFramesRx
sus	Suspect flag	tmnxOamPmStsBaseSuspect
dmm	Delay record	None - header only
mdr	Minimum frame delay, round-trip	tmnxOamPmStsDelayDmm2wyMin
xdr	Maximum frame delay, round-trip	tmnxOamPmStsDelayDmm2wyMax
adr	Average frame delay, round-trip	tmnxOamPmStsDelayDmm2wyAvg
mdf	Minimum frame delay, forward	tmnxOamPmStsDelayDmmFwdMin
xdf	Maximum frame delay, forward	tmnxOamPmStsDelayDmmFwdMax
adf	Average frame delay, forward	tmnxOamPmStsDelayDmmFwdAvg
mdb	Minimum frame delay, backward	tmnxOamPmStsDelayDmmBwdMin
xdb	Maximum frame delay, backward	tmnxOamPmStsDelayDmmBwdMax
adb	Average frame delay, backward	tmnxOamPmStsDelayDmmBwdAvg
mvr	Minimum inter-frame delay variation, round-trip	tmnxOamPmStsDelayDmm2wyMin
xvr	Maximum inter-frame delay variation, round-trip	tmnxOamPmStsDelayDmm2wyMax
avr	Average inter-frame delay variation, round-trip	tmnxOamPmStsDelayDmm2wyAvg
mvf	Minimum inter-frame delay variation, forward	tmnxOamPmStsDelayDmmFwdMin
xvf	Maximum inter-frame delay variation, forward	tmnxOamPmStsDelayDmmFwdMax
avf	Average inter-frame delay variation, forward	tmnxOamPmStsDelayDmmFwdAvg
mvb	Minimum inter-frame delay variation, backward	tmnxOamPmStsDelayDmmBwdMin
xvb	Maximum inter-frame delay variation, backward	tmnxOamPmStsDelayDmmBwdMax
avb	Average inter-frame delay variation, backward	tmnxOamPmStsDelayDmmBwdAvg
mrr	Minimum frame delay range, round-trip	tmnxOamPmStsDelayDmm2wyMin
xrr	Maximum frame delay range, round-trip	tmnxOamPmStsDelayDmm2wyMax
arr	Average frame delay range, round-trip	tmnxOamPmStsDelayDmm2wyAvg
mrf	Minimum frame delay range, forward	tmnxOamPmStsDelayDmmFwdMin
xrf	Maximum frame delay range, forward	tmnxOamPmStsDelayDmmFwdMax

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XML file keyword	Description	TIMETRA-OAM-PM-MIB object
arf	Average frame delay range, forward	tmnxOamPmStsDelayDmmFwdAvg
mrb	Minimum frame delay range, backward	tmnxOamPmStsDelayDmmBwdMin
xrb	Maximum frame delay range, backward	tmnxOamPmStsDelayDmmBwdMax
arb	Average frame delay range, backward	tmnxOamPmStsDelayDmmBwdAvg
fdr	Frame delay bin record, round-trip	None - header only
fdf	Frame delay bin record, forward	None - header only
fdb	Frame delay bin record, backward	None - header only
fvr	Inter-frame delay variation bin record, round-trip	None - header only
fvf	Inter-frame delay variation bin record, forward	None - header only
fvb	Inter-frame delay variation bin record, backward	None - header only
frr	Frame delay range bin record, round-trip	None - header only
frf	Frame delay range bin record, forward	None - header only
frb	Frame delay range bin record, backward	None - header only
lbo	Configured lower bound of the bin	tmnxOamPmCfgBinLowerBound
cnt	Number of measurements within the configured delay range [13]	tmnxOamPmStsDelayDmmBinFwdCount tmnxOamPmStsDelayDmmBinBwdCount tmnxOamPmStsDelayDmmBin2wyCount
slm	Synthetic loss measurement record	None - header only
txf	Transmitted frames in the forward direction	tmnxOamPmStsLossSlmTxFwd
rxf	Received frames in the forward direction	tmnxOamPmStsLossSlmRxFwd
txb	Transmitted frames in the backward direction	tmnxOamPmStsLossSlmTxBwd
rxb	Received frames in the backward direction	tmnxOamPmStsLossSlmRxBwd
avf	Available count in the forward direction	tmnxOamPmStsLossSlmAvailIndFwd
avb	Available count in the forward direction	tmnxOamPmStsLossSlmAvailIndBwd
uvf	Unavailable count in the forward direction	tmnxOamPmStsLossSlmUnavlIndFwd
uvb	Unavailable count in the forward direction	tmnxOamPmStsLossSlmUnavlIndBwd

[13] The session_name, interval_duration, interval_number, {fd, fdr, ifdv}, bin_number, and {forward, backward, round-trip} indices are provided by the surrounding XML context.

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XML file keyword	Description	TIMETRA-OAM-PM-MIB object
uaf	Undetermined available count in the forward direction	tmnxOamPmStsLossSlmUndtAvlFwd
uab	Undetermined available count in the backward direction	tmnxOamPmStsLossSlmUndtAvlBwd
uuf	Undetermined unavailable count in the forward direction	tmnxOamPmStsLossSlmUndtUnavlFwd
uub	Undetermined unavailable count in the backward direction	tmnxOamPmStsLossSlmUndtUnavlBwd
hlf	Count of HLIs in the forward direction	tmnxOamPmStsLossSlmHliFwd
hlb	Count of HLIs in the backward direction	tmnxOamPmStsLossSlmHliBwd
chf	Count of CHLIs in the forward direction	tmnxOamPmStsLossSlmChliFwd
chb	Count of CHLIs in the backward direction	tmnxOamPmStsLossSlmChliBwd
mff	Minimum FLR in the forward direction	tmnxOamPmStsLossSlmMinFlrFwd
xff	Maximum FLR in the forward direction	tmnxOamPmStsLossSlmMaxFlrFwd
aff	Average FLR in the forward direction	tmnxOamPmStsLossSlmAvgFlrFwd
mfb	Minimum FLR in the backward direction	tmnxOamPmStsLossSlmMinFlrBwd
xfb	Maximum FLR in the backward direction	tmnxOamPmStsLossSlmMaxFlrBwd
afb	Average FLR in the backward direction	tmnxOamPmStsLossSlmAvgFlrBwd

By default, the 15-min measurement interval stores 33 test runs (32+1) with a configurable range of 1 to 96, and the 1-hour measurement interval stores 9 test runs (8+1) with a configurable range of 1 to 24. The only storage for the 1-day measurement interval is 2 (1+1). This value for the 1-day measurement interval cannot be changed.

All three measurement intervals may be added to a single session if required. Each measurement interval that is included in a session is updated simultaneously for each test that is executing. If a measurement interval length is not required, it should not be configured. In addition to the three predetermined length measurement intervals, a fourth "always on" raw measurement interval is allocated at test creation. Data collection for the raw measurement interval commences immediately following the execution of a **no shutdown** command. It is a valuable tool for assisting in real-time troubleshooting as it maintains the same performance information and relates to the same bins as the fixed length collection windows. The operator may clear the contents of the raw measurement interval and flush stale statistical data to look at current conditions. This measurement interval has no configuration options, cannot be written to flash memory, and cannot be disabled; It is a single never-ending window.

Memory allocation for the measurement intervals is performed when the test is configured. Volatile memory is not flushed until the test is deleted from the configuration, a high availability event causes the backup CPM to become the newly active CPM, or some other event clears the active CPM system memory. Shutting down a test does not release the allocated memory for the test.

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Measurement intervals also include a suspect flag. The suspect flag is used to indicate that data collected in the measurement interval may not be representative. The flag will be set to true only under the following conditions:

- Time of day clock is adjusted by more than 10 seconds.
- Test start does not align with the start boundary of the measurement interval. This would be common for the first execution for clock aligned tests.
- Test stopped before the end of the measurement interval boundary

The suspect flag is not set when there are times of service disruption, maintenance windows, discontinuity, low packet counts, or other such events. Higher level systems would be required to interpret and correlate those types of event for measurement intervals which executed during the time that relate to the specific interruption or condition. Because each measurement interval contains a start and stop time, the information is readily available for higher level systems to discount the specific windows of time.

3.7.4 Data structures and storage

There are two main metrics that are the focus of OAM-PM: delay and loss. The different metrics have two unique storage structures and will allocate their own measurement intervals for these structures. This occurs regardless of whether the performance data is gathered with a single packet or multiple packet types.

Delay metrics include Frame Delay (FD), InterFrame Delay Variation (IFDV), Frame Delay Range (FDR) and Mean Frame Delay (MFD). Unidirectional and round trip results are stored for each metric:

- **Frame Delay**

  The Frame Delay is the amount of time required to send and receive the packet.
- **InterFrame Delay Variation**

  IFDV is the difference in the delay metrics between two adjacent packets.
- **Frame Delay Range**

  The Frame Delay Range is the difference between the minimum frame delay and the individual packet
- **Mean Frame Delay**

  The Mean Frame Delay is the mathematical average for the frame delay over the entire window.

FD, IFDV and FDR statistics are binnable results. FD, IFDV, FDR and MFD all include minimum, maximum, and average values. Unidirectional and round trip results are stored for each metric.

Unidirectional frame delay and frame delay range measurements require exceptional time of day clock synchronization. If the time of day clock does not exhibit extremely tight synchronization, unidirectional measurements will not be representative. In one direction, the measurement will be artificially increased by the difference in the clocks. In the other direction, the measurement will be artificially decreased by the difference in the clocks. This level of clocking accuracy is not available with NTP. To achieve this level of time of day clock synchronization, Precision Time Protocol (PTP) 1588v2 should be considered.

Round trip metrics do not require clock synchronization between peers, since the four timestamps allow for accurate representation of the round trip delay. The mathematical computation removes remote processing and any difference in time of day clocking. Round trip measurements do require stable local time of day clocks.

Any delay metric that is negative will be treated as zero and placed in bin 0, the lowest bin which has a lower boundary of 0 microseconds.

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Delay results are mapped to the measurement interval that is active when the result arrives back at the source.

There are no supported log events based on delay metrics.

Loss metrics are only unidirectional and will report frame loss ratio (FLR) and availability information. Frame loss ratio is the computation of loss (lost/sent) over time. Loss measurements during periods of unavailability are not included in the FLR calculation as they are counted against the unavailability metric.

Availability requires relating three different functions. First, the individual probes are marked as available or unavailable based on sequence numbers in the protocol. A number of probes are rolled up into a small measurement window, typically 1 s. Frame loss ratio is computed over all the probes in a small window. If the resulting percentage is higher than the configured threshold, the small window is marked as unavailable. If the resulting percentage is lower than the threshold, the small window is marked as available. A sliding window is defined as some number of small windows, typically 10. The sliding window is used to determine availability and unavailability events. Switching from one state to the other requires every small window in the sliding window to be the same state and different from the current state.

Availability and unavailability counters are incremented based on the number of small windows that have occurred in all available and unavailable windows.

Availability and unavailability using synthetic loss measurements is meant to capture the loss behavior for the service. It is not meant to capture and report on service outages or communication failures. Communication failures of a bidirectional or unidirectional nature must be captured using some other means of connectivity verification, alarming, or continuity checking. During times of complete or extended failure periods it becomes necessary to timeout individual test probes. It is not possible to determine the direction of the loss because no response packets are being received back on the source. In this case, the statistics calculation engine maintains the previous state, updating the appropriate directional availability or unavailability counter. At the same time, an additional per-direction undetermined counter is updated. This undetermined counter is used to indicate that the availability or unavailability statistics could not be determined for a number of small windows.

During connectivity outages, the higher level systems can be used to discount the loss measurement interval, which covers the same span as the outage.

Availability and unavailability computations may delay the completion of a measurement interval. The declaration of a state change or the delay to a closing a measurement interval could be equal to the length of the sliding window and the timeout of the last packet. Closing of a measurement interval cannot occur until the sliding window has determined availability or unavailability. If the availability state is changing and the determination is crossing two measurement intervals, the measurement interval will not complete until the declaration has occurred. Typically, standard bodies indicate the timeout per packet. In the case of Ethernet, DMMv1, and SLM, timeout values are set at 5 s and cannot be configured.

There are no log events based on availability or unavailability state changes.

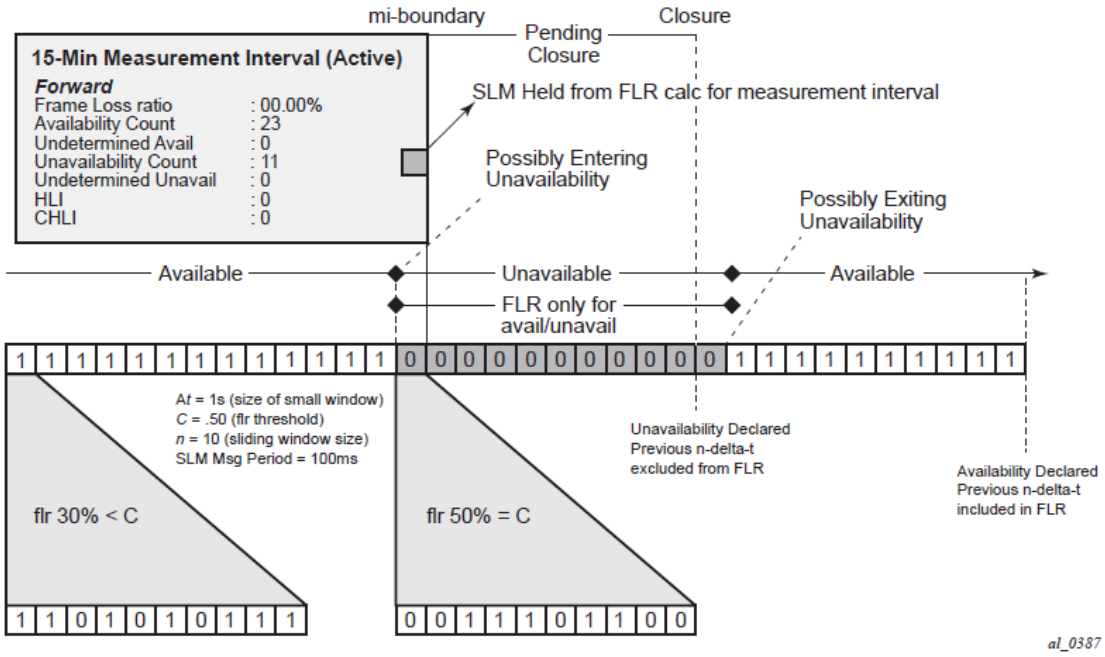
During times of availability, there can be times of high loss intervals (HLI) or consecutive high loss intervals (CHLI). These are indicators that the service was available but individual small windows or consecutive small windows experienced frame loss ratios exceeding the configured acceptable limit. A HLI is any single small window that exceeds the configured frame loss ratio. This could equate to a severely errored second, assuming the small window is one second. A CHIL is a consecutive high loss interval that exceeds a consecutive threshold within the sliding window. Only one HLI will be counted for a window.

Availability can only be reasonably determined with synthetic packets. This is because the synthetic packet is the packet being counted and provides a uniform packet flow that can be used for the computation. Transmit and receive counter-based approaches cannot reliably be used to determine availability because there is no guarantee that service data is on the wire, or the service data on the wire uniformity could make it difficult to make a declaration valid.

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The following figure shows loss in a single direction using synthetic packets, and demonstrates what happens when a possible unavailability event crosses a measurement interval boundary. In the diagram, the first 13 small windows are all marked available (1), which means that the loss probes that fit into each of those small windows did not equal or exceed a frame loss ratio of 50%. The next 11 small windows are marked as unavailable, which means that the loss probes that fit into each of those small windows were equal to or above a frame loss ratio of 50%. After the 10th consecutive small window of unavailability, the state transitions from available to unavailable. The 25th small window is the start of the new available state which is declared following the 10th consecutive available small window. Notice that the frame loss ratio is 00.00%; this is because all the small windows that are marked as unavailable are counted toward unavailability, and therefore are excluded from impacting the FLR. If there were any small windows of unavailability that were outside of an unavailability event, they would be marked as HLI or CHLI and be counted as part of the frame loss ratio.

Figure 30: Evaluating and computing loss and availability



3.7.5 Bin groups

Bin groups are templates that are referenced by the session. Three types of binnable statistics are available: FD, IFDV, and FDR, all of which are available in forward, backward, and round trip directions. Each of these metrics can have up to ten bin groups configured to group the results. Bin groups are configured by indicating a lower boundary. Bin 0 has a lower boundary that is always zero and is not configurable. The microsecond range of the bins is the difference between the adjacent lower boundaries. For example, **bin-type fd bin 1** configured with **lower-bound 1000** means that bin 0 will capture all frame delay statistics results between 0 and 1 ms. Bin 1 will capture all results above 1 ms and below the bin 2 lower boundary. The last bin to be configured would represent the bin that collects all the results at and above that value. Not all ten bins must be configured.

Each binnable delay metric type requires their own values for the bin groups. Each bin in a type is configurable for one value. It is not possible to configure a bin with different values for round trip, forward,

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and backward. Consideration must be given to the configuration of the boundaries that represent the important statistics for that specific service.

As stated earlier in this section, this is not a dynamic environment. If a bin group is being referenced by any active test the bin group cannot shutdown. To modify the bin group it must be shut down. If the configuration of a bin group must be changed, and a large number of sessions are referencing the bin group, migrating existing sessions to a new bin group with the new parameters can be considered to reduce the maintenance window. To modify any session parameter, every test in the session must be shut down.

Bin group 1 is the default bin group. Every session requires a bin group to be assigned. By default, bin group 1 is assigned to every OAM-PM session that does not have a bin group explicitly configured. Bin group 1 cannot be modified. The bin group 1 configuration parameters are as follows:

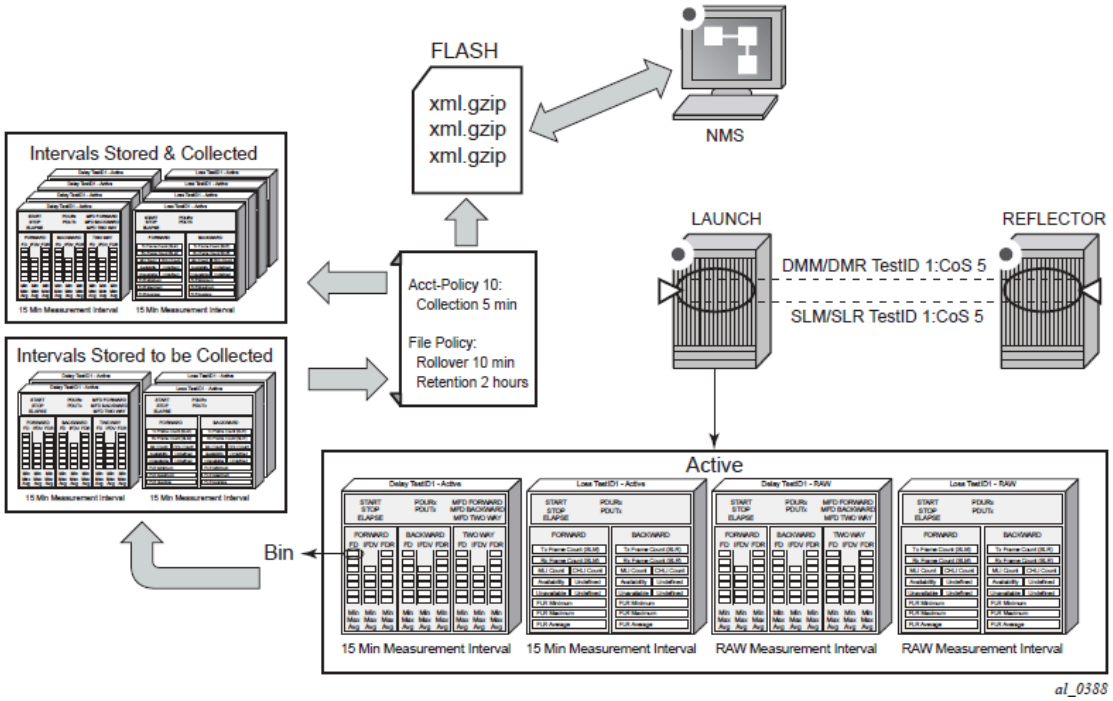
```
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                    Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
1     OAM PM default bin group (not*    Up   0          0          0          0
                                             1       5000       5000       5000
                                             2      10000          -          -
-------------------------------------------------------------------------------
```

3.7.6 Relating the components

The following figure shows the architecture of all of the OAM-PM concepts previously described. It shows a more detailed hierarchy than previously shown in the introduction. This shows the relationship between the tests, the measurement intervals, and the storage of the results.

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Figure 31: Relating OAM-PM components



3.7.7 Monitoring

The following configuration examples are used to demonstrate the different show and monitoring commands available to check OAM-PM.

3.7.7.1 Accounting policy configuration

Output example

```
config>log# info
----------------------------------------------
        file-id 1
            description "OAM PM XML file Paramaters"
            location cf2:
            rollover 10 retention 2
        exit
        accounting-policy 1
            description "Default OAM PM Collection Policy for 15-min Bins"
            record complete-pm
            collection-interval 5
            to file 1
            no shutdown
        exit
        log-id 1
        exit
----------------------------------------------
```


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3.7.7.2 ETH-CFM configuration

Output example

```
config>eth-cfm# info
----------------------------------------------
        domain 12 format none level 2
            association 4 format string name "vpls4-0000001"
                bridge-identifier 4
                    id-permission chassis
                exit
                ccm-interval 1
                remote-mepid 30
            exit
        exit
```

3.7.7.3 Service configuration

Output example

```
config>service>vpls# info
----------------------------------------------
            description "OAM PM Test Service to v30"
            stp
                shutdown
            exit
            sap 1/1/10:4.* create
                eth-cfm
                    mep 28 domain 12 association 4 direction up
                        ccm-enable
                        mac-address 00:00:00:00:00:28
                        no shutdown
                    exit
                exit
            exit
            sap 1/2/1:4.* create
            exit
            no shutdown
```

3.7.7.4 OAM-PM configuration

Output example

```
config>oam-pm#info detail
----------------------------------------------
        bin-group 2 fd-bin-count 10 fdr-bin-count 2 ifdv-bin-count 10 create
            no description
            bin-type fd
                bin 1
                    lower-bound 1000
                exit
                bin 2
                    lower-bound 2000
                exit
                bin 3
                    lower-bound 3000
```


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```
                exit
                bin 4
                    lower-bound 4000
                exit
                bin 5
                    lower-bound 5000
                exit
                bin 6
                    lower-bound 6000
                exit
                bin 7
                    lower-bound 7000
                exit
                bin 8
                    lower-bound 8000
                exit
                bin 9
                    lower-bound 10000
                exit
            exit
            bin-type fdr
                bin 1
                    lower-bound 5000
                exit
            exit
            bin-type ifdv
                bin 1
                    lower-bound 100
                exit
                bin 2
                    lower-bound 200
                exit
                bin 3
                    lower-bound 300
                exit
                bin 4
                    lower-bound 400
                exit
                bin 5
                    lower-bound 500
                exit
                bin 6
                    lower-bound 600
                exit
                bin 7
                    lower-bound 700
                exit
                bin 8
                    lower-bound 800
                exit
                bin 9
                    lower-bound 1000
                exit
            exit
            no shutdown
        exit
        session "eth-pm-service-4" test-family ethernet session-
type proactive create
            bin-group 2
            no description
            meas-interval 15-mins create
                no accounting-policy
                boundary-type clock-aligned
                clock-offset 0
```


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```
                intervals-stored 32
            exit
            ethernet
                dest-mac 00:00:00:00:00:30
                priority 0
                source mep 28 domain 12 association 4
                dmm test-id 10004 create
                    data-tlv-size 1000
                    interval 1000
                    no test-duration
                    no shutdown
                exit
                slm test-id 10004 create
                    data-tlv-size 1000
                    flr-threshold 50
                    no test-duration
                    timing frames-per-delta-t 10 consec-delta-t 10 interval 100
                           chli-threshold 4
                    no shutdown
                exit
            exit
        exit
```

3.7.7.5 Show and monitor commands

Output example

```
show oam-pm bin-group
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                    Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
1     OAM PM default bin group (not*    Up   0          0          0          0
                                             1       5000       5000       5000
                                             2      10000          -          -
-------------------------------------------------------------------------------
2                                      Up   0          0          0          0
                                             1       1000       5000        100
                                             2       2000          -        200
                                             3       3000          -        300
                                             4       4000          -        400
                                             5       5000          -        500
                                             6       6000          -        600
                                             7       7000          -        700
                                             8       8000          -        800
                                             9      10000          -       1000
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
* indicates that the corresponding row element may have been truncated.

show oam-pm bin-group 2
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                    Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
2                                      Up   0          0          0          0
                                             1       1000       5000        100
                                             2       2000          -        200
                                             3       3000          -        300
```


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```
                                          4       4000          -        400
                                          5       5000          -        500
                                          6       6000          -        600
                                          7       7000          -        700
                                          8       8000          -        800
                                          9      10000          -       1000
-------------------------------------------------------------------------------

show oam-pm bin-group-using
===============================================================================
OAM Performance Monitoring Bin Group Configuration for Sessions
===============================================================================
Bin Group       Admin   Session                             Session State
-------------------------------------------------------------------------------
2               Up      eth-pm-service-4                      Act
-------------------------------------------------------------------------------
===============================================================================

show oam-pm bin-group-using bin-group 2
===============================================================================
OAM Performance Monitoring Bin Group Configuration for Sessions
===============================================================================
Bin Group       Admin   Session                             Session State
-------------------------------------------------------------------------------
2               Up      eth-pm-service-4                      Act
-------------------------------------------------------------------------------
===============================================================================

show oam-pm sessions test-family ethernet
===============================================================================
OAM Performance Monitoring Session Summary for the Ethernet Test Family
===============================================================================
Session                         State   Bin Group   Sess Type   Test Types
-------------------------------------------------------------------------------
eth-pm-service-4                  Act           2   proactive      DMM SLM
===============================================================================

show oam-pm session "eth-pm-service-4" all
-------------------------------------------------------------------------------
Basic Session Configuration
-------------------------------------------------------------------------------
Session Name      : eth-pm-service-4
Description       : (Not Specified)
Test Family       : ethernet            Session Type       : proactive
Bin Group         : 2
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Ethernet Configuration
-------------------------------------------------------------------------------
Source MEP        : 28                  Priority           : 0
Source Domain     : 12                  Dest MAC Address   : 00:00:00:00:00:30
Source Assoc'n    : 4
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
DMM Test Configuration and Status
-------------------------------------------------------------------------------
Test ID           : 10004               Admin State        : Up
Oper State        : Up                  Data TLV Size      : 1000 octets
On-Demand Duration: Not Applicable      On-Demand Remaining: Not Applicable
Interval          : 1000 ms
-------------------------------------------------------------------------------
```


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```
-------------------------------------------------------------------------------
SLM Test Configuration and Status
-------------------------------------------------------------------------------
Test ID           : 10004               Admin State        : Up
Oper State        : Up                  Data TLV Size      : 1000 octets
On-Demand Duration: Not Applicable      On-Demand Remaining: Not Applicable
Interval          : 100 ms
CHLI Threshold    : 4 HLIs              Frames Per Delta-T : 10 SLM frames
Consec Delta-Ts   : 10                  FLR Threshold      : 50%
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
15-mins Measurement Interval Configuration
-------------------------------------------------------------------------------
Duration          : 15-mins             Intervals Stored   : 32
Boundary Type     : clock-aligned       Clock Offset       : 0 seconds
Accounting Policy : none
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                    Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
2                                    Up   0          0          0          0
                                          1       1000       5000        100
                                          2       2000          -        200
                                          3       3000          -        300
                                          4       4000          -        400
                                          5       5000          -        500
                                          6       6000          -        600
                                          7       7000          -        700
                                          8       8000          -        800
                                          9      10000          -       1000
-------------------------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" dmm meas-interval 15-
mins interval-number 2 all
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 10:00:00          Status          : completed
Elapsed (seconds) : 900                          Suspect         : no
Frames Sent       : 900                          Frames Received : 900
-------------------------------------------------------------------------------

-------------------------------------------------------------------
Bin Type     Direction     Minimum (us)   Maximum (us)   Average (us)
-------------------------------------------------------------------
FD           Forward                0           8330           712
FD           Backward             143          11710          2605
FD           Round Trip          1118          14902          3111
FDR          Forward                0           8330           712
FDR          Backward             143          11710          2605
FDR          Round Trip             0          13784          1990
IFDV         Forward                0           8330           431
IFDV         Backward               1          10436           800
IFDV         Round Trip             2          13542          1051
-------------------------------------------------------------------

-----------------------------------------------------------
Frame Delay (FD) Bin Counts
-----------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------
0               0 us           624            53             0
```


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```
1            1000 us           229           266           135
2            2000 us            29           290           367
3            3000 us             4           195           246
4            4000 us             7            71            94
5            5000 us             5            12            28
6            6000 us             1             7            17
7            7000 us             0             1             5
8            8000 us             1             4             3
9           10000 us             0             1             5
-------------------------------------------------------------

-------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------
0              0 us           893           875           873
1           5000 us             7            25            27
-------------------------------------------------------------

-------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------
0              0 us           411           162            96
1            100 us           113           115           108
2            200 us            67            84            67
3            300 us            56            67            65
4            400 us            36            46            53
5            500 us            25            59            54
6            600 us            25            27            38
7            700 us            29            34            22
8            800 us            41            47            72
9           1000 us            97           259           325
-------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" slm meas-interval 15-
mins interval-number 2
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 10:00:00         Status          : completed
Elapsed (seconds) : 900                         Suspect         : no
Frames Sent       : 9000                        Frames Received : 9000
-------------------------------------------------------------------------------

-----------------------------------------------------
                   Frames Sent       Frames Received
-----------------------------------------------------
Forward                   9000                  9000
Backward                  9000                  9000
-----------------------------------------------------

-------------------------------------------
Frame Loss Ratios
-------------------------------------------
             Minimum    Maximum    Average
-------------------------------------------
Forward       0.000%     0.000%     0.000%
Backward      0.000%     0.000%     0.000%
-------------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
```


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```
           Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward          900           0           0           0          0          0
Backward         900           0           0           0          0          0
-------------------------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" dmm meas-interval raw
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 09:43:58          Status          : in-progress
Elapsed (seconds) : 2011                         Suspect         : yes
Frames Sent       : 2011                         Frames Received : 2011
-------------------------------------------------------------------------------

-------------------------------------------------------------------------
Bin Type     Direction     Minimum (us)   Maximum (us)   Average (us)
-------------------------------------------------------------------------
FD           Forward                0          11670           632
FD           Backward               0          11710          2354
FD           Round Trip          1118          14902          2704
FDR          Forward                0          11670           611
FDR          Backward               0          11710          2353
FDR          Round Trip             0          13784          1543
IFDV         Forward                0          10027           410
IFDV         Backward               0          10436           784
IFDV         Round Trip             0          13542          1070
-------------------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay (FD) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us          1465           252             0
1           1000 us           454           628           657
2           2000 us            62           593           713
3           3000 us             8           375           402
4           4000 us            11           114           153
5           5000 us             7            26            41
6           6000 us             2            10            20
7           7000 us             0             2             8
8           8000 us             1            10            11
9          10000 us             1             1             6
-----------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us          2001          1963          1971
1           5000 us            11            49            41
-----------------------------------------------------------------

-----------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           954           429           197
1            100 us           196           246           197
2            200 us           138           168           145
3            300 us           115           172           154
4            400 us            89            96           136
5            500 us            63            91           108
```


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```
6             600 us            64            53            89
7             700 us            61            55            63
8             800 us           112            82           151
9            1000 us           219           619           771
-------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" slm meas-interval raw
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 09:44:03          Status          : in-progress
Elapsed (seconds) : 2047                         Suspect         : yes
Frames Sent       : 20470                        Frames Received : 20469
-------------------------------------------------------------------------------

-----------------------------------------------------
                   Frames Sent       Frames Received
-----------------------------------------------------
Forward                  20329                 20329
Backward                 20329                 20329
-----------------------------------------------------

-------------------------------------------
Frame Loss Ratios
-------------------------------------------
             Minimum    Maximum    Average
-------------------------------------------
Forward       0.000%     0.000%     0.000%
Backward      0.000%     0.000%     0.000%
-------------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
           Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward         2033           0           0           0          0          0
Backward        2033           0           0           0          0          0
-------------------------------------------------------------------------------
```

The **monitor** command can be used to automatically update the statistics for the raw measurement interval.

3.8 Diagnostics command reference

- OAM commands
  - Base operational commands
  - Show commands
  - Clear commands
- OAM Performance Monitoring, bin group, and session commands
  - OAM-PM session IP commands
  - Clear commands
- SAA commands
  - Show commands
  - Monitor commands

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– Clear commands

3.8.1 Command hierarchies

3.8.1.1 OAM commands

3.8.1.1.1 Base operational commands

```
GLOBAL
    - ping [ip-address | dns-name] [rapid | detail] [ttl time-to-live] [tos type-of-service]
 [size bytes] [pattern pattern] [source ip-address | dns-name ] [interval seconds] [{next-
hop ip-address} | {interface interface-name} | bypass-routing] [count requests] [do-not-
fragment] [router router-instance | service-
name service- name] [timeout timeout] [fc fc-name]
    - traceroute [ip-address | dns-name] [ttl ttl] [wait milli-seconds] [no-dns] [source ip-
address] [tos type-of-service] [router [router-instance | service- name service- name]
    - oam
        - dns target-addr dns-name name-server ip-address [source ip-address] [count send-
count] [timeout timeout] [interval interval] [record-type {ipv4-a-record|ipv6-aaaa-record}]
        - saa test-name [owner test-owner] {start | stop} [no-accounting]
```

3.8.1.1.1.1 LSP diagnostics

```
GLOBAL
    - oam
        - lsp-ping bgp-label-prefix ip-prefix/mask [path-destination ip-address [interface if-
name | next-hop ip-address]]
        - lsp-ping lsp-name [path path-name]
        - lsp-ping prefix ip-prefix/mask [path-destination ip-address [interface if-name |
 next-hop ip-address]]
        - lsp-ping static lsp-name [assoc-channel ipv4|non-ip|none] [dest-global-id global-id
 dest-node-id node-id] [force] [path-type active | working | protect]
        - lsp-trace bgp-label-prefix ip-prefix/mask [path-destination ip-address [interface if-
name | next-hop ip-address]] [downstream-map-tlv dsmap | ddmap | none]
        - lsp-trace lsp-name [path path-name]
        - lsp-trace prefix ip-prefix/mask [path-destination ip-address [interface if-name |
 next-hop ip-address]]
        - lsp-trace static lsp-name [assoc-channel ipv4|non-ip|none] [path-type active |
 working | protect]
        - p2mp-lsp-ping {{lsp-name [p2mp-instance instance-name] [s2l-dest-address ip-address…
[ip-address…up-to-5]] [ttl label-ttl]} | {ldp p2mp-id [sender-addr ip-address] [leaf-addr ip-
address…[ip-address…up-to-5]}} [fc fc-name] [size octets] [timeout timeout] [interval interval]
 [detail]
        - p2mp-lsp-trace {lsp-name [p2mp-instance instance-name] [s2l-dest-address ip-address…
[ip-address…up-to-5]]} | {ldp p2mp-id}} [fc fc-name] [size octets] [max-fail no-response-count]
 [probe-count probes-per-hop] [min-ttl min-label-ttl] [max-ttl max-label-ttl] [timeout timeout]
 [interval interval] [detail]
```


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3.8.1.1.1.2 LDP diagnostics

```
GLOBAL
    - oam
        - ldp-treetrace {prefix ip-prefix/mask} [max-ttl ttl-value] [max-path max-paths]
 [timeout timeout] [retry-count retry-count] [fc fc-name [profile profile]] [downstream-map-tlv
 {dsmap | ddmap}]
    - config
        - test-oam
            - [no] ldp-treetrace
                - fc fc-name
                - no fc
                - path-discovery
                    - interval minutes
                    - no interval
                    - max-path max-paths
                    - no max-path
                    - max-ttl ttl-value
                    - no max-ttl
                    - policy-statement policy-name [...(up to 5 max)]
                    - no policy-statement
                    - retry-count retry-count
                    - no retry-count
                    - timeout timeout
                    - no timeout
                - path-probing
                    - interval minutes
                    - no interval
                    - retry-count retry-count
                    - no retry-count
                    - timeout timeout
                    - no timeout
                - [no] shutdown
            - mpls-echo-request-downstream-map {dsmap | ddmap}
            - no mpls-echo-request-downstream-map
```

3.8.1.1.1.3 TWAMP

```
GLOBAL
    - configure
        - test-oam
            - twamp
                - server
                    - [no] prefix {ip-prefix | mask} [create]
                        - [no] description description-string
                        - [no] max-conn-prefix count
                        - [no] max-sess-prefix count
                    - [no] inactivity-timeout seconds
                    - [no] max-conn-server count
                    - [no] max-sess-server count
                    - [no] shutdown
```

3.8.1.1.1.4 TWAMP Light

```
configure
    - router
```


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```
        - twamp-light
            - reflector [udp-port udp-port-number] [create]
            - no reflector
                - description description-string
                - no description
                - prefix ip-prefix/prefix-length [create]
                - no prefix ip-prefix/prefix-length
                    - description description-string
                    - no description
                - [no] shutdown
configure
    - service
        - vprn
            - twamp-light
                - reflector [udp-port udp-port-number] [create]
                - no reflector
                    - description description-string
                    - no description
                    - prefix ip-prefix/prefix-length [create]
                    - no prefix ip-prefix/prefix-length
                        - description description-string
                        - no description
                    - [no] shutdown
configure
    - test-oam
        - twamp
            - twamp-light
                - inactivity-timeout seconds
                - no inactivity-timeout
```

3.8.1.1.1.5 SDP diagnostics

```
GLOBAL
    - oam
        - sdp-mtu orig-sdp-id size-inc start-octets end-octets [step step-size]
 [timeout timeout] [interval interval]
        - sdp-ping orig-sdp-id [resp-sdp resp-sdp-id] [fc fc-name] [timeout seconds]
 [interval seconds] [size octets] [count send-count] [interval interval]
```

3.8.1.1.1.6 Common service diagnostics

```
GLOBAL
    - oam
        - svc-ping {ip-addr} service service-id [local-sdp] [remote-sdp]
        - dns target-addr dns-name name-server ip-address [source ip-address] [count send-
count] [timeout timeout] [interval interval]
        - vprn-ping service-id service svc-name source ip-address destination ip-
address [fc fc-name [size size] [ttl vc-label-ttl] [return-control] [interval interval]
 [count send-count] [timeout timeout]
        - vprn-trace service-id source src-ip destination ip-address [fc fc-name ] [size size]
 [min-ttl vc-label-ttl] [max-ttl vc-label-ttl] [return-control] [probe-count sendcount]
 [interval interval] [timeout timeout]
```


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3.8.1.1.1.7 VLL diagnostics

```
GLOBAL
    - oam
        - vccv-ping sdp-id:vc-id[src-ip-address ip-addr dst-ip-address ip-addr pw-id pw-id]
[reply-mode {ip-routed | control-channel}] [fc fc-name [size octets] [send-count send-count]
 [timeout timeout] [interval interval] [ttl vc-label-ttl]
        - vccv-ping spoke-sdp spoke-sdp-id [reply-mode ip-routed| control-channel] [src-ip-
address ip-addr dst-ip-address ip-addr]
        - vccv-ping static sdp-id:vc-id [assoc-channel ipv4 | non-ip] [dest-global-id global-id
 dest-node-id node-id] [src-ip-address ip-addr]
        - vccv-ping saii-type2 global-id:prefix:ac-id taii-type2 global-id:prefix:ac-id [reply-
mode ip-routed | control-channel] [src-ip-address ip-addr dst-ip-address ip-addr]
        - vccv-ping spoke-sdp-fec spoke-sdp-fec-id [reply-mode ip-routed | control-channel]
 [saii-type2 global-id:prefix:ac-id taii-type2 global-id:prefix:ac-id] [src-ip-address ip-
addr dst-ip-address ip-addr]
        - options common to all vccv-ping cases: [count send-count] [fc fc-name [profile in
 | out]] [interval interval] [size octets] [timeout timeout] [ttl vc-label-ttl]
        - vccv-trace sdp-id:vc-id [fc fc-name [profile {in | out}]] [size octets]
 [reply-mode ip-routed | control-channel] [probe-count probes-count] [timeout timeout]
 [interval interval] [min-ttl min-vc-label-ttl] [max-ttl
max-vc-label-ttl] [max-fail no-response-count] [detail]
        - vccv-trace static sdp-id:vc-id [assoc-channel ipv4 | non-ip] [src-ip-address ipv4-
address]
        - vccv-trace saii-type2 global-id:prefix:ac-id taii-type2 global-id:prefix:ac-id
 [reply-mode ip-routed | control-channel]
        - vccv-trace spoke-sdp-fec spoke-sdp-fec-id [reply-mode ip-routed | control-channel]
 [saii-type2 global-id:prefix:ac-id taii-type2 global-id:prefix:ac-id]
        - options common to all vccv-trace cases: [detail] [fc fc-name [profile in | out]]
 [interval interval-value] [max-fail no-response-count] [max-ttl max-vc-label-ttl] [min-
ttl min-vc-label-ttl] [probe-count probe-count] [size octets] [timeout timeout-value]
```

3.8.1.1.1.8 VPLS MAC diagnostics

```
GLOBAL
    - oam
        - cpe-ping service service-id destination ip-address source ip-address [source-
mac ieee-address] [fc fc-name] [ttl vc-label-ttl] [count send-count] [send-control] [return-
control] [interval interval]
        - mac-ping service service-id destination dst-ieee-address [source src-ieee-address]
 [fc fc-name ] [size octets] [fc fc-name] [ttl vc-label-ttl] [send-count send-count] [return-
control] [interval interval] [timeout timeout]
        - mac-populate service-id mac ieee-address [flood] [age seconds] [force] [target-
sap sap-id]
        - mac-purge service-id target ieee-address [flood] [register]
        - mac-trace service service-id destination ieee-address [source ieee-address] [fc fc-
name ] [size octets] [min-ttl vc-label-ttl] [max-ttl vc-label-ttl] [probe-count send-count]
 return-control] [interval interval] [timeout timeout]
```

3.8.1.1.1.9 Ethernet in the First Mile (EFM) commands

```
GLOBAL
    - oam
        - efm port-id local-loopback {start | stop}
        - efm port-id remote-loopback {start | stop}
```


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3.8.1.1.1.10 ETH-CFM OAM commands

```
oam
    - eth-cfm
        - eth-test mac-address mep mep-id domain md-index association ma-index
 [priority priority] [data-length data-length]
        - linktrace mac-address mep mep-id domain md-index association ma-index [ttl ttl-value]
        - loopback mac-address mep mep-id domain md-index association ma-index [send-
count send-count] [size data-size] [priority priority]
        - one-way-delay-test mac-address mep mep-id domain md-index association ma-index
 [priority priority]
        - two-way-delay-test mac-address mep mep-id domain md-index association ma-index
 [priority priority]
        - two-way-slm-test mac-address mep mep-id domain md-index association ma-index
 [fc {fc-name} [profile {in | out}]] [count send-count] [size data-size] [timeout timeout]
 [interval interval]
```

3.8.1.1.1.11 ETH-CFM configuration commands

```
config
    - eth-cfm
        - domain md-index [format md-name-format] [name md-name] level level
        - domain md-index
        - no domain md-index
            - association ma-index [format ma-name-format] name ma-name
            - association ma-index
            - no association ma-index
                - [no] bridge-identifier bridge-id
                    - id-permission {chassis}
                    - no id-permission
                        - mhf-creation {none | explicit | default | static}
                    - no mhf-creation
                    - mip-ltr-priority priority
                    - vlan vlan-id
                    - no vlan
                - ccm-interval {300Hz | 10ms | 100ms | 1 | 10 | 60 | 600}
                - no ccm-interval
                - [no] remote-mepid mep-id
        - slm
            - inactivity-timer timer
            - no inactivity-timer
        - system
            - sender-id local local-name
            - sender-id system
            - no sender-id
```

3.8.1.1.1.12 Y.1564 testhead OAM commands

```
config
    - test-oam
        - loopback entry entry-id {line} port port-id service service-id sap sap-id src-
mac ieee-address dst-mac ieee-address
        - no loopback entry entry-id
        - testhead-profile profile-id create
            - [no] acceptance-criteria  acceptance-criteria-id create
                - [no] cir-threshold threshold
```


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```
                - [no] jitter-rising-threshold threshold
                - [no] jitter-rising-threshold-in threshold
                - [no] jitter-rising-threshold-out threshold
                - [no] latency-rising-threshold  threshold
                - [no] latency-rising-threshold-in threshold
                - [no] latency-rising-threshold-out threshold
                - [no] loss-rising-threshold  threshold
                - [no] loss-rising-threshold-in threshold
                - [no] loss-rising-threshold-out threshold
                - [no] pir-threshold threshold
            - [no] description description-string
            - dot1p in-profile dot1p-value out-profile dot1p-value
            - no dot1p
            - no frame-payload  payload-id [payload-type [l2 | tcp-ipv4 | udp-ipv4 | ipv4]
 create
            - no frame-payload  payload
                - [no] data-pattern data-pattern
                - [no] description description-string
                - [no] dscp  dscp-name
                - [no] dst-ip  ipv4 ipv4-address
                - [no] dst-mac ieee-address [ieee-address-mask]
                - [no] dst-port dst-port-number
                - [no] ethertype 0x0600..0xffff
                - [no] ip-proto  ip-protocol-number
                - [no] ip-tos  type-of-service
                - [no] ip-ttl  ttl-value
                - [no] src-ip  ipv4 ipv4-address
                - [no] src-mac ieee-address [ieee-address-mask]
                - [no] src-port  src-port-number
                - [no] vlan-tag-1 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value]
                - [no] vlan-tag-2 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value]
            - [no] frame-size  frame-size
            - [no] rate cir cir-rate-in-kbps [adaptation-rule adaptation-rule] [pir pir-rate-
in-kbps]
            - [no] test-completion-trap-enable
            - [no] test-duration [hours hours| minutes minutes| seconds seconds]
            - [no] test-duration
```

3.8.1.1.1.13 Y.1564 testhead OAM commands

```
oam
    - testhead test-name [owner owner-name] testhead-profile profile-id [frame-payload frame-
payload-id] sap sap-id [fc fc-name] [acceptance-criteria acceptance-criteria-id [color-aware
 enable | disable]] [enforce-fc-check enable | disable]
    - testhead test-name [owner owner-name] stop
```

3.8.1.1.2 Show commands

```
show
    - test-oam
        - testhead-profile  profile-id
show
    - testhead  [test-name owner test-owner] [detail]
```


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3.8.1.1.3 Clear commands

```
clear
    - test-oam
        - twamp
            - server
    - testhead
        - result result [test-name] owner [test-owner]
        - result testhead-profile profile-id
```

3.8.1.2 OAM Performance Monitoring, bin group, and session commands

```
GLOBAL
    - oam
        - oam-pm session session-name {dmm | slm | twamp-light} {start | stop}
config
    - oam-pm
        - bin-group bin-group-number [fd-bin-count fd-bin-count fdr-bin-count fdr-bin-count
 ifdv-bin-count ifdv-bin-count create]
        - no bin-group bin-group-number
            - bin-type {fd | fdr | ifdv}
                - bin bin-number
                    - lower-bound microseconds
                    - no lower-bound
                    - delay-event {forward | backward | round-trip} lowest-bin bin-number
 threshold raise-threshold [clear clear-threshold]
                    - no delay-event {forward | backward | round-trip}
            - description description-string
            - no description
            - [no] shutdown
        - session session-name [test-family {ethernet | ip} [session-type {proactive | on-
demand}] create]
        - no session session-name
            - bin-group bin-group-number
            - no bin-group
            - description description-string
            - no description
            - ethernet
                - dest-mac ieee-address
                - no dest-mac
                - dmm [test-id test-id] [create]
                - no dmm
                    - data-tlv-size octets
                    - no data-tlv-size
                    - interval milliseconds
                    - no interval
                    - [no] shutdown
                    - test-duration seconds
                    - no test-duration
                - priority priority
                - no priority
                - slm [test-id test-id] [create]
                    - data-tlv-size octets
                    - no data-tlv-size
                    - flr-threshold percentage
                    - no flr-threshold
                    - loss-events
                    - loss-events {forward | backward} threshold raise-threshold-percent
 [clear clear-threshold-percent]
```


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```
                        - [no] avg-flr-event {forward | backward} threshold raise-threshold-
percent [clear clear-threshold-percent]
                        - chli-event {forward | backward | aggregate} threshold raise-threshold
 [clear clear-threshold]
                        - [no] chli-event {forward | backward | aggregate}
                        - [no] flr-threshold percentage
                        - hli-event {forward | backward | aggregate} threshold raise-threshold
 [clear clear-threshold]
                        - [no] hli-event {forward | backward | aggregate}
                        - unavailability-event {forward | backward | aggregate}
 threshold raise-threshold [clear clear-threshold]
                        - [no] unavailability-event {forward | backward | aggregate}
                        - undet-availability-event {forward | backward | aggregate}
 threshold raise-threshold [clear clear-threshold]
                        - [no] undet-availability-event {forward | backward | aggregate}
                        - undet-unavailability-event {forward | backward | aggregate}
 threshold raise-threshold [clear clear-threshold]
                        - [no] undet-unavailability-event {forward | backward | aggregate}
                    - [no] shutdown
                    - test-duration seconds
                    - no test-duration
                    - timing frames-per-delta-t frames consec-delta-t deltas
 interval milliseconds chli-threshold threshold
                    - no timing
                - source mep mep-id domain md-index association ma-index
                - no source
            - meas-interval {5-mins | 15-mins | 1-hour | 1-day} [create]
                - accounting-policy acct-policy-id
                - no accounting-policy
                - boundary-type {clock-aligned | test-relative}
                - no boundary-type
                - clock-offset seconds
                - no clock-offset
                - event-mon
                    - [no] delay-events
                    - [no] loss-events
                    - [no] shutdown
                - intervals-stored intervals
                - no intervals-stored
```

3.8.1.2.1 OAM-PM session IP commands

```
configure
    - oam-pm
        - session session-name [test-family {ethernet | ip} [session-type {proactive | on-
demand}] create]
        - no session session-name
            - ip
                - destination ip-address
                - no destination
                - dest-udp-port udp-port-number
                - no dest-udp-port
                - fc fc-name
                - no fc
                - forwarding bypass-routing
                - forwarding interface interface-name
                - forwarding next-hop ip-address
                - no forwarding
                - profile {in | out}
                - no profile
                - router router-instance
```


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```
                - router service-name service-name
                - no router
                - source ip-address
                - no source
                - source-udp-port udp-port-number
                - no source-udp-port
                - ttl time-to-live
                - no ttl
                - twamp-light [test-id test-id] [create]
                - no twamp-light
                    - interval milliseconds
                    - no interval
                    - loss
                        - flr-threshold percentage
                        - no flr-threshold
                        - timing frames-per-delta-t frames consec-delta-t deltas chli-
threshold threshold
                        - no timing
                    - loss-events
                        - avg-flr-event {forward | backward} threshold raise-threshold-
percent [clear clear-threshold-percent]
                        - no avg-flr-event {forward | backward}
                        - chli-event {forward | backward | aggregate} threshold raise-threshold
 [clear clear-threshold]
                        - no chli-event {forward | backward | aggregate}
                        - hli-event {forward | backward | aggregate} threshold raise-threshold
 [clear clear-threshold]
                        - no hli-event {forward | backward | aggregate}
                        - unavailability-event {forward | backward | aggregate}
 threshold raise-threshold [clear clear-threshold]
                        - no unavailability-event {forward | backward | aggregate}
                        - undet-availability-event {forward | backward | aggregate}
 threshold raise-threshold [clear clear-threshold]
                        - no undet-availability-event {forward | backward | aggregate}
                        - undet-unavailability-event {forward | backward | aggregate}
 threshold raise-threshold [clear clear-threshold]
                        - no undet-unavailability-event {forward | backward | aggregate}
                    - pad-size octets
                    - no pad-size
                    - record-stats {delay | loss | delay-and-loss}
                    - no record-stats
                    - [no] shutdown
                    - test-duration seconds
                    - no test-duration
```

3.8.1.2.2 Clear commands

```
clear
    - oam-pm
        - session session-name {dmm | slm | twamp-light}
clear
    - eth-cfm
        - mep mep-id domain md-index association ma-index statistics
        - statistics
```


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3.8.1.3 SAA commands

Note:
The following commands are supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode:

- **cpe-ping**
- **lsp-ping**
- **lsp-trace**
- **mac-ping**
- **mac-trace**
- **sdp-ping**
- **vccv-ping**
- **vccv-trace**
- **vprn-ping**
- **vprn-trace**

```
config
    - saa
        - [no] test test-name [owner test-owner]
            - accounting-policy acct-policy-id
            - no accounting-policy
            - [no] continuous
            - description description-string
            - no description
            - [no] jitter-event rising-threshold threshold [falling-threshold threshold]
 [direction]
            - [no] latency-event rising-threshold threshold [falling-threshold threshold]
 [direction]
            - [no] loss-event rising-threshold threshold [falling-threshold threshold]
 [direction]
            - probe-history {keep|drop|auto}
            - [no] shutdown
            - trap-gen
                - [no] probe-fail-enable
                - [no] probe-fail-threshold 0..15
                - [no] test-completion-enable
                - [no] test-fail-enable
                - [no] test-fail-threshold 0..15
            - [no] type
                - cpe-ping service service-id destination ip-address source ip-address [source-
mac ieee-address] [fc fc-name ][ttl vc-label-ttl] [send-count send-count] [return-control]
 [interval interval]
                - dns target-addr dns-name name-server ip-address [source ip-address] [send-
count send-count] [timeout timeout] [interval interval]
                - eth-cfm-linktrace mac-address mep mep-id domain md-index association  ma-
index [ttl ttl-value] [fc {fc-name}] [count send-count] [timeout timeout]   [interval interval]
 [record-type {ipv4-a-record|ipv6-aaaa-record}]
                - eth-cfm-loopback mac-address mep mep-id domain md-index association ma-index
 [size data-size] [fc {fc-name}] [count send-count ][timeout timeout] [interval interval]
                - eth-cfm-two-way-delay mac-address mep mep-id domain md-index association ma-
index [fc {fc-name}][count send-count ][timeout timeout] [interval interval]
                - eth-cfm-two-way-slm mac-address mep mep-id domain md-index association ma-
index [fc fc-name] [count send-count] [size data-size] [timeout timeout] [interval interval]
```


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```
                - icmp-ping [ip-address | dns-name] [rapid | detail] [ttl time-to-live] [tos
 type-of-service] [size bytes] [pattern pattern] [source ip-address] [interval seconds] [{next-
hop ip-address}|{interface interface-name}|bypass-routing] [count
requests] [do-not-fragment] [router-instance | service- name service- name] [timeout timeout]fc
 {fc-name}
                - icmp-trace [ip-address | dns-name] [ttl time-to-live] [wait milli-seconds]
 [source ip-address] [tos type-of-service][router-instance | service-name service- name]
                - lsp-ping bgp-label-prefix ip-prefix/mask [src-ip-address ip-address]
[fc fc-name] [size octets] [ttl label-ttl] [send-count send-count] [timeout timeout]
 [interval interval] [path-destination ip-address [interface if-name | next-hop ip-address]]
                - lsp-ping {{lsp-name [path path-name]}|{prefix ip-prefix/mask}} [src-ip-
address ip-address] [size octets] [ttl label-ttl] [timeout timeout] [interval interval] [fc fc-
name] [send-count send-count] {lsp-name [path
path-name]} [fc fc-name] [size octets][ttl label-ttl] [send-count send-count] [timeout timeout]
 [interval interval]
                - lsp-trace bgp-label-prefix ip-prefix/mask [src-ip-address ip-address]
[fc fc-name] [max-fail no-response-count] [probe-count probes-per-hop] [size octets] [min-ttl
 min-label-ttl] [max-ttl max-label-ttl] [timeout timeout] [interval interval] [path-destination
 ip-address [interface if-name | next-hop ip-address]] [downstream-map-tlv dsmap | ddmap |
 none] [detail]
                - lsp-trace {lsp-name [path path-name]} [fc fc-name] [max-fail no-response-
count] [probe-count probes-per-hop] [size octets] [min-ttl min-label-ttl] [max-ttl max-label-
ttl] [src-ip-address ip-address] [timeout timeout] [interval interval]
                - mac-ping service service-id destination dst ieee-address  [source  src-ieee-
address] [fc fc-name] [size octets] [ttl vc-label-ttl] [send-count send-count] [send-control]
 [return-control] [interval interval] [timeout timeout]
                - mac-trace service  service-id destination ieee-address  [source  src-ieee-
address] [fc fc-name] [size octets]] [min-ttl min-label-ttl] [max-ttl max-label-ttl] [send-
count send-count] [send-control] [return-control] [interval interval] [timeout
timeout]
                - sdp-ping orig-sdp-id [resp-sdp resp-sdp-id] [fc fc-name]] [size octets]
 [send-count send-count][timeout seconds] [interval seconds]
                - vccv-ping sdp-id:vc-id [src-ip-address ip-addr dst-ip-address ip-addr pw-id
 pw-id][reply-mode {ip-routed | control-channel}][fc fc-name [size octets] [send-count send-
count][timeout timeout] [interval interval][ttl vc-label-ttl]
                - vccv-trace sdp-id:vc-id [size octets][min-ttl vc-label-ttl] [max-ttl vc-
label-ttl][max-fail no-response-count][probe-count probe-count][reply-mode ip-routed|control-
channel][timeout timeout-value][interval interval-value][fc fc-name ][detail]
                - vprn-ping service-id service svc-name [src-ip-address ip-addr dst-ip-address
 ip-addr [fc fc-name [profile in | out]] [size size] [ttl vc-label-ttl] [count send-count]
 [return-control] [timeout timeout] [interval seconds]
                - vprn-trace service-id source src-ip destination dst-ip  [fc fc-name [profile
 in | out]] [size size] [min-ttl vc-label-ttl] [max-ttl vc-label-ttl] [count send-count]
 [return-control] [timeout timeout] [interval interval]
```

3.8.1.3.1 Show commands

```
show
    - eth-cfm
        - association [ma-index] [detail]
        - cfm-stack-table [port [port-id [vlan qtag[.qtag]]| sdp sdp-id[:vc-id]][level 0..7]
 [direction up | down]
        - domain [md-index] [association ma-index | all-associations] [detail]
        - mep mep-id domain md-index association ma-index [loopback] [linktrace] [eth-
bandwidth-notification]
        - mep mep-id domain md-index association ma-index [remote-mepid mep-id | all-remote-
mepids]
        - mep mep-id domain md-index association ma-index eth-test-results [remote-peer mac-
address]
        - mep mep-id domain md-index association ma-index one-way-delay-test [remote-peer mac-
address]
```


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```
        - mep mep-id domain md-index association ma-index two-way-delay-test [remote-peer mac-
address]
        - mep mep-id domain md-index association ma-index two-way-slm-test [remote-peer mac-
address]
        - mip
        - statistics
        - system-config
    - router
        - twamp-light
    - saa [test-name [owner test-owner]]
    - service service-id
        - twamp-light
    - test-oam
        - ldp-treetrace [prefix ip-prefix/mask] [detail]
        - twamp
            - twamp-light
                - reflectors
            - server all
            - server prefix ip-prefix/mask
            - server
show
    - oam-pm
        - bin-group [bin-group-number]
        - bin-group-using [bin-group bin-group-number]
        - session session-name [{all | base | bin-group | event-mon | meas-interval}]
        - sessions [test-family {ethernet | ip}] [event-mon]
        - statistics
            - session session-name
                - dmm
                    - meas-interval raw [{all | bins | summary}]
                    - meas-interval {5-mins | 15-mins | 1-hour | 1-day} interval-
number interval-number [{all | bins | summary}]
                - slm
                    - meas-interval raw
                    - meas-interval {5-mins | 15-mins | 1-hour | 1-day} interval-
number interval-number
                - twamp-light
                    - meas-interval raw delay [{all | bins | summary}]
                    - meas-interval raw [loss]
                    - meas-interval {5-mins | 15-mins | 1-hour | 1-day} interval-
number interval-number delay [{all | bins | summary}]
                    - meas-interval {5-mins | 15-mins | 1-hour | 1-day} interval-
number interval-number loss
```

3.8.1.3.2 Monitor commands

```
monitor
    - oam-pm
        - session session-name [{dmm | slm | twamp-light}]
```

3.8.1.3.3 Clear commands

```
clear
    - saa [test-name [owner test-owner]]
    - test-oam
        - twamp
            - server
```


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3.8.2 Command descriptions

3.8.2.1 Operational commands

shutdown

Syntax

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

Context

config>saa>test

Platforms

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

Description

This command shuts down a test. To modify an existing test it must first be shut down. When a test is created it is in shutdown mode until a **no shutdown** command is executed.

A **shutdown** can only be performed if a test is not executing at the time the command is entered.

The **no** form of this command sets the state of the test to operational.

shutdown

Syntax

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

Context

config>test-oam>ldp-treetrace

config>test-oam>twamp>server

config>test-oam>twamp>server>prefix

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command suspends the background process running the LDP ECMP OAM tree discovery and path probing features. The configuration is not deleted.

The **no** form of this command enables the background process.

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shutdown

Syntax

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

Context

config>oam-pm>bin-group

config>oam-pm>session>ethernet>dmm

config>oam-pm>session>ethernet>slm

config>oam-pm>session>ip>twamp-light

config>oam-pm>session>measurement-interval>event-mon

config>saa>test

config>test-oam>ldp-treetrace

config>test-oam>mpls-dm

config>test-oam>twamp>server

config>test-oam>twamp>server>prefix

Platforms

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

Description

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

The operational state of the entity is disabled as well as the operational state of any entities contained within. Many objects must be shut down before they may be deleted.

Entities are created in the administratively down (**shutdown**) state. When a **no shutdown** command is entered, the entity becomes administratively up and then tries to enter the operationally up state.

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

dns

Syntax

dns target-addr *dns-name* **name-server** *ip-address* [**source** *ip-address*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**record-type** {**ipv4-a-record** | **ipv6-aaaa-record**}]

Context

oam

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Platforms

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

Description

This command performs DNS name resolution. If **ipv4-a-record** is specified, DNS names are queried for A-records only.

Parameters

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **send-count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

ip-address

Specifies the IP or IPv6 address of the primary DNS server.

Values

ipv4-address - a.b.c.d

ipv6-address - x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x - [0..FFFF]H

d - [0..255]D

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 120

Default 5

interval *interval*

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This

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depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

record-type

Specifies a record type.

Values **ipv4-a-record** — A record specific mapping a hostname to an IPv4 address.

ipv6-aaaa-record — A record specific to the Internet class that stores a single IPv6 address.

ping

Syntax

ping [*ip-address* | *dns-name*] [**rapid** | **detail**] [**ttl** *time-to-live*] [**tos** *type-of-service*] [**size** *bytes*] [**pattern** *pattern*] [**source** *ip-address* | *dns-name*] [**interval** *seconds*] [{**next-hop** *ip-address*} | {**interface** *interface-name*} | **bypass-routing**] [**count** *requests*] [**do-not-fragment**] [**router** *router-instance* | **service-name** *service-name*] [**timeout** *timeout*]

Context

<GLOBAL>

Platforms

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

Description

This command verifies the reachability of a remote host.

Parameters

ip-address

Specifies the far-end IP address to which to send the **sve-ping** request message in dotted-decimal notation.

Note:
IPv6 is supported only for the "Management" instance of the router.

Values

ipv4-address:	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
	x:x:x:x:x:x:d.d.d.d

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x: [0 .. FFFF]H

d: [0 .. 255]D

dns-name

Specifies the DNS name of the far-end device to which to send the **sve-ping** request message, expressed as a character string.

rapid

Packets are generated as fast as possible instead of the default 1 per second.

detail

Specifies detailed information.

ttl *time-to-live*

Specifies the TTL value for the MPLS label, expressed as a decimal integer.

Values 1 to 128

tos *type-of-service*

Specifies the service type.

Values 0 to 255

size *bytes*

Specifies the request packet size in bytes, expressed as a decimal integer.

Values 0 to 16384

pattern *pattern*

Specifies that the date portion in a ping packet is filled with the pattern value specified. If not specified, position info is filled instead.

Values 0 to 65535

source *ip-address*

Specifies the IP address to be used.

Note:
IPv6 is supported only for the "Management" instance of the router.

Values

ipv4-address: a.b.c.d

ipv6-address: x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x: [0 .. FFFF]H

d: [0 .. 255]D

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router *router-instance*

Specifies the router name or service ID.

Values *router-name*: Base, management

Default Base

service-name *service-name*

Specifies the service name as an integer or string.

bypass-routing

Specifies whether to send the ping request to a host on a directly attached network bypassing the routing table.

interface *interface-name*

Specifies the name of an IP interface. The name must already exist in the **config**>**router**>**interface** context.

next-hop *ip-address*

Only displays static routes with the specified next hop IP address.

Note:
IPv6 is supported only for the "Management" instance of the router.

Values

ipv4-address: a.b.c.d (host bits must be 0)

ipv6-address: x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x: [0 to FFFF]H

d: [0 to 255]

interval *seconds*

Specifies the interval parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the interval is set to 1 second, and the timeout value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10000

count *requests*

Specifies the number of times to perform an OAM ping probe operation. Each OAM echo message request must either timeout or receive a reply before the next message request is sent.

Values 1 to 100000

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Default 5

do-not-fragment

Sets the DF (Do Not Fragment) bit in the ICMP ping packet.

fc-name

Specifies the forwarding class of the MPLS echo request encapsulation.

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

Default nc

timeout *seconds*

Overrides the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. A 'request timeout' message is displayed by the CLI for each message request sent that expires. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

traceroute

Syntax

traceroute [*ip-address* | *dns-name*] [**ttl** *ttl*] [**wait** *milli-seconds*] [**no-dns**] [**source** *ip-address*] [**tos** *type-of-service*] [**router** *router-instance* | **service- name** *service- name*]

Context

<GLOBAL>

Platforms

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

Description

This command determines the route to a destination address. DNS lookups of the responding hosts is enabled by default.

```
*A:ALA-1# traceroute 192.168.xx.xx4
traceroute to 192.168.xx.xx4, 30 hops max, 40 byte packets
 1  192.168.xx.xx4 0.000 ms  0.000 ms  0.000 ms
*A:ALA-1#
```


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Parameters

ip-address

Specifies the far-end IP address to which to send the traceroute request message in dotted decimal notation.

Note:
IPv6 is supported only for the "Management" instance of the router.

Values

ipv4-address:	a.b.c.d	
ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)	
	x:x:x:x:x:x:d.d.d.d	
	x:	[0 .. FFFF]H
	d:	[0 .. 255]D

dns-name

Specifies the DNS name of the far-end device to which to send the traceroute request message, expressed as a character string.

ttl *ttl*

Specifies the maximum Time-To-Live (TTL) value to include in the traceroute request, expressed as a decimal integer.

Values 1 to 255

wait *milliseconds*

Specifies the time in milliseconds to wait for a response to a probe, expressed as a decimal integer.

Values 10 to 60000

Default 5000

no-dns

When the **no-dns** keyword is specified, DNS lookups of the responding hosts are not performed. Only the IP addresses is printed.

Default DNS lookups are performed

source *ip-address*

Specifies the source IP address to use as the source of the probe packets in dotted-decimal notation. If the IP address is not one of the device's interfaces, an error is returned.

tos *type-of-service*

Specifies the type-of-service (TOS) bits in the IP header of the probe packets, expressed as a decimal integer.

Values 0 to 255

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router *router-name*

Specifies the alphanumeric character string up to 32 characters.

Values Base, Management

service-name *service-name*

Specifies the service name as an integer or string.

lsp-ping

Syntax

lsp-ping *lsp-name* [**path** *path-name*]

lsp-ping bgp-label prefix *ip-prefix/mask* [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

lsp-ping prefix *ip-prefix/mask* [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]] [**src-ip-address** *ip-address*]

lsp-ping {{*lsp-name* [**path** *path-name*]}|{**prefix** *ip-prefix/mask*}} [**src-ip-address** *ip-address*] [**size** *octets*] [**ttl** *label-ttl*] [**timeout** *timeout*] [**interval** *interval*] [**fc** *fc-name*] [**send-count** *send-count*] {**lsp-name** [**path** *path-name*]} [**fc** *fc-name*] [**size** *octets*][**ttl** *label-ttl*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]

lsp-ping static *lsp-name* [**assoc-channel ipv4**|**none**|**non-ip**] [**force**] [**dest-global-id** *global-id* **dest-node-id** *node-id*] [**path-type active** | **working** | **protect**]

Options common to all lsp-ping cases: [**detail**] [**fc** *fc-name*] [**interval** *interval*] [**send-count** *send-count*] [**size** *octets*] [**src-ip-address** *ip-address*] [**timeout** *timeout*] [**ttl** *label-ttl*]

Context

oam

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs in-band LSP connectivity tests.

The **lsp-ping** command performs an LSP ping using the protocol and data structures defined in the RFC 4379, Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures.

The LSP ping operation is modeled after the IP ping utility which uses ICMP echo request and reply packets to determine IP connectivity.

In an LSP ping, the originating device creates an MPLS echo request packet for the LSP and path to be tested. The MPLS echo request packet is sent through the data plane and awaits an MPLS echo reply packet from the device terminating the LSP. The status of the LSP is displayed when the MPLS echo reply packet is received.

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This command, when used with the **static** option, performs in-band on-demand LSP connectivity verification tests for static MPLS-TP LSPs. For other LSP types, the **static** option should be excluded and these are described elsewhere in this guide.

The **lsp-ping static** command performs an LSP ping using the protocol and data structures defined in the RFC 4379, Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures, as extended by RFC 6426, MPLS On-Demand Connectivity Verification and Route Tracing.

In MPLS-TP, the echo request and echo reply messages are always sent in-band over the LSP, either in a G-ACh channel or encapsulated as an IP packet below the LSP label.

The timestamp format to be sent, and to be expected when received in a PDU, is as configured by the **config**>**test-oam**>**mpls-time-stamp-format** command. If RFC 4379 is selected, the timestamp is in seconds and microseconds since 1900, otherwise it is in seconds and microseconds since 1970.

Parameters

lsp-name

Specifies the name that identifies an LSP to ping. The LSP name can be up to 32 characters.

dest-global-id *global-id*

Specifies the MPLS-TP global ID for the far end node of the LSP under test. If this is not entered, the dest-global-id is taken from the LSP context.

dest-node-id *node-id*

Specifies the MPLS-TP global ID for the far end node of the LSP under test. If this is not entered, the dest-global-id is taken from the LSP context.

control-channel {none | non-ip}

Specifies the encapsulation format to use for the LSP Ping echo request and echo reply packet.

Values **none** — IP encapsulation in an MPLS labeled packet

non-ip — MPLS-TP encapsulation without UDP/IP headers, in an MPLS-TP G-ACh on the LSP using channel type 0x025.

Default non-ip

force

Allows LSP Ping to test a path that is operationally down, including cases where MPLS-TP BFD CC/V is enabled and has taken a path down. This parameter is only allowed in the OAM context; it is not allowed for a test configured as a part of an SAA.

Default disabled

path-type {active | working | protect}

The LSP path to test.

Values **active** — Specifies the currently active path. If MPLS-TP linear protection is configured on the LSP, this is the path that is selected by MPLS-TP PSC protocol for sending user plane traffic. If MPLS-TP linear protection is not configured, this is the working path.

working — Specifies the working path of the MPLS-TP LSP.

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protect — Specifies the protect path of the MPLS-TP LSP.

Default active

path *path-name*

Specifies the LSP path name along which to send the LSP ping request.

Values Any path name associated with the LSP.

Default The active LSP path.

bgp-label-prefix *ip-prefix/mask*

Specifies the address prefix and subnet mask of the target BGP IPv4 label route.

src-ip-address ip-addr

Specifies the source IP address. This option is used when an OAM packet must be generated from a different address than the node's system interface address. An example is when the OAM packet is sent over an LDP LSP and the LDP LSR-ID of the corresponding LDP session to the next-hop is set to an address other than the system interface address.

Values ipv4-address: a.b.c.d

fc *fc-name*

Specifies the **fc** parameter is used to indicate the forwarding class of the MPLS echo request packet.

When an MPLS echo request packet is generated in CPM and is forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the specified **fc** parameter value. The marking of the packet's EXP is dictated by the LSP-EXP mappings on the outgoing interface.

When the MPLS echo request packet is received on the responding node, the **fc** parameter value is dictated by the LSP-EXP mappings of the incoming interface.

When an MPLS echo reply packet is generated in CPM and is forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the **fc** parameter value determined by the classification of the echo request packet, which is being replied to, at the incoming interface. The marking of the packet's EXP is dictated by the LSP-EXP mappings on the outgoing interface. The TOS byte is not modified. The following table summarizes this behavior:

Table 22: Request packet and behavior

Node	Packet and description of behavior
cpm (sender node)	echo request packet: • packet{tos=1, fc1 • fc1 is as entered by user in OAM command or default values • tos1 as per mapping of fc1 to IP precedence in network egress QoS policy of outgoing interface

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Node	Packet and description of behavior
outgoing interface (sender node)	echo request packet: • pkt queued as fc1 • ToS field=tos1 not remarked • EXP=exp1, as per mapping of fc1 to EXP in network egress QoS policy of outgoing interface
Incoming interface (responder node)	echo request packet: • packet{tos1, exp1} • exp1 mapped to fc2 as per classification in network QoS policy of incoming interface
cpm (responder node)	echo reply packet: • packet{tos=1, fc2
outgoing interface (responder node)	echo reply packet: • pkt queued as fc2 • ToS filed= tos1 not remarked (reply in-band or out-of-band) • EXP=exp2, if reply is in-band, remarked as per mapping of fc2 to EXP in network egress QoS policy of outgoing interface
Incoming interface (sender node)	echo reply packet: • packet{tos1, exp2} • exp2 mapped to fc1 as per classification in network QoS policy of incoming interface

The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating router.be

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

Default be

src-ip-address *ip-addr*

Specifies the source IP address. This parameter is used when an OAM packet must be generated from a different address than the node's system interface address. For example, when the OAM packet is sent over an LDP LSP and the LDP LSR-ID of the corresponding LDP session to the next-hop is set to an address other than the system interface address.

Values ipv4-address: a.b.c.d

size *octets*

Specifies the MPLS echo request packet size in octets, expressed as a decimal integer. The request payload is padded with zeros to the specified size.

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Values 1 to 9198

Default 1

ttl ***label-ttl***

Specifies the TTL value for the MPLS label, expressed as a decimal integer.

Values 1 to 255

Default 255

send-count ***send-count***

Specifies the number of messages to send, expressed as a decimal integer. The **send-count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

time-out ***interval***

Specifies the time-out parameter in seconds, expressed as a decimal integer. This value is used to override the default timeout value and is the amount of time that the router waits for a message reply after sending the last probe for a particular test. Upon the expiration of timeout the test is marked complete and no more packets are processed for any of those request probes.

Values 1 to 10

Default 5

interval ***interval***

Specifies the interval parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

path-destination ***ip-address***

Specifies the IP address of the path destination from the range 127/8.

interface ***interface-name***

Specifies the name of an IP interface. The name must already exist in the **config**>**router**>**interface** context.

next-hop ***ip-address***

Only displays static routes with the specified next hop IP address.

Values ipv4-address: a.b.c.d (host bits must be 0)

prefix ***ip-prefix/mask***

Specifies the address prefix and subnet mask of the target BGP IPv4 label route.

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static *lsp-name*

Specifies an LSP ping route using the RFC 6426, *MPLS On-Demand Connectivity Verification and Route Tracing*, Target FEC Stack code point Static LSP.

assoc-channel ipv4 | none | non-ip

Specifies the launched echo request's usage of the Associated Channel (ACH) mechanism, when testing an MPLS-TP LSP.

Values **ipv4** — Use the

none — Use the Associated Channel mechanism described in RFC 6426, Section 3.3.

non-ip — Do not use an Associated Channel, as described in RFC 6426, Section 3.1.

dest-global-id *global-id*

Specifies the source MPLS-TP global identifier of the replying node. The value is copied from the reply's RFC 6426 Source Identifier TLV.

Values 0 to 4294967295

Default 0

dest-node-id *node-id*

Specifies the target MPLS-TP Node Identifier.

Values a.b.c.d | 1 to 4294967295>

Default 0

path-type active | working | protect

Specifies the type of an MPLS TP path.

Values **active** - test the currently-active path of the MPLS-TP LSP

working - test the primary path of the MPLS-TP LSP

protect - test the secondary path of the MPLS-TP LSP

Output

Sample output

```
A:DUTA# oam lsp-ping prefix 10.4.4.4/32 detail
LSP-PING 10.4.4.4/32: 80 bytes MPLS payload
Seq=1, send from intf dut1_to_dut3, reply from 10.4.4.4
       udp-data-len=32 ttl=255 rtt=5.23ms rc=3 (EgressRtr)

---- LSP 4.4.4.4/32 PING Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min = 5.23ms, avg = 5.23ms, max = 5.23ms, stddev = 0.000ms

===============================================================================
LDP LSR ID: 1.1.1.1
===============================================================================
Legend: U - Label In Use,  N - Label Not In Use, W - Label Withdrawn
```


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```
        WP - Label Withdraw Pending, BU - Alternate For Fast Re-Route
===============================================================================
LDP Prefix Bindings
===============================================================================
Prefix              IngLbl       EgrLbl     EgrIntf/         EgrNextHop
   Peer                                     LspId
-------------------------------------------------------------------------------
10.4.4.4/32          131069N      131067     1/1/1            1.3.1.2
   3.3.3.3
10.4.4.4/32          131069U      131064       --               --
   6.6.6.6
-------------------------------------------------------------------------------
No. of Prefix Bindings: 2
===============================================================================
A:DUTA#
```

lsp-trace

Syntax

lsp-trace *lsp-name* [**path** *path-name*]

lsp-trace bgp-label prefix *ip-prefix/mask* [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

lsp-trace prefix *ip-prefix/mask* [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

lsp-trace static *lsp-name* [**assoc-channel ipv4**|**none**|**non-ip**] [**path-type active** | **working** | **protect**]

Options common to all **lsp-trace** cases: [**detail**] [**downstream-map-tlv** {**dsmap** | **ddmap** | **none**}] [**fc** *fc-name*] [**interval** *interval*] [**max-fail** *no-response-count*] [**max-ttl** *max-label-ttl*] [**min-ttl** *min-label-ttl*] [**probe-count** *probes-per-hop*] [**size** *octets*] [**src-ip-address** *ip-address*] [**timeout** *timeout*]

Context

oam

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command, when used with the **static** option, performs in-band on-demand LSP traceroute tests for static MPLS-TP LSPs. For other LSP types, the **static** option should be excluded and these are described elsewhere in this guide.

The **lsp-trace static** command performs an LSP trace using the protocol and data structures defined in the RFC 4379, Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures, as extended by RFC 6426, MPLS On-Demand Connectivity Verification and Route Tracing.

The LSP trace operation is modeled after the IP traceroute utility which uses ICMP echo request and reply packets with increasing TTL values to determine the hop-by-hop route to a destination IP.

In an LSP trace, the originating device creates an MPLS echo request packet for the LSP to be tested with increasing values of the TTL in the outermost label. The MPLS echo request packet is sent through

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the data plane and awaits a TTL exceeded response or the MPLS echo reply packet from the device terminating the LSP. The devices that reply to the MPLS echo request packets with the TTL exceeded and the MPLS echo reply are displayed.

The downstream mapping TLV is used in **lsp-trace** to provide a mechanism for the sender and responder nodes to exchange and validate interface and label stack information for each downstream hop in the path of the LDP FEC or an RSVP LSP, or a BGP IPv4 label route.

Two downstream mapping TLVs are supported. The original Downstream Mapping (DSMAP) TLV defined in RFC 4379 and the new Downstream Detailed Mapping (DDMAP) TLV defined in RFC 6424. More details are provided in the following DDMAP TLV sub-section.

In addition, when the responder node has multiple equal cost next-hops for an LDP FEC or a BGP label IPv4 prefix, it replies in the Downstream Mapping TLV with the downstream information for each outgoing interface which is part of the ECMP next-hop set for the prefix. The downstream mapping TLV can further be used to exercise a specific path of the ECMP set using the path-destination option.

In MPLS-TP, the echo request and echo reply messages are always sent in-band over the LSP, either in a G-ACh channel or encapsulated as an IP packet below the LSP label.

Some restrictions apply when using this feature on 7210 nodes. LSP diagnostics: LSP ping and trace

Parameters

lsp-name

Specifies the name that identifies an LSP to ping. The LSP name can be up to 32 characters.

path *path-name*

Specifies the LSP path name along which to send the LSP trace request.

Values Any path name associated with the LSP.

Default The active LSP path.

control-channel {none | non-ip}

Specifies the encapsulation format to use for the MPLS echo request and echo reply packet.

Values **none** — IP encapsulation in an MPLS labeled packet non-ip — MPLS-TP encapsulation without UDP/IP headers, in an MPLS-TP G-ACh on the LSP using channel type 0x025.

Default **non-ip**

size *octets*

Specifies the size in octets, expressed as a decimal integer, of the MPLS echo request packet, including the IP header but not the label stack. The request payload is padded with zeros to the specified size. Note that an OAM command is not failed if the user entered a size lower than the minimum required to build the packet for the echo request message. The payload is automatically padded to meet the minimum size.

Values [104 to 9198]

Default 1

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src-ip-address ip-addr

Specifies the source IP address. This option is used when an OAM packet must be generated from a different address than the node's system interface address. An example is when the OAM packet is sent over an LDP LSP and the LDP LSR-ID of the corresponding LDP session to the next-hop is set to an address other than the system interface address.

Values ipv4-address: a.b.c.d

min-ttl *min-label-ttl*

Specifies the minimum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer.

Values 1 to 255

Default 1

max-ttl *max-label-ttl*

Specifies the maximum TTL value in the MPLS label for the LDP treetrace test, expressed as a decimal integer.

Values 1 to 255

Default 30

max-fail *no-response-count*

Specifies the maximum number of consecutive MPLS echo requests, expressed as a decimal integer that do not receive a reply before the trace operation fails for a specific TTL.

Values 1 to 255

Default 5

probes-per-hop

Specifies the number of messages to send, expressed as a decimal integer. The **send-count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 10

Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. A 'request timeout' message is displayed by the CLI for each message request sent that expires. Any response received after the request times out is silently discarded.

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Values 1 to 60

Default 3

interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

fc ***fc-name***

Specifies the fc parameter used to indicate the forwarding class of the MPLS echo request packet.

When an MPLS echo request packet is generated in CPM and is forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the specified fc parameter value. The marking of the packet's EXP is dictated by the LSP-EXP mappings on the outgoing interface.

When the MPLS echo request packet is received on the responding node, The fc parameter value is dictated by the LSP-EXP mappings of the incoming interface.

When an MPLS echo reply packet is generated in CPM and is forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the fc parameter value determined by the classification of the echo request packet, which is being replied to, at the incoming interface. The marking of the packet's EXP is dictated by the LSP-EXP mappings on the outgoing interface. The TOS byte is not modified. The following table summarizes this behavior:

Table 23: Request packet and behavior

Node	Packet and description
cpm (sender node)	echo request packet: • packet{tos=1, fc1 • fc1 is as entered by user in OAM command or default values • tos1 as per mapping of fc1 to IP precedence in network egress QoS policy of outgoing interface
outgoing interface (sender node)	echo request packet: • pkt queued as fc1 • ToS field=tos1 not remarked

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Node	Packet and description
	• EXP=exp1, as per mapping of fc1 to EXP in network egress QoS policy of outgoing interface
Incoming interface (responder node)	echo request packet: • packet {tos1, exp1} • exp1 mapped to fc2 as per classification in network QoS policy of incoming interface
cpm (responder node)	echo reply packet: • packet {tos=1, fc2
outgoing interface (responder node)	echo reply packet: • pkt queued as fc2 • ToS filed= tos1 not remarked (reply in-band or out-of-band) • EXP=exp2, if reply is in-band, remarked as per mapping of fc2 to EXP in network egress QoS policy of outgoing interface
Incoming interface (sender node)	echo reply packet: • packet {tos1, exp2} • exp2 mapped to fc1 as per classification in network QoS policy of incoming interface

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

Default be

path-destination *ip-address*

Specifies the IP address of the path destination from the range 127/8.

interface *interface-name*

Specifies the name of an IP interface. The name must already exist in the config>router>interface context.

downstream-map-tlv {dsmap | ddmap | none}

Specifies which format of the downstream mapping TLV to use in the LSP trace packet. The DSMAP TLV is the original format in RFC 4379. The DDMAP is the new enhanced format specified in RFC 6424. The user can also choose not to include the downstream mapping TLV by entering the value none. When lsp-trace is used on a MPLS-TP LSP (static option), it can only be executed if the control-channel is set to none. In addition, the DSMAP/DDMAP TLV is only included in the echo request message if the egress interface is either a numbered IP interface, or an unnumbered IP interface. The TLV is not included if the egress interface is of type **unnumbered-mpls-tp**.

Default Inherited from global configuration of downstream mapping TLV in option mpls-echo-request-downstream-map {dsmap | ddmap}.

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Output

Sample output: lsp-trace

```
*A:Dut-A# oam lsp-trace prefix 10.20.1.6/32 downstream-map-tlv ddmap path-
destination 127.0.0.1 detail lsp-trace to 10.20.1.6/
32: 0 hops min, 0 hops max, 152 byte packets
1  10.20.1.2  rtt=3.44ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=127.0.0.1 ifaddr=0 iftype=ipv4Unnumbered MRU=1500
           label[1]=131070 protocol=3(LDP)
2  10.20.1.4  rtt=4.65ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=127.0.0.1 ifaddr=0 iftype=ipv4Unnumbered MRU=1500
           label[1]=131071 protocol=3(LDP)
3  10.20.1.6  rtt=7.63ms rc=3(EgressRtr) rsc=1
*A:Dut-A#


*A:Dut-C# oam lsp-trace "p_1" detail
lsp-trace to p_1: 0 hops min, 0 hops max, 116 byte packets
1  10.20.1.2  rtt=3.46ms rc=8(DSRtrMatchLabel)
     DS 1: ipaddr 10.20.1.4 ifaddr 3 iftype 'ipv4Unnumbered' MRU=1500
label=131071 proto=4(RSVP-TE)
2  10.20.1.4  rtt=3.76ms rc=8(DSRtrMatchLabel)
     DS 1: ipaddr 10.20.1.6 ifaddr 3 iftype 'ipv4Unnumbered' MRU=1500
label=131071 proto=4(RSVP-TE)
3  10.20.1.6  rtt=5.68ms rc=3(EgressRtr)
*A:Dut-C#
```

lsp-trace over a numbered IP interface

```
A:DUTA#
A:DUTA# oam lsp-trace prefix 10.5.5.5/32 detail
lsp-trace to 10.5.5.5/32: 0 hops min, 0 hops max, 104 byte packets
1  6.6.6.6  rtt=2.45ms rc=8(DSRtrMatchLabel)
     DS 1: ipaddr=10.6.5.1 ifaddr=10.6.5.1 iftype=ipv4Numbered MRU=1564
label=131071 proto=3(LDP)
2  5.5.5.5  rtt=4.77ms rc=3(EgressRtr)
A:DUTA#
```

lsp-trace over an unnumbered IP interface

```
*A:Dut-A# oam lsp-trace prefix 10.20.1.6/32 downstream-map-tlv ddmap path-
destination 127.0.0.1 detail lsp-trace to 10.20.1.6/
32: 0 hops min, 0 hops max, 152 byte packets
1  10.20.1.2  rtt=3.44ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=127.0.0.1 ifaddr=0 iftype=ipv4Unnumbered MRU=1500
           label[1]=131070 protocol=3(LDP)
2  10.20.1.4  rtt=4.65ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=127.0.0.1 ifaddr=0 iftype=ipv4Unnumbered MRU=1500
           label[1]=131071 protocol=3(LDP)
3  10.20.1.6  rtt=7.63ms rc=3(EgressRtr) rsc=1
*A:Dut-A#

*A:Dut-A# oam ldp-treetrace prefix 10.20.1.6/32

ldp-treetrace for Prefix 10.20.1.6/32:

         127.0.0.1, ttl =   3 dst =      127.1.0.255 rc = EgressRtr status = Done
    Hops:         127.0.0.1         127.0.0.1

         127.0.0.1, ttl =   3 dst =      127.2.0.255 rc = EgressRtr status = Done
```


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```
    Hops:         127.0.0.1         127.0.0.1

ldp-treetrace discovery state: Done
ldp-treetrace discovery status: ' OK '
Total number of discovered paths: 2
Total number of failed traces: 0
```

p2mp-lsp-ping

Syntax

p2mp-lsp-ping {{*lsp-name* **p2mp-instance** *instance-name* **s2l-dest-addr** *ip-address***…**[*ip-address...*up to 5] [**ttl** *label-ttl*]} | {**ldp** *p2mp-id* [**sender-addr** *ip-address*] [**leaf-addr** *ip-address***…**[*ip-address…*up to 5]}} [**fc** *fc-name*] [**size** *octets*] [**timeout** *timeout*] [**interval** *interval*] [**detail**]

Context

oam

Platforms

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

Description

This command performs an in-band connectivity test for an RSVP P2MP LSP.

The echo request message is sent on the active P2MP instance and is replicated in the datapath over all branches of the P2MP LSP instance. By default, all egress LER nodes that are leaves of the P2MP LSP instance reply to the echo request message.

The user can reduce the scope of the echo reply messages by explicitly entering a list of addresses for the egress LER nodes that are required to reply. A maximum of 5 addresses can be specified in a single run of the **p2mp-lsp-ping** command. An LER node parses the list of egress LER addresses, and if its address is included, it replies with an echo reply message.

The display is delayed until all responses are received or the timer configured in the **timeout** parameter expires. Entering other CLI commands while waiting for the display is not allowed. Use **control-C** (**^C**) to stop the ping operation.

Parameters

fc *fc-name*

Specifies the forwarding class of the MPLS echo request packet.

When an MPLS echo request packet is generated in CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the specified **fc** parameter value. The LSP-EXP mappings on the outgoing interface dictate the marking of the packet EXP bits.

When the MPLS echo request packet is received on the responding node, the LSP-EXP mappings of the incoming interface determine the **fc** parameter value.

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When an MPLS echo reply packet is generated in CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the **fc** parameter value determined by the classification of the echo request packet, which is being replied to, at the incoming interface. The LSP-EXP mappings on the outgoing interface dictate the marking of the packet EXP bits.

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

Default be

p2mp-instance ***instance-name***

Configures the name of the P2MP LSP instance to send the echo request, up to 32 characters.

p2mp-lsp-ping ***lsp-name***

Specifies the name for the P2MP LSP, up to 32 characters, to ping.

s2l-dest-addr ***ip-address***

Specifies the egress LER system address of the S2L sub-LSP path that is being traced.

Values ipv4-address: a.b.c.d

size ***octets***

Specifies the size in octets, expressed as a decimal integer, of the MPLS echo request packet, including the IP header but not the label stack. The request payload is padded with zeros to the specified size. The OAM command does not fail if the size entered is lower than the minimum number of octets required to build the packet for the echo request message. The payload is automatically padded to meet the minimum size.

Values 1 to 9198

Default 1

ttl ***label-ttl***

Specifies the TTL value for the MPLS label, expressed as a decimal integer.

Values 1 to 255

Default 255

ldp ***p2mp-id***

Specifies the identifier of the LDP P2MP LSP to ping, expressed as a 32-bit integer.

Values 1 to 4294967295

sender-addr ***ip-address***

Optional parameter to specify root-node address. If omitted, the system IP address is used.

leaf-addr ***ip-address…*****[*****ip-address…*****up to 5]**

Specifies the list of egress LER system addresses that are required to reply to an LSP ping echo request message.

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Values ipv4-address: a.b.c.d

timeout *timeout*

Specifies the timeout parameter, in seconds, expressed as a decimal integer. This value is used to override the default timeout value and is the length of time that the router waits for an echo reply message from all leaves of the P2MP LSP after sending the message request message. When message timeout expires, the requesting router assumes that the missing replies are not received. Any echo reply message received after the request times out is silently discarded.

Values 1 to 60

Default 3

detail

If the **detail** parameter is omitted, the command output provides a high-level summary of error and success codes received. If the **detail** parameter is specified, the command output displays a line for each replying node, similar to the output of the LSP ping for a P2P LSP.

Output

The following sample output is an example of P2MP LSP ping information.

Sample output

```
*A:Dut-C# oam lsp-ping A2F_3

LSP-PING A2F_3: 92 bytes MPLS payload
Total S2L configured/up/responded = 400/390/388, round-trip min/avg/max = <10/10/
11 ms
Responses based on return code:
EgressRtr(3) = 387
NoFecMapping(4) = 1

Note: Missing responses on UP S2Ls implies "request timeout"

*A:Dut-A#

*A:Dut-C# oam lsp-ping A2F_3 detail

LSP-PING A2F_3: 92 bytes MPLS payload

=========================================
S2L Info
=========================================
From            Rtt         ReturnCode
-----------------------------------------
10.20.1.2       <10ms       EgressRtr
10.20.1.3       10ms        EgressRtr
10.20.1.5       11ms        EgressRtr
10.20.1.6       <10ms       EgressRtr
10.20.1.7       10ms        NoFecMapping
   :
   :
=========================================

Total S2L configured/up/responded = 400/390/388, round-trip min/avg/max
= <10/10/11 ms
```


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```
Responses based on return code:
EgressRtr(3) = 387
NoFecMapping(4) = 1

*A:Dut-A#

*A:Dut-C# oam lsp-ping A2F_3 > p2mp-instance "1" s2l-dest-
address 10.20.1.5 10.20.2.6 10.20.3.7

LSP-PING A2F_3: 132 bytes MPLS payload
P2MP Instance 1, S2L Egress 10.20.1.5 S2L Egress 10.20.2.6 S2L Egress 10.20.3.7

Total S2L configured/up/responded = 400/390/4, round-trip min/avg/max = <10/10/11 ms

Responses based on return code:
EgressRtr(3) = 3
NoFecMapping(4) = 1

Note: Missing responses on UP S2Ls implies "request timeout"

*A:Dut-A#

*A:Dut-C# oam lsp-ping A2F_3 > p2mp-instance "1" s2l-dest-
address 10.20.1.5 10.20.2.6 10.20.3.7 detail

LSP-PING A2F_3: 132 bytes MPLS payload
P2MP Instance 1, S2L Egress 10.20.1.5 S2L Egress 10.20.2.6 S2L Egress 10.20.3.7

===============================================
S2L Info
===============================================
From            Rtt         ReturnCode
-----------------------------------------------
10.20.1.2       <10ms       EgressRtr
10.20.1.3       10ms        EgressRtr
10.20.1.4       Timeout     N/A
10.20.1.5       11ms        NoFecMapping
10.20.1.6       <10ms       EgressRtr
===============================================

Total S2L configured/up/responded = 400/390/4, round-trip min/avg/max
= <10/10/11 ms

Responses based on return code:
EgressRtr(3) = 3
NoFecMapping (4) = 1

*A:Dut-A#
```

p2mp-lsp-trace

Syntax

p2mp-lsp-trace {*lsp-name* [**p2mp-instance** *instance-name*] [**s2l-dest-address** *ip-address*…[*ip-address*…*up-to-5*]]} | {**ldp** *p2mp-id*}} [**fc** *fc-name*] [**size** *octets*] [**max-fail** *no-response-count*] [**probe-count** *probes-per-hop*] [**min-ttl** *min-label-ttl*] [**max-ttl** *max-label-ttl*] [**timeout** *timeout*] [**interval** *interval*] [**detail**]

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Context

oam

Platforms

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

Description

This command discovers and displays the hop-by-hop path for a source-to-leaf (S2L) sub-LSP of an RSVP P2MP LSP.

The LSP trace capability allows the user to trace the path of a single S2L path of a P2MP LSP. Its operation is similar to that of the p2mp-lsp-ping, but the sender of the echo reply request message includes the downstream mapping TLV to request the downstream branch information from a branch LSR or bud LSR. The branch LSR or bud LSR also includes the downstream mapping TLV to report the information about the downstream branches of the P2MP LSP. An egress LER must not include this TLV in the echo response message.

The **probe-count** parameter operates in the same way as in LSP Trace on a P2P LSP. It represents the maximum number of probes sent per TTL value before giving up on receiving the echo reply message. If a response is received from the traced node before reaching maximum number of probes, no more probes are sent for the same TTL. The sender of the echo request increments the TTL and uses the information it received in the downstream mapping TLV to start sending probes to the node downstream of the last node which replied. This continues until the egress LER for the traced S2L path replied.

Similar to the **p2mp-lsp-ping** command, an LSP trace probe results in all egress LER nodes eventually receiving the echo request message, but only the traced egress LER node replies to the last probe.

Any branch LSR node or bud LSR node in the P2MP LSP tree may receive a copy of the echo request message with the TTL in the outer label expiring at this node. However, only a branch LSR or bud LSR that has a downstream branch over which the traced egress LER is reachable responds.

When a branch LSR or bud LSR responds, it sets the global return code in the echo response message to RC=14, "See DDMAP TLV for Return Code and Return Sub-Code" and the return code in the DDMAP TLV corresponding to the outgoing interface of the branch used by the traced S2L path to RC=8, "Label switched at stack-depth <RSC>".

Parameters

fc *fc-name*

Specifies the forwarding class of the MPLS echo request packet.

When an MPLS echo request packet is generated in CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the specified **fc** parameter value. The LSP-EXP mappings on the outgoing interface dictate the marking of the packet EXP bits.

When the MPLS echo request packet is received on the responding node, the LSP-EXP mappings of the incoming interface dictate the marking of the packet EXP bits.

When an MPLS echo reply packet is generated in CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the **fc** parameter value determined by the classification of the echo request packet, which is being replied to, at the incoming interface. The LSP-EXP mappings on the outgoing interface dictate the marking of the packet EXP bits.

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

Default be

interval ***interval***

Specifies the minimum amount of time, in seconds, that must expire before the next echo request message is sent. The parameter overrides the default echo request message send interval.

If the interval is set to 1 second, and the timeout value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of an echo reply message corresponding to the outstanding message request.

Values 1 to 10

Default 1

ldp ***p2mp-id***

Specifies the identifier for a LDP P2MP LSP to ping, expressed as a 32-bit integer.

Values 1 to 4294967295

p2mp-lsp-trace ***lsp-name***

Specifies the name of an P2MP LSP to ping, up to 32 characters.

max-fail ***no-response-count***

Specifies the maximum number of consecutive MPLS echo requests, expressed as a decimal integer, that do not receive a reply before the trace operation fails for a specific TTL.

Values 1 to 255

Default 5

max-ttl ***max-label-ttl***

Specifies the maximum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer.

Values 1 to 255

Default 30

min-ttl ***min-label-ttl***

Specifies the minimum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer.

Values 1 to 255

Default 1

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p2mp-instance *instance-name*

Specifies the name, up to 32 characters, of the specific instance of the P2MP LSP to send the echo request.

probe-count *probes-per-hop*

Specifies the number of LSP trace echo request messages to send per TTL value.

Values 1 to 10

Default 1

s2l-dest-addr *ip-addres*

Specifies the egress LER system address of the S2L sub-LSP path that is being traced.

Values ipv4-address: a.b.c.d

size *octets*

Specifies the size in octets, expressed as a decimal integer, of the MPLS echo request packet, including the IP header but not the label stack. The request payload is padded with zeros to the specified size. The OAM command is not failed if the user enters a size lower than the minimum required to build the packet for the echo request message. The payload is automatically padded to meet the minimum size.

Values 1 to 9198

Default 1

timeout *timeout*

Specifies the length of time, in seconds, expressed as a decimal integer, that the router waits for an echo reply message from all leaves of the P2MP LSP after sending the message request message. This value overrides the default **timeout** value. When the message timer expires, the requesting router assumes that the missing replies are not received. Any echo reply message received after the request times out is silently discarded.

Values 1 to 60

Default 3

detail

If the **detail** parameter is omitted, the command output provides a high-level summary of error and success codes received. If the **detail** parameter is specified, the command output displays a line for each replying node, similar to the output of the LSP ping for a P2P LSP.

Output

The following sample output is an example of P2MP LSP trace information.

Sample output

```
*A:Dut-C# oam p2mp-lsp-trace "p2mp_1" p2mp-instance "1" s2l-dest-
address 10.20.1.5 detail
P2MP LSP p2mp_1: 132 bytes MPLS payload
```


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```
P2MP Instance 1, S2L Egress 10.20.1.5

  1  10.20.1.1  rtt=3.78 ms rc=8(DSRtrMatchLabel)
     DS 1: ipaddr 10.20.1.2 iftype 'ipv4Unnumbered' ifaddr 2 MRU=1500 label=131060 p
roto=4(RSVP-TE) B/E flags:0/0
  2  10.20.1.2  rtt=3.54 ms rc=8(DSRtrMatchLabel)
     DS 1: ipaddr 10.20.1.4 iftype 'ipv4Unnumbered' ifaddr 3 MRU=1500 label=131061 p
roto=4(RSVP-TE) B/E flags:0/0
  3  10.20.1.5  rtt=5.30 ms rc=5(DSMappingMismatched)

*A:Dut-A#
```

3.8.2.2 Service diagnostics

sdp-mtu

Syntax

sdp-mtu *orig-sdp-id* **size-inc** *start-octets end-octets* [**step** *step-size*] [**timeout** *timeout*] [**interval** *interval*]

Context

oam

Platforms

Supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode

Description

This command performs MTU path tests on an SDP to determine the largest path-mtu supported on an SDP. The **size-inc** parameter can be used to easily determine the **path-mtu** of a specific SDP-ID. The forwarding class is assumed to be Best-Effort Out-of-Profile. The message reply is returned with IP encapsulation from the far-end IP/MPLS router. OAM request messages sent within an IP SDP must have the 'DF' IP header bit set to 1 to prevent message fragmentation. This command is not supported on the 7210 SAS-T in the access-uplink mode of operation.

To terminate an **sdp-mtu** in progress, use the CLI break sequence <Ctrl-C>.

Special Cases

SDP Path MTU Tests

SDP Path MTU tests can be performed using the **sdp-mtu size-inc** keyword to easily determine the **path-mtu** of a specific SDP-ID. The forwarding class is assumed to be Best-Effort Out-of-Profile. The message reply is returned with IP encapsulation from the far-end 7210 SAS.

With each OAM Echo Request sent using the **size-inc** parameter, a response line is displayed as message output. The path MTU test displays incrementing packet sizes, the number sent at each size until a reply is received and the response message.

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As the request message is sent, its size value is displayed followed by a period for each request sent of that size. Up to three requests are sent unless a valid response is received for one of the requests at that size. When a response is received, the next size message is sent. The response message indicates the result of the message request.

After the last reply has been received or response timeout, the maximum size message replied to indicates the largest size OAM Request message that received a valid reply.

Parameters

orig-sdp-id

Specifies the *sdp-id* to be used by **sdp-ping**, expressed as a decimal integer. The far-end address of the specified *sdp-id* is the expected *responder-id* within each reply received. The specified *sdp-id* defines the encapsulation of the SDP tunnel encapsulation used to reach the far end. This can be IP MPLS. If *orig-sdp-id* is invalid or administratively down or unavailable for some reason, the SDP echo request message is not sent and an appropriate error message is displayed (when the **interval** timer expires, sdp-ping attempts to send the next request if required).

Values 1 to 17407

size-inc *start-octetsend-octets*

Specifies that an incremental path MTU test is performed by sending a series of message requests with increasing MTU sizes. The *start-octets* and *end-octets* parameters are described as follows.

start-octets

Specifies the beginning size in octets of the first message sent for an incremental MTU test, expressed as a decimal integer.

Values 40 to 9198

end-octets

Specifies the ending size in octets of the last message sent for an incremental MTU test, expressed as a decimal integer. The specified value must be greater than *start-octets*.

Values 40 to 9198

step *step-size*

Specifies the number of octets to increment the message size request for each message sent for an incremental MTU test, expressed as a decimal integer. The next size message is not sent until a reply is received or three messages have timed out at the current size.

If the incremented size exceeds the *end-octets* value, no more messages are sent.

Values 1 to 512

Default 32

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received.

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A 'request timeout' message is displayed by the CLI for each message request sent that expires. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

interval *interval*

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

Output

The following is an SDP MTU path test sample output.

Sample SDP MTU path test sample output

```
*A:Dut-A# oam sdp-mtu 1201 size-inc 512 3072 step 256
Size    Sent    Response
---------------------------
512     .        Success
768     .        Success
1024    .        Success
1280    .        Success
1536    .        Success
1792    .        Success
2048    .        Success
2304    .        Success
2560    .        Success
2816    .        Success
3072    .        Success

Maximum Response Size: 3072
*A:Dut-A#
```

svc-ping

Syntax

svc-ping *ip-address* [**service** *service-id*] [**local-sdp**] [**remote-sdp**]

Context

<GLOBAL>

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Platforms

Supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode

Description

This command tests a service ID for correct and consistent provisioning between two service end points. This command is not supported on the 7210 SAS-T in the access-uplink mode of operation.

The **svc-ping** command accepts a far-end IP address and a *service-id* for local and remote service testing. The following information can be determined from **svc-ping**:

1. Local and remote service existence
2. Local and remote service state
3. Local and remote service type correlation
4. Local and remote customer association
5. Local and remote service-to-SDP bindings and state
6. Local and remote ingress and egress service label association

Unlike **sdp-ping**, only a single message is sent per command; no count nor interval parameter is supported and round trip time is not calculated. A timeout value of 10 seconds is used before failing the request. The forwarding class is assumed to be Best-Effort Out-of-Profile

If no request is sent or a reply is not received, all remote information is shown as N/A.

To terminate a **svc-ping** in progress, use the CLI break sequence <Ctrl-C>.

Upon request timeout, message response, request termination, or request error the following local and remote information is displayed. Local and remote information is dependent upon service existence and reception of reply.

Table 24: SVC ping information

Field	Description	Values
Request Result	The result of the **svc-ping** request message.	Sent - Request Timeout
		Sent - Request Terminated
		Sent - Reply Received
		Not Sent - Non-Existent Service-ID
		Not Sent - Non-Existent SDP for Service
		Not Sent - SDP For Service Down
		Not Sent - Non-existent Service Egress Label

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Field	Description	Values
Service-ID	The ID of the service being tested.	service-id
Local Service Type	The type of service being tested. If *service-id* does not exist locally, N/A is displayed.	Epipe
		TLS
		IES
		Mirror-Dest
		N/A
Local Service Admin State	The local administrative state of *service-id*. If the service does not exist locally, the administrative state is Non-Existent.	Admin-Up
		Admin-Down
		Non-Existent
Local Service Oper State	The local operational state of *service-id*. If the service does not exist locally, the state is N/A.	Oper-Up
		Oper-Down
		N/A
Remote Service Type	The remote type of service being tested. If *service-id* does not exist remotely, N/A is displayed.	Epipe
		TLS
		IES
		Mirror-Dest
		N/A
Remote Service Admin State	The remote administrative state of *service-id*. If the service does not exist remotely, the administrative state is Non-Existent.	Up
		Down
		Non-Existent
Local Service MTU	The local **service-mtu** for *service-id*. If the service does not exist, N/A is displayed.	service-mtu
		N/A
Remote Service MTU	The remote **service-mtu** for *service-id*. If the service does not exist remotely, N/A is displayed.	remote-service-mtu
		N/A
Local Customer ID	The local *customer-id* associated with *service-id*. If the service does not exist locally, N/A is displayed.	customer-id
		N/A
Remote Customer ID	The remote *customer-id* associated with *service-id*. If the service does not exist remotely, N/A is displayed.	customer-id
		N/A

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Field	Description	Values
Local Service IP Address	The local system IP address used to terminate remotely configured SDP-ID (as the **far-end** address). If an IP interface has not been configured to be the system IP address, N/A is displayed.	system-ip-address
		N/A
Local Service IP Interface Name	The name of the local system IP interface. If the local system IP interface has not been created, N/A is displayed.	system-interface-name
		N/A
Local Service IP Interface State	The state of the local system IP interface. If the local system IP interface has not been created, Non-Existent is displayed.	Up
		Down
		Non-Existent
Expected Far-end Address	The expected IP address for the remote system IP interface. This must be the **far-end** address entered for the **svc-ping** command.	orig-sdp-far-end-addr
		dest-ip-addr
		N/A
Actual Far-end Address	The returned remote IP address. If a response is not received, the displayed value is N/A. If the far-end service IP interface is down or non-existent, a message reply is not expected. **sdp-ping** should also fail.	resp-ip-addr
		N/A
Responders Expected Far-end Address	The expected source of the originator's *sdp-id* from the perspective of the remote router terminating the *sdp-id*. If the far-end cannot detect the expected source of the ingress *sdp-id* or the request is transmitted outside the *sdp-id*, N/A is displayed.	resp-rec-tunnel-far-end-address
		N/A
Originating SDP-ID	The *sdp-id* used to reach the **far-end** IP address if **sdp-path** is defined. The originating *sdp-id* must be bound to the *service-id* and terminate on the **far-end** IP address. If an appropriate originating *sdp-id* is not found, Non-Existent is displayed.	orig-sdp-id
		Non-Existent
Originating SDP-ID Path Used	Whether the Originating router used the originating *sdp-id* to send the **svc-ping** request. If a valid originating *sdp-id* is found, operational and has a valid egress service label, the originating router should use the *sdp-id* as the requesting path if **sdp-path** has been defined. If the originating router uses the originating *sdp-id* as the request path, Yes is displayed. If the originating router does not use the originating *sdp-id* as the request path, No is displayed. If the originating *sdp-id* is non-existent, N/A is displayed.	Yes
		No
		N/A
Originating SDP-ID Administrative State	The local administrative state of the originating *sdp-id*. If the *sdp-id* has been shutdown, Admin-Down is displayed. If the originating *sdp-id* is in the no shutdown state, Admin-	Admin-Up
		Admin-Up

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Field	Description	Values
	Up is displayed. If an originating *sdp-id* is not found, N/A is displayed.	N/A
Originating SDP-ID Operating State	The local operational state of the originating *sdp-id*. If an originating *sdp-id* is not found, N/A is displayed.	Oper-Up
		Oper-Down
		N/A
Originating SDP-ID Binding Admin State	The local administrative state of the originating *sdp-id*s binding to *service-id*. If an *sdp-id* is not bound to the service, N/A is displayed.	Admin-Up
		Admin-Up
		N/A
Originating SDP-ID Binding Oper State	The local operational state of the originating *sdp-id*s binding to *service-id*. If an *sdp-id* is not bound to the service, N/A is displayed.	Oper-Up
		Oper-Down
		N/A
Responding SDP-ID	The *sdp-id* used by the far end to respond to the **svc-ping** request. If the request was received without the **sdp-path** parameter, the responding router does not use an *sdp-id* as the return path, but the appropriate responding *sdp-id* is displayed. If a valid *sdp-id* return path is not found to the originating router that is bound to the *service-id*, Non-Existent is displayed.	resp-sdp-id
		Non-Existent
Responding SDP-ID Path Used	Whether the responding router used the responding *sdp-id* to respond to the **svc-ping** request. If the request was received via the originating *sdp-id* and a valid return *sdp-id* is found, operational and has a valid egress service label, the far-end router should use the *sdp-id* as the return *sdp-id*. If the far end uses the responding *sdp-id* as the return path, Yes is displayed. If the far end does not use the responding *sdp-id* as the return path, No is displayed. If the responding *sdp-id* is non-existent, N/A is displayed.	Yes
		No
		N/A
Responding SDP-ID Administrative State	The administrative state of the far-end *sdp-id* associated with the return path for *service-id*. When a return path is administratively down, Admin-Down is displayed. If the return *sdp-id* is administratively up, Admin-Up is displayed. If the responding *sdp-id* is non-existent, N/A is displayed.	Admin-Up
		Admin-Up
		N/A
Responding SDP-ID Operational State	The operational state of the far-end *sdp-id* associated with the return path for *service-id*. When a return path is operationally down, Oper-Down is displayed. If the return *sdp-id* is operationally up, Oper-Up is displayed. If the responding *sdp-id* is non-existent, N/A is displayed.	Oper-Up
		Oper-Down
		N/A

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Field	Description	Values
Responding SDP-ID Binding Admin State	The local administrative state of the responder's *sdp-id* binding to *service-id*. If an *sdp-id* is not bound to the service, N/A is displayed.	Admin-Up
		Admin-Down
		N/A
Responding SDP-ID Binding Oper State	The local operational state of the responder's *sdp-id* binding to *service-id*. If an *sdp-id* is not bound to the service, N/A is displayed.	Oper-Up
		Oper-Down
		N/A
Originating VC-ID	The originator's VC-ID associated with the *sdp-id* to the far-end address that is bound to *service-id*. If the *sdp-id* signaling is off, *originator-vc-id* is 0. If the *originator-vc-id* does not exist, N/A is displayed.	originator-vc-id
		N/A
Responding VC-ID	The responder's VC-ID associated with the *sdp-id* to *originator-id* that is bound to *service-id*. If the *sdp-id* signaling is off or the service binding to *sdp-id* does not exist, *responder-vc-id* is 0. If a response is not received, N/A is displayed.	responder-vc-id
		N/A
Originating Egress Service Label	The originating service label (VC-Label) associated with the *service-id* for the originating *sdp-id*. If *service-id* does not exist locally, N/A is displayed. If *service-id* exists, but the egress service label has not been assigned, Non-Existent is displayed.	egress-vc-label
		N/A
		Non-Existent
Originating Egress Service Label Source	The originating egress service label source. If the displayed egress service label is manually defined, Manual is displayed. If the egress service label is dynamically signaled, Signaled is displayed. If the *service-id* does not exist or the egress service label is non-existent, N/A is displayed.	Manual
		Signaled
		N/A
Originating Egress Service Label State	The originating egress service label state. If the originating router considers the displayed egress service label operational, Up is displayed. If the originating router considers the egress service label inoperative, Down is displayed. If the *service-id* does not exist or the egress service label is non-existent, N/A is displayed.	Up
		Down
		N/A
Responding Service Label	The actual responding service label in use by the far-end router for this *service-id* to the originating router. If *service-id* does not exist in the remote router, N/A is displayed. If *service-id* does exist remotely but the remote egress service label has not been assigned, Non-Existent is displayed.	rec-vc-label
		N/A
		Non-Existent
	The responder's egress service label source. If the responder's egress service label is manually defined,	Manual

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Field	Description	Values
Responding Egress Service Label Source	Manual is displayed. If the responder's egress service label is dynamically signaled, Signaled is displayed. If the *service-id* does not exist on the responder or the responder's egress service label is non-existent, N/A is displayed.	Signaled N/A
Responding Service Label State	The responding egress service label state. If the responding router considers it is an egress service label operational, Up is displayed. If the responding router considers it is an egress service label inoperative, Down is displayed. If the *service-id* does not exist or the responder's egress service label is non-existent, N/A is displayed.	Up Down N/A
Expected Ingress Service Label	The locally assigned ingress service label. This is the service label that the far-end is expected to use for *service-id* when sending to the originating router. If *service-id* does not exist locally, N/A is displayed. If *service-id* exists but an ingress service label has not been assigned, Non-Existent is displayed.	ingress-vc-label N/A Non-Existent
Expected Ingress Label Source	The originator's ingress service label source. If the originator's ingress service label is manually defined, Manual is displayed. If the originator's ingress service label is dynamically signaled, Signaled is displayed. If the *service-id* does not exist on the originator or the originators ingress service label has not been assigned, N/A is displayed.	Manual Signaled N/A
Expected Ingress Service Label State	The originator's ingress service label state. If the originating router considers it as an ingress service label operational, Up is displayed. If the originating router considers it as an ingress service label inoperative, Down is displayed. If the *service-id* does not exist locally, N/A is displayed.	Up Down N/A
Responders Ingress Service Label	The assigned ingress service label on the remote router. This is the service label that the far end is expecting to receive for *service-id* when sending to the originating router. If *service-id* does not exist in the remote router, N/A is displayed. If *service-id* exists, but an ingress service label has not been assigned in the remote router, Non-Existent is displayed.	resp-ingress-vc-label N/A Non-Existent
Responders Ingress Label Source	The assigned ingress service label source on the remote router. If the ingress service label is manually defined on the remote router, Manual is displayed. If the ingress service label is dynamically signaled on the remote router, Signaled is displayed. If the *service-id* does not exist on the remote router, N/A is displayed.	Manual Signaled N/A

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Field	Description	Values
Responders Ingress Service Label State	The assigned ingress service label state on the remote router. If the remote router considers it as an ingress service label operational, Up is displayed. If the remote router considers it as an ingress service label inoperative, Down is displayed. If the *service-id* does not exist on the remote router or the ingress service label has not been assigned on the remote router, N/A is displayed.	Up
		Down
		N/A

Parameters

ip-address

Specifies the far-end IP address to which to send the **svc-ping** request message in dotted-decimal notation.

service *service-id*

Specifies the service ID of the service being tested. The service ID need not exist on the local to receive a reply message.

Values 1 to 2147483647

local-sdp

Specifies the **svc-ping** request message should be sent using the same service tunnel encapsulation labeling as service traffic. If **local-sdp** is specified, the command attempts to use an egress *sdp-id* bound to the service with the specified **far-end** IP address with the VC-Label for the service. The far-end address of the specified *sdp-id* is the expected *responder-id* within the reply received. The *sdp-id* defines the encapsulation of the SDP tunnel encapsulation used to reach the far end; this can be IP or MPLS. On originator egress, the service-ID must have an associated VC-Label to reach the far-end address of the *sdp-id* and the *sdp-id* must be operational for the message to be sent.

If **local-sdp** is not specified, the **svc-ping** request message is sent with encapsulation with the OAM label.

The following table indicates whether a message is sent and how the message is encapsulated based on the state of the service ID.

Table 25: SVC ping messaging depending on service ID state

Local service state	local-sdp Not specified		local-sdp Specified	
	Message sent	Message encapsulation	Message sent	Message encapsulation
Invalid Local Service	Yes	Generic IP OAM (PLP)	No	None
No Valid SDP-ID Bound	Yes	Generic IP OAM (PLP)	No	None
SDP-ID Valid But Down	Yes	Generic IP OAM (PLP)	No	None

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Local service state	local-sdp Not specified		local-sdp Specified	
	Message sent	Message encapsulation	Message sent	Message encapsulation
SDP-ID Valid and Up, But No Service Label	Yes	Generic IP OAM (PLP)	No	None
SDP-ID Valid, Up and Egress Service Label	Yes	Generic IP OAM (PLP)	Yes	SDP Encapsulation with Egress Service Label (SLP)

remote-sdp

Specifies **svc-ping** reply message from the **far-end** should be sent using the same service tunnel encapsulation labeling as service traffic. If **remote-sdp** is specified, the **far-end** responder attempts to use an egress *sdp-id* bound to the service with the message originator as the destination IP address with the VC-Label for the service. The *sdp-id* defines the encapsulation of the SDP tunnel encapsulation used to reply to the originator; this can be IP or MPLS. On responder egress, the service-ID must have an associated VC-Label to reach the originator address of the *sdp-id* and the *sdp-id* must be operational for the message to be sent.

The following table indicates how the message response is encapsulated based on the state of the remote service ID.

Table 26: SVC ping messaging depending on remote service ID state

Remote service state	Message encapsulation	
	remote-sdp Not specified	remote-sdp Specified
Invalid Ingress Service Label	Generic IP OAM (PLP)	Generic IP OAM (PLP)
Invalid Service-ID	Generic IP OAM (PLP)	Generic IP OAM (PLP)
No Valid SDP-ID Bound on Service-ID	Generic IP OAM (PLP)	Generic IP OAM (PLP)
SDP-ID Valid But Down	Generic IP OAM (PLP)	Generic IP OAM (PLP)
SDP-ID Valid and Up, but No Service Label	Generic IP OAM (PLP)	Generic IP OAM (PLP)
SDP-ID Valid and Up, Egress Service Label, but VC-ID Mismatch	Generic IP OAM (PLP)	Generic IP OAM (PLP)
SDP-ID Valid and Up, Egress Service Label, but VC-ID Match	Generic IP OAM (PLP)	SDP Encapsulation with Egress Service Label (SLP)

Output

The following sample output is an example of svc-ping information.

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Sample output

```
A:ALU_G7X1>config# oam svc-ping 10.20.1.3 service 1
Service-ID: 1

Err Info                Local           Remote
------------------------------------------------------
    Type:               EPIPE           EPIPE
    Admin State:        Up              Up
==> Oper State:         Down            Down
    Service-MTU:        1514            1514
    Customer ID:        1               1

    IP Interface State: Up
    Actual IP Addr:     10.20.1.1       10.20.1.3
    Expected Peer IP:   10.20.1.3       10.20.1.1

    SDP Path Used:      No              No
    SDP-ID:             1               2
    Admin State:        Up              Up
    Operative State:    Up              Up
    Binding Admin State:Up              Up
    Binding Oper State: Up              Up
    Binding VC ID:      10              10
    Binding Type:       Spoke           Spoke
    Binding Vc-type:    Ether           Ether
    Binding Vlan-vc-tag:N/A             N/A

    Egress Label:       131070          131068
    Ingress Label:      131068          131070
    Egress Label Type:  Signaled        Signaled
    Ingress Label Type: Signaled        Signaled

Request Result: Send - Reply Received: Responder Service ID Oper-Down
A:ALU_G7X1>config#
```

vprn-ping

Syntax

vprn-ping *service-id* **source** *ip-address* **destination** *ip-address* [**fc** *fc-name*] [**size** *size*] [**ttl** *vc-label-ttl*] [**return-control**] [**interval** *interval*] [**send-count** *send-count*] [**timeout** *timeout*]

Context

<GLOBAL>

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs a VPRN ping.

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Parameters

service *service-id*

Specifies the VPRN service ID to diagnose or manage.

Values *service-id*: 1 —to 2147483647

source *ip-address*

Specifies the IP prefix for the source IP address in dotted-decimal notation.

Values	ipv4-address	a.b.c.d
	ipv6-address	x:x:x:x:x:x:x:x (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x - [0 to FFFF]H
		d - [0 to 255]D

destination *ip-address*

Specifies the IP prefix for the destination IP address in dotted-decimal notation.

Values	ipv4-address	a.b.c.d
	ipv6-address	x:x:x:x:x:x:x:x (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x - [0 to FFFF]H
		d - [0 to 255]D

size *octets*

Specifies the OAM request packet size in octets, expressed as a decimal integer.

Values 1 to 9198

ttl *vc-label-ttl*

Specifies the TTL value in the VC label for the OAM request, expressed as a decimal integer.

Values 1 to 255

Default 255

return-control

Specifies the response to come on the control plane.

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interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second where the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10 seconds

Default 1

send-count ***send-count***

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

timeout ***timeout***

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 100

Default 5

fc-name

Specifies the forwarding class of the MPLS echo request encapsulation.

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

Default be

Output

Sample output

```
A:PE_1# oam vprn-ping 25 source 10.4.128.1 destination 10.16.128.0
Sequence Node-id                                Reply-Path Size     RTT
-------------------------------------------------------------------------------
[Send request Seq. 1.]
1        10.128.0.3:cpm                          In-Band   100      0ms
-------------------------------------------------------------------------------
...
```


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```
A:PE_1#
------------------------------------------------------------------------------
A:PE_1#
```

vprn-trace

Syntax

vprn-trace *service-id* **source** *src-ip* **destination** *ip-address* [**fc** *fc-name*] [**size** *size*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**return-control**] [**send-count** *send-count*] [**interval** *seconds*] [**timeout** *timeout*]

Context

<GLOBAL>

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Performs VPRN trace.

Parameters

service *service-id*

Specifies the VPRN service ID to diagnose or manage.

Values *service-id*: 1 to 2147483647

source *src-ip*

Specifies the IP prefix for the source IP address in dotted-decimal notation.

Values		
	ipv4-address	a.b.c.d
	ipv6-address	x:x:x:x:x:x:x:x (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x - [0 to FFFF]H
		d - [0 to 255]D

destination *dst-ip*

Specifies the IP prefix for the destination IP address in dotted-decimal notation.

Values		
	ipv4-address	a.b.c.d
	ipv6-address	x:x:x:x:x:x:x:x (eight 16-bit pieces)

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x:x:x:x:x:x:d.d.d.d

x - [0 to FFFF]H

d - [0 to 255]D

size ***octets***

Specifies the OAM request packet size in octets, expressed as a decimal integer.

Values [1 to 9198]

min-ttl ***vc-label-ttl***

Specifies the minimum TTL value in the VC label for the trace test, expressed as a decimal integer.

Values 1 to 255

Default 1

max-ttl ***vc-label-ttl***

Specifies the maximum TTL value in the VC label for the trace test, expressed as a decimal integer.

Values 1 to 255

Default 4

return-control

Specifies the OAM reply to a data plane OAM request be sent using the control plane instead of the data plane.

Default OAM reply sent using the data plane.

send-count ***sendcount***

Specifies the number of OAM requests sent for a particular TTL value, expressed as a decimal integer.

Values 1 to 10

Default 1

interval ***seconds***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second where the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10 seconds

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Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 60

Default 3

fc-name

Specifies the forwarding class of the MPLS echo request encapsulation.

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

Default be

Output

Sample output

```
A:PE_1# oam vprn-
trace 25 source 10.4.128.1 destination 10.16.128.0
TTL Seq Reply Node-id         Rcvd-on         Reply-Path RTT
-------------------------------------------------------------------------------
[Send request TTL: 1, Seq. 1.]
1   1   1     10.128.0.4      cpm             In-Band    0ms
  Requestor 10.128.0.1 Route: 0.0.0.0/0
    Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
    Next Hops: [1] ldp tunnel
    Route Targets: [1]: target:65100:1
  Responder 10.128.0.4 Route: 10.16.128.0/24
    Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
    Next Hops: [1] ldp tunnel
    Route Targets: [1]: target:65001:100

[Send request TTL: 2, Seq. 1.]
2   1   1     10.128.0.3      cpm             In-Band    0ms
  Requestor 10.128.0.1 Route: 0.0.0.0/0
    Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
    Next Hops: [1] ldp tunnel
    Route Targets: [1]: target:65100:1
  Responder 10.128.0.3 Route: 10.16.128.0/24
    Vpn Label: 0 Metrics 0 Pref 0 Owner local
    Next Hops: [1] ifIdx 2 nextHopIp 10.16.128.0

[Send request TTL: 3, Seq. 1.]
[Send request TTL: 4, Seq. 1.]
...
-------------------------------------------------------------------------------
A:PE_1#
```


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3.8.2.3 VPLS MAC diagnostics

Note:
VPLS MAC diagnostics commands are supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

cpe-ping

Syntax

cpe-ping service *service-id* **destination** *ip-address* **source** *ip-address* [**ttl** *vc-label-ttl*] [**return-control**] [**source-mac** *ieee-address*] [**fc** *fc-name*] [**interval** *interval*] [**count** *send-count*]

Context

oam

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command determines the IP connectivity to a CPE within a specified VPLS service.

Parameters

service *service-id*

Specifies the service ID of the service to diagnose or manage.

Values *service-id*: 1 to 2147483647

destination *ip-address*

Specifies the IP address to be used as the destination for performing an OAM ping operations.

source *ip-address*

Specifies an unused IP address in the same network that is associated with the VPLS.

ttl *vc-label-ttl*

Specifies the TTL value in the VC label for the OAM MAC request, expressed as a decimal integer.

Values 1 to 255

Default 255

return-control

Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

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Default MAC OAM reply sent using the data plane.

source-mac ***ieee-address***

Specifies the source MAC address that is sent to the CPE. If not specified or set to 0, the MAC address configured for the CPM is used.

fc-name

Specifies the forwarding class of the MPLS echo request encapsulation.

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

Default be

interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second where the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

count ***send-count***

The number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

mac-populate

Syntax

mac-populate *service-id* **mac** *ieee-address* [**flood**] [**age** *seconds*] [**force**] [**target-sap sap-id**]

Context

oam

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

This command populates the FIB with an OAM-type MAC entry indicating the node is the egress node for the MAC address and optionally floods the OAM MAC association throughout the service. The **mac-populate** command installs an OAM MAC into the service FIB indicating the device is the egress node for a particular MAC address. The MAC address can be bound to a particular SAP (the **target-sap**) or can be associated with the control plane in that any data destined for the MAC address is forwarded to the control plane (cpm). As a result, if the service on the node has neither a FIB nor an egress SAP, it is not allowed to initiate a **mac-populate**.

The MAC address that is populated in the FIBs in the provider network is specific a type OAM, so that it can be treated distinctly from regular dynamically learned or statically configured MACs. Note that OAM MAC addresses are operational MAC addresses and are not saved in the device configuration. An exec file can be used to define OAM MACs after system initialization.

The **force** option in **mac-populate** forces the MAC in the table to be type OAM in the case it already exists as a dynamic, static or an OAM induced learned MAC with some other type binding.

An OAM-type MAC cannot be overwritten by dynamic learning and allows customer packets with the MAC to either ingress or egress the network while still using the OAM MAC entry.

The **flood** option causes each upstream node to learn the MAC (that is, populate the local FIB with an OAM MAC entry) and to flood the request along the data plane using the flooding domain.The flooded **mac-populate** request can be sent via the data plane or the control plane. The **send-control** option specifies the request be sent using the control plane. If **send-control** is not specified, the request is sent using the data plane. An **age** can be provided to age a particular OAM MAC using a specific interval. By default, OAM MAC addresses are not aged and can be removed with a **mac-purge** or with an FDB clear operation.

When split horizon group (SHG) is configured, the flooding domain depends on which SHG the packet originates from. The **target-sap** *sap-id* value dictates the originating SHG information.

Parameters

service *service-id*

Specifies the Service ID of the service to diagnose or manage.

Values 1 to 2147483647

destination *ieee-address*

Specifies the MAC address to be populated.

flood

Sends the OAM MAC populate to all upstream nodes.

Default MAC populate only the local FIB.

age *seconds*

Specifies the age for the OAM MAC, expressed as a decimal integer.

Values 1 to 65535

Default The OAM MAC does not age.

force

Converts the MAC to an OAM MAC even if it currently another type of MAC.

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Default Do not overwrite type.

target-sap ***sap-id***

Specifies the local target SAP bound to a service on which to associate the OAM MAC. By default, the OAM MAC is associated with the control place, that is, it is associated with the CPU on the router.

When the **target-sap** *sap-id* value is not specified the MAC is bound to the CPM. The originating SHG is 0 (zero). When the **target-sap** *sap-id* value is specified, the originating SHG is the SHG of the target-sap.

Default Associate OAM MAC with the control plane (CPU).

mac-purge

Syntax

mac-purge *service-id* **target** *ieee-address* [**flood**] [**register**]

Context

oam

Platforms

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

Description

This command removes an OAM-type MAC entry from the FIB and optionally floods the OAM MAC removal throughout the service. A **mac-purge** can be sent via the forwarding path or via the control plane. When sending the MAC purge using the data plane, the TTL in the VC label is set to 1. When sending the MAC purge using the control plane, the packet is sent directly to the system IP address of the next hop.

A MAC address is purged only if it is marked as OAM. A **mac-purge** request is an HVPLS OAM packet, with the following fields. The Reply Flags is set to 0 (since no reply is expected), the Reply Mode and Reserved fields are set to 0. The Ethernet header has source set to the (system) MAC address, the destination set to the broadcast MAC address. There is a VPN TLV in the FEC Stack TLV to identify the service domain.

If the register option is provided, the R bit in the Address Delete flags is turned on.

The **flood** option causes each upstream node to be sent the OAM MAC delete request and to flood the request along the data plane using the flooding domain. The flooded **mac-purge** request can be sent via the data plane or the control plane. The **send-control** option specifies the request be sent using the control plane. If **send-control** is not specified, the request is sent using the data plane.

The **register** option reserves the MAC for OAM testing where it is no longer an active MAC in the FIB for forwarding, but it is retained in the FIB as a registered OAM MAC. Registering an OAM MAC prevents relearns for the MAC based on customer packets. Relearning a registered MAC can only be done through a **mac-populate** request. The originating SHG is always 0 (zero).

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Parameters

service *service-id*

Specifies the service ID of the service to diagnose or manage.

Values 1 to 2147483647

target *ieee-address*

Specifies the MAC address to be purged.

flood

Sends the OAM MAC purge to all upstream nodes.

Default MAC purge only the local FIB.

register

Reserve the MAC for OAM testing.

Default Do not register OAM MAC.

mac-ping

Syntax

mac-ping service *service-id* **destination** *dst-ieee-address* [**source** *src-ieee-address*] [**fc** *fc-name*] [**size** *octets*] [**ttl** *vc-label-ttl*] [**count** *send-count*] [**return-control**] [**interval** *interval*] [**timeout** *timeout*]

Context

oam

config>saa>test>type

Platforms

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

Description

This command tests for the existence of an egress SAP binding of a specific MAC within a VPLS service.

A **mac-ping** packet can be sent through the control plane or the data plane. The **send-control** option specifies the request be sent using the control plane. If **send-control** is not specified, the request is sent using the data plane.

A **mac-ping** is forwarded along the flooding domain if no MAC address bindings exist. If MAC address bindings exist, the packet is forwarded along those paths, provided they are active. A response is generated only when there is an egress SAP binding for that MAC address or if the MAC address is a "local" OAM MAC address associated with the device's control plan.

A **mac-ping** reply can be sent using the data plane or the control plane. The **return-control** option specifies the reply be sent using the control plane. If **return-control** is not specified, the request is sent using the data plane.

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A **mac-ping** with data plane reply can only be initiated on nodes that can have an egress MAC address binding. A node without a FIB and without any SAPs cannot have an egress MAC address binding, so it is not a node where replies in the data plane are trapped and sent up to the control plane.

A control plane request is responded to through a control plane reply only.

By default, MAC OAM requests are sent with the system or chassis MAC address as the source MAC. The **source** option allows overriding of the default source MAC for the request with a specific MAC address.

When a **source** *ieee-address* value is specified and the source MAC address is locally registered within a split horizon group (SHG), this SHG membership is used as if the packet originated from this SHG. In all other cases, SHG 0 (zero) is used. Note that if the **mac-trace** is originated from a non-zero SHG, such packets do not go out to the same SHG.

If EMG is enabled, mac-ping returns only the first SAP in each chain.

Parameters

service *service-id*

Specifies the service ID of the service to diagnose or manage.

Values 1 to 2147483647

destination *ieee-address*

Specifies the destination MAC address for the OAM MAC request.

size *octets*

Specifies the MAC OAM request packet size in octets, expressed as a decimal integer. The request payload is padded to the specified size with a 6 byte PAD header and a byte payload of 0xAA as necessary. If the octet size specified is less than the minimum packet, the minimum sized packet necessary to send the request is used.

Values 1 to 9198

Default No OAM packet padding.

ttl *vc-label-ttl*

Specifies the TTL value in the VC label for the OAM MAC request, expressed as a decimal integer.

Values 1 to 255

Default 255

return-control

Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply sent using the data plane.

source src-*ieee-address*

Specifies the source MAC address from which the OAM MAC request originates. By default, the system MAC address for the chassis is used.

Values Any unicast MAC value.

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Default The system MAC address.

fc *fc-name*

Specifies the **fc** parameter used to test the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

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

interval *interval*

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second where the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

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mac-trace

Syntax

mac-trace service *service-id* **destination** *ieee-address* [**fc** *fc-name*] [**size** *octets*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**return-control**] [**source** *ieee-address*] [**send-count** *send-count*] [**interval** *interval*] [**timeout** *timeout*]

Context

oam

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays the hop-by-hop path for a destination MAC address within a VPLS.

The MAC traceroute operation is modeled after the IP traceroute utility which uses ICMP echo request and reply packets with increasing TTL values to determine the hop-by-hop route to a destination IP. The MAC traceroute command uses Nokia OAM packets with increasing TTL values to determine the hop-by-hop route to a destination MAC.

In a MAC traceroute, the originating device creates a MAC ping echo request packet for the MAC to be tested with increasing values of the TTL. The echo request packet is sent through the control plane or data plane and awaits a TTL exceeded response or the echo reply packet from the device with the destination MAC. The devices that reply to the echo request packets with the TTL exceeded and the echo reply are displayed.

When a **source** *ieee-address* value is specified and the source MAC address is locally registered within a split horizon group (SHG), this SHG membership is used as if the packet originated from this SHG. In all other cases, SHG 0 (zero) is used. Note that if the **mac-ping** is originated from a non-zero SHG, such packets do not go out to the same SHG.

If EMG is enabled, mac-trace returns only the first SAP in each chain.

Parameters

service *service-id*

Specifies the Service ID of the service to diagnose or manage.

Values 1 to 2147483647

destination *ieee-address*

Specifies the destination MAC address to be traced.

size *octets*

Specifies the MAC OAM request packet size in octets, expressed as a decimal integer. The request payload is padded to the specified size with a 6 byte PAD header and a byte payload of 0xAA as necessary. If the octet size specified is less than the minimum packet, the minimum sized packet necessary to send the request is used.

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Values 1 to 9198

Default No OAM packet padding.

fc *fc-name*

Specifies the **fc** parameter used to test the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

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

min-ttl *vc-label-ttl*

The minimum TTL value in the VC label for the MAC trace test, expressed as a decimal integer.

Values 1 to 255

Default 1

max-ttl *vc-label-ttl*

Specifies the maximum TTL value in the VC label for the MAC trace test, expressed as a decimal integer.

Values 1 to 255

Default 4

return-control

Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply sent using the data plane.

source *ieee-address*

Specifies the source MAC address from which the OAM MAC request originates. By default, the system MAC address for the chassis is used.

Values Any unicast MAC value.

Default The system MAC address.

send-count *send-count*

Specifies the number of MAC OAM requests sent for a particular TTL value, expressed as a decimal integer.

Values 1 to 10

Default 1

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interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

timeout ***timeout***

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 60

Default 5

3.8.2.4 EFM commands

efm

Syntax

efm *port-id* **local-loopback** {**start** | **stop**}

efm *port-id* **remote-loopback** {**sart** | **stop**}

Context

oam>efm

Platforms

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

Description

This command enables Ethernet in the First Mile (EFM) OAM loopback tests on the specified port.

Parameters

port-id

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

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local-loopback {start | stop}

Specifies to start or stop local loopback tests on the specified port.

remote-loopback {start | stop}

Specifies to start or stop remote loopback tests on the specified port.

3.8.2.5 ETH-CFM OAM commands

eth-test

Syntax

mac-address **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**priority** *priority*] [**data-length** *data-length*]

Context

oam>eth-cfm

Platforms

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

Description

This command issues an ETH-CFM test.

Parameters

mac-address

Specifies a unicast MAC address.

mep *mep-id*

Specifies target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

data-length *data-length*

Specifies the UDP data length of the echo reply, the length starting after the IP header of the echo reply.

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Values 64 to 1500

Default 64

priority *priority*

Specifies the priority.

Values 0 to 7

Default The CCM and LTM priority of the MEP

linktrace

Syntax

linktrace *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**ttl** *ttl-value*]

Context

oam>eth-cfm

Platforms

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

Description

The command specifies to initiate a linktrace test.

Parameters

mac-address

Specifies a unicast destination MAC address.

mep *mep-id*

Specifies the target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

ttl *ttl-value*

Specifies the TTL for a returned linktrace.

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Values 0 to 255

Default 64

loopback

Syntax

loopback *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**send-count** *send-count*] [**size** *data-size*] [**priority** *priority*]

Context

oam>eth-cfm

Platforms

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

Description

The command specifies to initiate a loopback test.

Parameters

mac-address

Specifies a unicast MAC address.

mep *mep-id*

Specifies the local MEP ID.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. Loopback messages are sent back to back, with no delay between the transmissions.

Values 1 to 1024

Default 1

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size *data-size*

Specifies the size of the data portion of the data TLV, allowing for an optional octet string to be specified. If 0 is specified, no data TLV is added to the packet.

Values 0 to 1500

priority *priority*

Specifies a 3-bit value to be used in the VLAN tag, if present, in the transmitted frame.

Values 0 to 7

one-way-delay-test

Syntax

one-way-delay-test *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**priority** *priority*]

Context

oam>eth-cfm

Platforms

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

Description

This command issues an ETH-CFM one-way delay test.

Parameters

mac-address

Specifies a unicast MAC address.

mep *mep-id*

Specifies target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

priority *priority*

Specifies the priority.

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Values 0 to 7

Default The CCM and LTM priority of the MEP.

two-way-delay-test

Syntax

two-way-delay-test *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**priority** *priority*]

Context

oam>eth-cfm

Platforms

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

Description

This command issues an ETH-CFM two-way delay test.

Parameters

mac-address

Specifies a unicast MAC address.

mep *mep-id*

Specifies target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

priority *priority*

Specifies the priority.

Values 0 to 7

Default The CCM and LTM priority of the MEP.

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two-way-slm-test

Syntax

two-way-slm-test *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**priority** *priority*] [**send-count** *send-count*] [**size** *data-size*] [**timeout** *timeout*] [**interval** *interval*]

Context

oam>eth-cfm

Platforms

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

Description

This command configures an Ethernet CFM two-way SLM test in SAA.

Parameters

mac-address

Specifies a unicast destination MAC address.

mep *mep-id*

Specifies the target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

priority *priority*

Specifies a 3-bit value to be used in the VLAN tag, if present, in the transmitted frame.

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 1000

Default 1

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size *data-size*

Specifies the size of the data portion of the data TLV. If 0 is specified no data TLV is added to the packet.

Values 0 to 1500

Default 0

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a reply message after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

interval *interval*

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values [0.1, 0.2, .. 0.9] | [1, 2, .. 10]

Default 5

3.8.2.6 ETH CFM configuration commands

eth-cfm

Syntax

eth-cfm

Context

config

Platforms

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

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Description

Commands in this context configure 802.1ag CFM parameters.

domain

Syntax

domain *md-index* [**format** *md-name-format*] [**name** *md-name*] **level** *level*

domain *md-index*

no domain *md-index*

Context

config>eth-cfm

Platforms

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

Description

This command configures Connectivity Fault Management domain parameters.

The **no** form of this command removes the Maintenance Domain (MD) index parameters from the configuration.

Parameters

md-index

Specifies the MD index value.

Values 1 to 4294967295

format *md-name-format*

Specifies a value that represents the type (format).

Values

dns: Specifies the DNS name format.

mac: x:x:x:x:x:x-u

x: [0..ff]h

u: [0..65535]d

none: Specifies a Y.1731 domain format and the only format allowed to execute Y.1731 specific functions.

string Specifies an ASCII string.

Default string

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name *md-name*

Specifies a generic MD name.

Values 1 to 43 characters

level *level*

Specifies the integer identifying the MD level. Higher numbers correspond to higher maintenance domains, those with the greatest physical reach, with the highest values for customers' CFM packets. Lower numbers correspond to lower maintenance domains, those with more limited physical reach, with the lowest values for single bridges or physical links.

Values 0 to 7

association

Syntax

association *ma-index* [**format** *ma-name-format*] **name** *ma-name*

association *ma-index*

no association *ma-index*

Context

config>eth-cfm>domain

Platforms

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

Description

This command configures the Maintenance Association (MA) for the domain.

Parameters

ma-index

Specifies the MA index value.

Values 1 to 4294967295

format *ma-name-format*

Specifies a value that represents the type (format).

Values

icc-based: Only applicable to a Y.1731 context where the domain format is configured as none, allows for exactly a 13 character name in raw ascii.

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integer	0 to 65535 (integer value 0 means the MA is not attached to a VID.)
string:	raw ascii
vid:	0 to 4094
vpn-id:	RFC-2685, *Virtual Private Networks Identifier* xxx:xxxx, where x is a value between 00 and ff.

Default integer

name *ma-name*

Specifies the part of the MA identifier that is unique within the MD name.

Values 1 to 45 characters

bridge-identifier

Syntax

[**no**] **bridge-identifier** *bridge-id*

Context

config>eth-cfm>domain>association

Platforms

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

Description

This command configures the service ID for the domain association. The value must be configured to match the service ID of the service where MEPs for this association is created.

Note: The system does not verify whether a service has been created with a matching service ID.

Parameters

bridge-id

Specifies the bridge ID for the domain association.

Values 1 to 2147483647

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id-permission

Syntax

id-permission {**chassis**}

no id-permission

Context

config>eth-cfm>domain>association>bridge-identifier

Platforms

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

Description

This command enables the inclusion of the Sender ID TLV information specified with the **config>eth-cfm>system>sender-id** command for installed MEPs and MIPs. When this option is present under the maintenance association, the specific MIPs in the association includes the Sender ID TLV information in ETH-CFM PDUs. MEPs include the Sender ID TLV for CCM (subsecond CCM-enabled MEPs do not support the Sender ID TLV) in LBM/LBR and LTM/LTR PDUs. MIPs include this value in the LBR and LTR PDUs.

Note: LBR functions reflect back all TLVs received in the LBM unchanged, including the Sender ID TLV. Transmission of the Management Domain and Management Address fields are not supported in this TLV.

The **no** form of this command disables the inclusion of the Sender ID TLV.

Default

no id-permission

Parameters

chassis

Specifies to include the Sender ID TLV with a value configured with the **config>eth-cfm>system>sender-id** command.

mhf-creation

Syntax

mhf-creation {**none** | **explicit** | **default** | **static**}

no mhf-creation

Context

config>eth-cfm>domain>association>bridge-identifier

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Platforms

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

Description

This command determines whether to allow MIP creation for the MA. Use of the none, default and explicit parameters are only allowed for MHFs (MIPs) that are not associated with a configured primary VLAN.

The static parameter is only applicable to MHFs (MIPs) that are associated with a Primary VLAN.

Note:
Ingress MIPs and egress MIPs are supported on 7210 SAS platforms. Ingress MIPs respond to OAM messages received from the wire. Egress MIPs respond to OAM messages that are being sent out to the wire.

See Table 12: ETH-CFM support matrix for the 7210 SAS-T (network mode), Table 13: ETH-CFM support matrix for the 7210 SAS-T (access-uplink mode), Table 14: ETH-CFM support matrix for 7210 SAS-Mxp devices, Table 15: ETH-CFM support matrix for 7210 SAS-R6 and 7210 SAS-R12 devices, Table 16: ETH-CFM support matrix for 7210 SAS-Sx/S 1/10GE devices, and Table 17: ETH-CFM support matrix for 7210 SAS-Sx 10/100GE devices for MEP and MIP support available for different services on different platforms.

Parameters

none

Specifies that no MHFs can be created for this VID.

explicit

Specifies that MHFs can be created for this VID only on bridge ports through which this VID can pass, and only if a MEP is created at some lower MA level. There must be at least one lower-level MEP provisioned on the same SAP.

default

Specifies that MHFs can be created for this VID only on bridge ports through which this VID can pass without the requirement for a MEP at some lower MA level.

Note:
On 7210 SAS-R6 and 7210 SAS-R12, the **default** parameter is supported for Ingress MIPs only in a VPLS service and it is supported for MIP creation in an Epipe service.

static

Specifies the exact level of the MHF (MIP) that are created for this SAP. Multiple MHFs (MIPs) are allowed as long as the MD level hierarchy is correctly configured for the particular primary VLAN.

mip-ltr-priority

Syntax

mip-ltr-priority *priority*

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Context

config>eth-cfm>domain>association>bridge-identifier

Platforms

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

Description

This command sets the priority of the Linktrace Response Message (ETH-LTR) from a MIP for this association. If this command is not specified, an LTR priority of 7 is used.

Default

no mip-ltr-priority

Parameters

priority

Specifies the priority of the Linktrace Response Message (ETH-LTR) from a MIP for this association.

Values 0 to 7

vlan

Syntax

vlan *vlan-id*

no vlan

Context

config>eth-cfm>domain>association>bridge-identifier

Platforms

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

Description

This command configures the bridge identifier primary VLAN ID. Note that this configuration is optional as no verification is done to ensure that MEPs on this association are on the configured VLAN. When the primary VLAN feature is enabled for the MEP or a MIP, this is used to match with the VLAN in the packet to identify the packets to process in the context of the primary VLAN MIP/MEP.

Note: Also see the description for the **config**>**eth-cfm**>**domain**>**association**>**bridge-identifier** command.

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Parameters

vlan-id

Specifies a VLAN ID monitored by MA.

Values 0 to 4094

ccm-interval

Syntax

ccm-interval {**300Hz** | **10ms** | **100ms** | **1** | **10** | **60** | **600**}

no ccm-interval

Context

config>eth-cfm>domain>association

Platforms

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

Description

This command configures the CCM transmission interval for all MEPs in the association. See the following tables for the CCM transmission interval values for each 7210 SAS platform.

Table 27: CCM transmission interval for 7210 SAS-T (network mode), 7210 SAS-Mxp, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-Sx 10/100GE

MEP timer support	7210 SAS-T network mode	7210 SAS-Mxp	7210 SAS-Sx/S 1/10GE	7210 SAS-Sx 10/100GE
Service down MEP	1 | 10 | 60 | 600	1 | 10 | 60 | 600	1 | 10 | 60 | 600	1 | 10 | 60 | 600
G.8032 down MEP	100ms | 1 | 10 | 60 | 600	10ms | 100ms | 1 | 10 | 60 | 600	300Hz | 10ms | 100ms | 1 | 10 | 60 | 600	100ms | 1 | 10 | 60 | 600
Service up MEP	1 | 10 | 60 | 600	1 | 10 | 60 | 600	1 | 10 | 60 | 600	1 | 10 | 60 | 600

Table 28: CCM transmission interval for 7210 SAS-T (access-uplink mode)

MEP timer support	7210 SAS-T access-uplink mode
Service down MEP	100ms | 1 | 10 | 60 | 600
G.8032 down MEP	100ms | 1 | 10 | 60 | 600

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MEP timer support	7210 SAS-T access-uplink mode
Service up MEP	1 | 10 | 60 | 600

Table 29: CCM transmission interval for 7210 SAS-R6 and 7210 SAS-R12

MEP timer support	7210 SAS-R6 and 7210 SAS-R12
Service down MEP	1s
G.8032 down MEP	10ms
Service up MEP	1s

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

Default

10 s

Parameters

{300Hz | 10ms | 100ms | 1 | 10 | 60 | 600}

Specifies the interval between CCM transmissions to be used by all MEPs in the MA.

Values 10 ms, 100 ms, 1 second, 10 s, 60 s, 600 s, 100 ms

300Hz (this value is only available on the 7210 SAS-Sx/S 1/10GE in standalone and standalone-VC mode with G.8032 MEPs)

Default 10 s

remote-mepid

Syntax

[**no**] **remote-mepid** *mep-id*

Context

config>eth-cfm>domain>association

Platforms

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

Description

This command configures the remote MEP identifier.

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Parameters

mep-id

Specifies the MEP identifier of a remote MEP whose information from the MEP database is to be returned.

Values 1 to 8191

slm

Syntax

slm

Context

config>eth-cfm

Platforms

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

Description

This command specifies the container that provides the global configuration parameters for ITU-T Synthetic Loss Measurement (ETH-SL).

inactivity-timer

Syntax

inactivity-timer *timer*

no inactivity-timer

Context

config>eth-cfm>slm

Platforms

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

Description

This command configures the length of time that the responder keeps a test active. If the time between packets exceeds this values within a test, the responder marks the previous test as complete. It treats any new packets from a peer with the same test ID, source MAC address, and MEP ID as a new test responding with the sequence number 1.

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

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Default

100

Parameters

timer

Specifies the amount of time in seconds.

Values 10 to 100

system

Syntax

system

Context

config>eth-cfm

Platforms

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

Description

Commands in this context configure connectivity fault management general system parameters.

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

Values - 10 to 100

sender-id

Syntax

sender-id local *local-name*

sender-id system

no sender-id

Context

config>eth-cfm>system

Platforms

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

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Description

This command configures the ETH-CFM Sender ID used in CFM PDUs.

This command includes the configured system name or a locally configured name as the Chassis ID in Sender ID TLVs for ETH-CFM PDUs sent from MEPs and MIPs. MEPs include the Sender ID TLV for the CCM (subsecond CCM-enabled MEPs do not support the Sender ID TLV) in LBM/LBR and LTM/LTR PDUs. MIPs include this value in the LBR and LTR PDUs.

Note:
LBR functions reflect back all TLVs received in the LBM unchanged, including the Sender ID TLVs.

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

Default

no sender-id

Parameters

local-name

Specifies to use a local name, up to 45 alphanumeric characters, as the Sender ID.

system

Specifies to use the configured system name as the Sender ID.

3.8.2.7 Testhead commands

test-oam

Syntax

test-oam

Context

config

Platforms

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

Description

Commands in this context configure Operations, Administration, and Maintenance test parameters.

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loopback

Syntax

loopback entry *entry-id* {**line**} **port** *port-id* **service** *service-id* **sap** *sap-id* **src-mac** *ieee-address* **dst-mac** *ieee-address*

no loopback entry *entry-id*

Context

config>test-oam

Platforms

7210 SAS-Sx/S 1/10GE (standalone)

Description

This command configures loopback commands when using multiple streams, for each traffic stream corresponding to the test SAPs being validated, to loopback traffic that is being forwarded or sent out of the test SAPs.

The traffic streams are identified by the source MAC and destination MAC addresses, regardless of whether they belong to the same or different SAPs.

Note:
This command is not stored across a reboot in the configuration file.

The **no** form of this command removes the loopback entry.

Parameters

entry-id

Specifies the entry ID expressed as a decimal integer. An *entry-id* identifies a loopback entry uniquely in the system.

Values 1 to 65535

line

Keyword to specify that traffic ingressing the SAP is looped back toward the SAP it was received on. See SAP ingress loopback for Ethernet SAPs for more information.

port-id

Specifies the port ID, up to 17 characters.

sap-id

Specifies the identifier for the SAP. See SAP syntax in Common CLI command descriptions for information about parameter format options.

ieee-address

Specifies the unicast source or destination MAC address.

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Values a hexadecimal string using the notation xx:xx:xx:xx:xx:xx. The values for xx can be in the range of 0 to 9 and a to f.

testhead-profile

Syntax

testhead-profile *profile-id* **create**

Context

config>test-oam

Platforms

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

Description

This command creates service testhead profiles which are used by the Y.1564/RFC 2544 testhead (also known as, traffic generator) OAM tool. A service testhead profile configures the parameters, such as contents of the frame payload that is generated by traffic generator, the size of the frame, test duration, test acceptance criteria, and other criteria to be used by the testhead tool.

The profile is used by the testhead OAM tool to generate the appropriate frame at the configured rate and measure the performance parameters (FD, FDV, and loss). At the end of the test run, the tool compares the measured values against the test acceptance criteria that is configured in the profile to determine whether the service is within bounds of the acceptance criteria or not.

The **no** form of this command removes user created profile from the system.

Parameters

profile-id

Specifies the identifier for the profile.

Values 1 to 10

acceptance-criteria

Syntax

[**no**] **acceptance-criteria** *acceptance-criteria-id* **create**

Context

configure>test-oam>testhead-profile

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Platforms

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

Description

This command specifies the test acceptance criteria to be used by the testhead OAM tool to declare the PASS/FAIL result at the completion of the test.

Users can create up to 4 different acceptance criteria per profile to measure different SLA needs. User has an option to specify only one of the acceptance criteria to be specified with the testhead OAM tool during the invocation of the test.

The **no** form of this command removes the test acceptance criteria.

Default

no defaults

Parameters

acceptance-criteria-id

Specifies a number to identify the test acceptance criteria. It is a decimal number used to identify the test acceptance criteria and to use when starting the throughput test.

Values 1 to 4

cir-threshold

Syntax

[**no**] **cir-threshold** *cir-threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the CIR rate with the measured CIR rate at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'PASS', else it is considered to be 'FAIL'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no cir-threshold

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Parameters

threshold

Specifies the value, in kbps, for comparison with the measured value.

Values 0 to 1000000

jitter-rising-threshold

Syntax

[**no**] **jitter-rising-threshold** *threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the jitter with the measured jitter at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no jitter-rising-threshold

Parameters

threshold

Specifies, in microseconds, the value for comparison with measured value.

Values 0 to 2147483000

jitter-rising-threshold-in

Syntax

[**no**] **jitter-rising-threshold-in** *in-profile-threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

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Platforms

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

Description

This command compares the specified value for the jitter with the measured jitter for green/in-profile packets at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no jitter-rising-threshold-in

Parameters

In-profile-threshold

Specifies the value, in microseconds, for comparison with measured value.

Values 0 to 2147483000

jitter-rising-threshold-out

Syntax

[**no**] **jitter-rising-threshold-out** *out-profile-threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the jitter with the measured jitter for yellow/out-of-profile packets at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no jitter-rising-threshold-out

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Parameters

out-profile-threshold

Specifies, in microseconds, the value for comparison with measured value.

Values 0 to 2147483000

latency-rising-threshold

Syntax

[**no**] **latency-rising-threshold** *threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the latency with the measured latency at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no latency-rising-threshold

Parameters

threshold

Specifies the value, in microseconds, for comparison with measured value.

Values 0 to 2147483000

latency-rising-threshold-in

Syntax

[**no**] **latency-rising-threshold-in** *in-profile-threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

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Platforms

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

Description

This command compares the specified value for the latency with the measured latency for green/in-profile packets at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no latency-rising-threshold-in

Parameters

In-profile-threshold

Specifies the value, in microseconds, for comparison with measured value.

Values 0 to 2147483000

latency-rising-threshold-out

Syntax

[**no**] **latency-rising-threshold out-profile-threshold**

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the latency with the measured latency of yellow or out-of-profile packets at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no latency-rising-threshold-out

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Parameters

out-profile-threshold

Specifies the value, in microseconds, for comparison with measured value

Values 0 to 2147483000

loss-rising-threshold

Syntax

[**no**] **loss-rising-threshold** *threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the Frame Loss Ratio (FLR) with the measured FLR at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as ‘FAIL’, else it is considered to be ‘PASS’.

Frame Loss Ratio is computed as a ratio of the difference of number of received frames, to number of injected or sent frames, divided by the number of sent frames.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no loss-rising-threshold

Parameters

threshold

Specifies the value for comparison with measured value. the loss-rising-threshold is specified as a number which denotes one ten-thousandth (1/10000) of a percent. For example, specifying a value of 1 is equivalent to 0.0001%, and specifying a value of 10000 is equivalent to 1%.

Values 1 to 1000000

loss-rising-threshold-in

Syntax

[**no**] **loss-rising-threshold-in** *in-profile-threshold*

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Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the frame loss ratio (FLR) with the measured FLR for green or in-profile packets at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

Frame Loss Ratio for green/in-profile packets is computed as a ratio of the difference of number of received green or in-profile frames to number of injected/sent green/in-profile frames divided by the number of sent green frames.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no loss-rising-threshold-in

Parameters

in-profile-threshold

Specifies the value for comparison with measured value. The loss-rising-threshold is specified as a number which denotes one ten-thousandth (1/10000) of a percent. For example, specifying a value of 1 is equivalent to 0.0001%, and specifying a value of 10000 is equivalent to 1%.

Values 1 to 1000000

loss-rising-threshold-out

Syntax

[**no**] **loss-rising-threshold-out** *out-profile-threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

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Description

This command compares the specified value for the frame loss ratio (FLR) with the measured FLR for yellow/out-of-profile packets at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'FAIL', else it is considered to be 'PASS'.

Frame Loss ratio for yellow/out-of-profile packets is computed as a ratio of the difference of number of received yellow frames to number of injected/sent yellow frames divided by the number of sent yellow frames.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. The threshold value is ignored and not considered for declaring the test result.

Default

no loss-rising-threshold

Parameters

out-profile-threshold

Specifies the value for comparison with measured value. The loss-rising-threshold is specified as a number which denotes one ten-thousandth (1/10000) of a percent. For example, specifying a value of 1 is equivalent to 0.0001%, and specifying a value of 10000 is equivalent to 1%.

Values 1 to 1000000

pir-threshold

Syntax

[**no**] **pir-threshold** *pir-threshold*

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

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

Description

This command compares the specified value for the PIR rate with the measured PIR rate at the end of the test to declare the test result. If the measured value is greater than the specified value, the test is declared as 'PASS', else it is considered to be 'FAIL'.

The **no** form of this command disables the comparison of the parameter with the measured value at the end of the test. Basically, the threshold value is ignored and not considered for declaring the test result.

Default

no pir-threshold

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Parameters

threshold

Specifies the value, in kbps, for comparison with measured value.

Values 0 to 1000000

description

Syntax

description *profile-description*

Context

config>test-oam>testhead-profile

Platforms

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

Description

This command associates a description with the profile.

The **no** form the command removes description.

Parameters

profile-description

Specifies a description for the profile.

Values ASCII string

dot1p

Syntax

[**no**] **dot1p in-profile** *dot1p-value* **out-of-profile** *dot1p-value*

Context

configure>test-oam>testhead-profile

Platforms

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

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Description

This command configures the Dot1p values to identify the in-profile or green packets and out-of-profile or yellow packets. The values configured using this command are used by the testhead tool on the local end (that is, the node on which the testhead tool is executed) to match the dot1p values received in the packet header and identify green and yellow packets and appropriately account the packets. These values are used only when the testhead tool is invoked with the parameter **color-aware** is set to '**enable**'.

The dot1p in-profile value (that is, packets with dot1p values in the L2 header equal to the dot1p-in-profile value configured is considered to be in-profile or green packet) is used to count the number of in-profile packets and measure the latency, jitter, and FLR for in-profile packets. Similarly, the dot1p out-profile is used to count the total out-of-profile or yellow packets and measure latency, jitter, and FLR for out-of-profile or yellow packets.

While the testhead tool is initiated, if color-aware is set to enable and no values are specified (that is, the no form of this command is used in the profile), the CLI gives an error. If values are specified, the configured values are used to match and identify in-profile and out-of-profile packets.

The **no** form of this command disables the use of dot1p to identify a green or yellow packet.

Note:
Testhead OAM tool does not mark the packets below CIR as in-profile packets and packets above CIR and below PIR as out-of-profile packets using the Dot1p or DSCP or other packet header bits to indicate the color of the packet (for example: DEI bit), as the 7210 SAS access SAP ingress does not support color-aware metering. It is used to only identify green and yellow packets and maintain a count of received green and yellow packets when the tests are run in color-aware mode.

Default

The **no** form of this command is the default. There are no defaults for the dot1p values.

Parameters

in-profile dot1p-value

Specifies the dot1p value used to identify green or in-profile packets. It must be different from the value configured for yellow or out-of-profile packets.

Values 0 to 7

out-profile dot1p-value

Specifies the dot1p value used to identify green or out-of-profile packets. It must be different from the value configured for green or in-profile packets.

Values 0 to 7

frame-payload

Syntax

[**no**] **frame-payload** *frame-payload-id* [**payload-type** [**l2**|**tcp-ipv4**|**udp-ipv4**|**ipv4**] **create**

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Context

configure>test-oam>testhead-profile

Platforms

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

Description

This command specifies the packet header values to be used in frames generated by the testhead tool.

User can create up to 4 different types of frame payload representing different kinds of traffic, within a profile. User chooses one among these when starting the throughput test.

The parameter payload-type determines the packet header fields that are used to populate the frame generated by the testhead OAM tool. The packet header fields use the value from the parameters configured under the frame-payload. For example, when the payload-type is configured as "l2", software uses the parameters src-mac, dst-mac, vlan-tag-1 (if configured), vlan-tag-2 (if configured), ethertype, and data-pattern. See the following for parameters used when other values are specified with payload-type.

The **no** form of this command removes the frame payload context.

Parameters

frame-payload-id

A number to identify the frame-payload. it is an integer used to identify the frame type to use when starting the throughput test.

Values 1 to 4

frame-payload-type

Identifies whether the frame payload is L2 traffic, IP traffic, TCP/IP traffic or UDP/IP traffic and uses appropriate parameters to build the frame to be generated by the testhead OAM tool. It defaults to tcp-ipv4, if the user does not specify the value during creation of the new frame-payload.

Values l2|tcp-ipv4|udp-ipv4|ipv4

If l2 is specified, use src-mac+dst-mac+vlan-tag-1(if available)+vlan-tag-2 (if available)+ethertype+data-pattern.

If tcp-ipv4 or udp-ipv4 is specified, use src-mac+dst-mac+vlan-tag-1(if available)+vlan-tag-2 (if available)+ethertype=0x0800+src-ipv4+dst-ipv4+ip-ttl+ip-dscp or ip-tos+TCP/UDP Protocol Number+src-port+dst-port+data-pattern.

If ipv4 is specified, use src-mac+dst-mac+vlan-tag-1(if available)+vlan-tag-2 (if available)+ethertype=0x0800+src-ipv4+dst-ipv4+ip-ttl+ip-dscp or ip-tos+ip-proto+data-pattern.

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data-pattern

Syntax

[**no**] **data-pattern** *data-pattern*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the data pattern to populate the payload portion of the frame generated by the testhead tool.

This value can be specified if the payload-type is configured as l2 or ipv4 or tcp-ipv4 or udp-ipv4. For all these payload types, the frame with the appropriate headers is created and the payload portion of the frame, is filled up with the data-pattern-value specified with this command, repeating it as many times as required to fill up the remaining length of the payload.

The **no** form of this command uses the default data-pattern value of 0xa1b2c3d4e5f6.

Default

no data-pattern

Parameters

data-pattern

Specifies the data-pattern to fill the payload data.

Values A string of decimal or hexadecimal numbers of length in the range 1-64.

description

Syntax

[**no**] **description** *frame-description*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

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Description

This command adds a description to the frame type created to describe the purpose or identify the usage or any other such purpose.

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

Default

no description

Parameters

frame-description

An ASCII string used to describe the frame.

Values ASCII string

dscp

Syntax

[**no**] **dscp** *dscp-name*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the IP DSCP value to use in the IP header for the frame generated by the testhead tool.

This value can be specified if the **payload-type** is configured as **ipv4** or **tcp-ipv4** or **udp-ipv4** and if configured is used by the testhead tool to populate the IP DSCP field of the IP header. If it is not specified it defaults to 0 when the payload type is **ipv4**, **tcp-ipv4**, and **udp-ipv4**. The testhead tool does not use the value specified with this command if the **payload-type** is "l2".

Note:

- If both IP DSCP and IP ToS is configured, IP DSCP take precedence.
- If IP DSCP is not configured, but IP ToS is configured, the IP ToS value is used.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no dscp

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Parameters

dscp-name

Specifies the IPv4 DSCP value to use in the IP header.

Values Valid values from the list of DSCP names.

be|ef|cp1|cp2|cp3|cp4|cp5|cp6|cp7|cp9|cs1|cs2|cs3|cs4|cs5|nc1|nc2|
af11|af12|af13|af21|af22|af23|af31|af32|af33|af41|af42|af43|cp11|cp13|
cp15|cp17|cp19|cp21|cp23|cp25|cp27|cp29|cp31|cp33|cp35|cp37|cp39|
cp41|cp42|cp43|cp44|cp45|cp47|cp49|cp50|cp51|cp52|cp53|cp54|cp55|
cp57|cp58|cp59|cp60|cp61|cp62|cp63

dst-ip

Syntax

[**no**] **dst-ip ipv4** *ipv4-address*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the destination IPv4 address to use in the IP header for the frame generated by the testhead tool.

This value must be specified if the payload-type is configured as ipv4 or tcp-ipv4 or udp-ipv4. The testhead tool does not use the value specified with this command if the payload-type is "l2".

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no dst-ip, if the payload-type is set to ipv4, tcp-ipv4, udp-ipv4.

Parameters

ipv4-address

Specifies the IPv4 destination IP address to use in the IP header.

Values Valid IPv4 address specified in dotted-decimal format (that is, a.b.c.d) where a, b, c, d are decimal values in the range 1-255.

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dst-mac

Syntax

[**no**] **dst-mac** *mac-address*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

Specifies the value of source MAC address to use in the frame generated by the testhead OAM tool. Only unicast MAC address must be specified.

This value must be specified for all possible values of payload-type.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no dst-mac

Parameters

mac-address

Specify the unicast source MAC address.

Values It is specified as a hexadecimal string using the notation xx:xx:xx:xx:xx:xx. The values for xx can be in the range 0-9 and a-f.

dst-port

Syntax

[**no**] **dst-port**

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

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Description

This command specifies the destination port to use in the TCP header for the frame generated by the testhead tool.

This value must be specified if the payload-type is configured as tcp-ipv4 or udp-ipv4. The testhead tool does not use the value specified with this command if the payload-type is l2 or ipv4.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no dst-port, if the payload-type is set to tcp-ipv4 or udp-ipv4

Parameters

dst-port-number

Specifies the destination TCP/UDP port number to use in the frame's TCP/UDP header.

Values Valid TCP/UDP port number specified in decimal or hexadecimal in the range 0 to 65535.

ethertype

Syntax

[**no**] **ethertype** *ethertype-value*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the ethertype of the frame generated by the testhead tool.

This value must be specified if the payload-type is "l2". The testhead tool uses the value specified with this command only if the payload-type is "l2". For all other values of payload-type, the ethertype value used in the frame generated by the testhead tool uses specific value based on the payload-type. See the frame-payload CLI description for more information.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no ethertype, if the payload-type is set to l2, else the values used depends on the payload-type specified.

Parameters

ethertype-value

Specifies the frame payload ethertype value.

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Values Valid ethertype values specified in the range 0x0600..0xffff, as hexadecimal string.

ip-proto

Syntax

[**no**] **ip-proto** *ip-protocol-number*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the IP protocol value to use in the IP header for the frame payload generated by the testhead tool.

This value must be specified if the payload-type is configured as ipv4. If the payload-type is specified as tcp-ipv4 or udp-ipv4, the appropriate standard defined values are used. The testhead tool does not use the value specified with this command if the payload-type is "l2".

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no ip-proto

Parameters

ip-protocol-number

Specifies the IP-protocol number to use in the IP header.

Values Valid IP protocol number specified as a decimal number in the range 0-255.

ip-tos

Syntax

[**no**] **ip-tos** *type-of-service*

Context

configure>test-oam>testhead-profile>frame-payload

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Platforms

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

Description

This command specifies the IP TOS (Type of Service) value to use in the IP header for the frame generated by the testhead tool.

This value can be specified if the payload-type is configured as ipv4 or tcp-ipv4 or udp-ipv4 and if configured is used by the testhead tool to populate the IP TOS field of the IP header. If it is not specified it defaults to 0 when the payload type is ipv4, tcp-ipv4, and udp-ipv4. The testhead tool does not use the value specified with this command if the payload-type is "l2".

Note:

- If both IP DSCP and IP ToS are configured, IP DSCP takes precedence.
- If IP DSCP is not configured, but IP ToS is configured, the IP ToS value is used.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no ip-tos

Parameters

type-of-service

Specifies the value of ToS bits to use in the IP header.

Values 0 to 8

ip-ttl

Syntax

[**no**] **ip-ttl** *ttl-value*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the IP TTL (Time-to-Live) value to use in the IP header for the frame generated by the testhead tool.

This value can be specified if the payload-type is configured as ipv4 or tcp-ipv4 or udp-ipv4 and if configured is used by the testhead tool to populate the IP TTL field of the IP header. If it is not specified

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it defaults to 1 when the payload type is ipv4, tcp-ipv4, and udp-ipv4. The testhead tool does not use the value specified with this command if the payload-type is "l2".

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no ip-ttl

Parameters

ttl-value

Specifies the IP TTL value, as a decimal number, to use in the IP header.

Values 1 to 255

src-ip

Syntax

[**no**] **src-ip ipv4** *ipv4-address*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the source IPv4 address to use in the IP header for the frame generated by the testhead tool.

This value must be specified if the payload-type is configured as ipv4 or tcp-ipv4 or udp-ipv4. The testhead tool does not use the value specified with this command if the payload-type is "l2".

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no src-ip, if the payload-type is set to ipv4, tcp-ipv4, udp-ipv4.

Parameters

ipv4-address

Specifies the IPv4 source IP address to use in the IP header.

Values Valid IPv4 address specified in dotted-decimal format (that is, a.b.c.d) where a, b, c, d are decimal values in the range 1-255

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src-mac

Syntax

[**no**] **src-mac** *mac-address*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the unicast source MAC address to use in the frame generated by the testhead OAM tool.

This value must be specified for all possible values of payload-type.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no src-mac

Parameters

mac-address

Specifies the unicast source MAC address.

Values It is specified as a hexadecimal string using the notation xx:xx:xx:xx:xx:xx. The values for xx can be in the range 0 to 9 and a-f.

src-port

Syntax

[**no**] **src-port** *src-port-number*

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

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Description

This command specifies the source port to use in the TCP header for the frame generated by the testhead tool.

This value must be specified if the payload-type is configured as tcp-ipv4 or udp-ipv4. The testhead tool does not use the value specified with this command if the payload-type is l2 or ipv4.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

no src-port, if the payload-type is set to tcp-ipv4 or udp-ipv4

Parameters

src-port-number

Specifies the source TCP/UDP port number to use in the frame's TCP/UDP header.

Values Valid TCP/UDP port number specified in decimal or hexadecimal in the range 0 to 65535.

vlan-tag-1

Syntax

[**no**] **vlan-tag-1 vlan-id** *vlan-id-value* [**tpid** *tpid value*] [**dot1p** *dot1p-value*]

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the values to be used for the outermost vlan-tag (often called the outer vlan) in the frame generated by the testhead OAM tool. The tool uses the values specified for VLAN ID, dot1p bits and TPID in populating the outermost VLAN tag in the frame generated.

Configuration of this parameter is optional and it is used for all possible values of payload-type, if configured.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Note:

- The user must ensure that TPID/Ethertype configured with this command matches the QinQ Ethertype value in use on the port on which the test SAP is configured or must match 0x8100 if the test SAP is configured on a Dot1q encapsulation port, for the frame generated by the tool to be processed successfully on SAP ingress. If this value does not match the one configured under the port, frames generated by the testhead are dropped by the node on SAP ingress because of ethertype mismatch.

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- The user must ensure that VLAN ID configured with this command matches the outermost VLAN tag of the QinQ SAP or the Dot1q SAP used for the test SAP for the frame generated by the tool to be processed successfully on SAP ingress. If this value does not match the one configured for the SAP, frames generated by the testhead are dropped by the node on SAP ingress because of VLAN ID mismatch.
- The Dot1p bits specified for the outermost tag can be used for SAP ingress QoS classification.

Default

no vlan-tag-1

Parameters

vlan-id-value

Specifies the VLAN ID to use to populate the VLAN ID value of the VLAN tag. No defaults are chosen and the user has to specify a value to use, if they configure this command.

Values Values can be in the range 0 to 4094.

tpid-value

Specifies the TPID (also known as, ethertype) to use for the VLAN tag addition. It defaults to 0x8100 if user does not specify it.

Values Values can be any of the valid ethertype values allowed for use with VLAN tags in the range 0x0600..0xffff.

Dot1p-value

Specifies the Dot1p value to use to populate the Dot1p bits in the VLAN tag. It defaults to 0, if the user does not specify it.

Values Values can be in the range of 0 to 7.

vlan-tag-2

Syntax

[**no**] **vlan-tag-2 vlan-id** *vlan-id-value* [**tpid** *tpid value*] [**dot1p** *dot1p-value*]

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

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

Description

This command specifies the values to be used for the second vlan-tag (often called the inner vlan or the C-vlan) in the frame generated by the testhead OAM tool. The tool uses the values specified for VLAN ID, dot1p bits and TPID in populating the second VLAN tag in the frame generated.

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Configuration of this parameter is optional and it is used for all possible values of payload-type, if configured.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Note:

- The user must ensure that TPID/Ethertype configured with this command is 0x8100 for the frame generated by the tool to be processed successfully on SAP ingress. If this value does not match 0x8100, frames generated by the testhead are dropped by the node on SAP ingress because of Ethertype mismatch (7210 supports only 0x8100 as the Ethertype value for the inner vlan tag).
- The user must ensure that VLAN ID configured with this command matches the outermost VLAN tag of the QinQ SAP or the Dot1q SAP used for the test SAP for the frame generated by the tool to be processed successfully on SAP ingress. If this value does not match the one configured for the SAP, frames generated by the testhead are dropped by the node on SAP ingress because of VLAN ID mismatch.
- The Dot1p bits specified for the outermost tag can be used for SAP ingress QoS classification.

Default

no vlan-tag-2

Parameters

vlan-id-value

Specifies the VLAN ID to use to populate the VLAN ID value of the VLAN tag. No defaults are chosen and user has to specify a value to use, if they configure this command.

Values Values can be in the range 0 to 4094.

tpid-value

Specifies the TPID (also referred to as, ethertype) to use for the VLAN tag addition. It defaults to 0x8100 if user does not specify it.

Values Values can be any of the valid ethertype values allowed for use with VLAN tags in the range 0x0600..0xffff.

Dot1p-value

Specifies the Dot1p value to use to populate the Dot1p bits in the VLAN tag. It defaults to 0, if the user does not specify it.

Values Values can be in the range of 0 to 7

frame-size

Syntax

[**no**] **frame-size** [64 to 9212]

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Context

config>test-oam>testhead-profile

Platforms

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

Description

This command specifies the frame size of the packets generated by the testhead tool. Any frame size in the specific range can be specified.

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

Default

1514

Parameters

frame-size

Specifies the size, in bytes, of the frame generated by the testhead tool.

Values 64 to 9212

rate

Syntax

rate cir *cir-rate-in-kbps* [**adaptation-rule** *adaptation-rule*] [**pir** *pir-rate-in-kbps*]

no rate

Context

config>test-oam>testhead-profile

Platforms

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

Description

This command configures the committed information rate (CIR) and peak information rate (PIR) for a testhead profile.

Note:
The testhead uses the Layer 2 rate, which is calculated by subtracting the Layer 1 overhead that is caused when the IFG and Preamble are added to every Ethernet frame (typically about 20 bytes (IFG = 12 bytes and Preamble = 8 bytes)). The testhead tool uses the user-configured frame size to compute the Layer 2 rate and does not allow the user to configure a value greater

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than that rate. For 512-byte Ethernet frames, the L2 rate is 962406 Kb/s and the Layer 1 rate is 1 Gb/s.

If the optional PIR rate is not specified, the testhead tool generates traffic up to the configured CIR rate. The CIR rate specifies the bandwidth or throughput that the user needs to validate. If specified, the PIR value must be greater than or equal to the CIR value. The testhead tool then generates traffic up to the configured PIR value.

Configure the **adaptation-rule** parameter to derive the operational hardware rate for both the CIR and PIR. The software finds the best operational rate based on the user-specified constraint and the hardware-based rate supported on the platform. See the *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* for more information about the hardware rate steps supported for testhead traffic generator meters on different platforms.

The **no** form of this command sets the CIR to the default value; the PIR value is not set. Consequently, if the testhead tool is run after the **no rate** command is run, the test generates traffic up to the configured CIR rate.

Default

rate cir 1000 adaptation-rule closest

Parameters

cir-rate-in-kbps

Specifies the **cir** parameter, in kilobits per second (Kb/s), which overrides the default CIR value. The configured value must be a positive integer; fractional values are not allowed. The actual CIR rate depends on the meter **adaptation-rule** parameters and the hardware. If the **rate** command is not executed or the CIR parameter is not explicitly configured, the default CIR value applies.

Values 0 to 10000000, max

adaptation-rule

Specifies the constraints enforced when adapting the CIR and PIR, defined using the **rate** command, to the hardware rates supported by the platform. The **adaptation-rule** parameter requires a qualifier that defines the constraint used to derive the operational CIR and PIR. If the **adaptation-rule** is not specified, the default of **closest** applies. The **max** (maximum), **min** (minimum), and **closest** qualifiers are mutually exclusive.

Default closest

Values **max** — Specifies that the operational PIR or CIR value is equal to or less than the specified rate, taking into account the hardware step size. The hardware step size varies based on the rate and the platform.

min — Specifies that the operational PIR or CIR value is equal to or greater than the specified rate, taking into account the hardware step size. The hardware step size varies based on the rate and the platform.

closest — Specifies that the operational PIR or CIR value is equal to the closest specified rate, taking into account the hardware step size. The hardware step size varies based on the rate and the platform.

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pir-rate-in-kbps

Specifies the **pir** parameter, in kilobits per second (Kb/s), which overrides the default administrative PIR value. The configured value must be a positive integer; fractional values are not allowed. The actual PIR rate depends on the meter **adaptation-rule** parameters and the hardware. If the **rate** command is not executed or the PIR parameter is not explicitly specified, the default PIR value is used.

Values 0 to 10000000, max

test-completion-trap-enable

Syntax

[**no**] **test-completion-trap-enable**

Context

configure>test-oam>testhead-profile

Platforms

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

Description

This command specifies that the test completion trap needs to be generated after the completion of the test or if the test is stopped. The trap contains the details of test configuration, the measured values, test completion status and PASS or FAIL result.

The **no** form of this command disables the generation of the event/log/trap after test completion.

Default

no test-completion-trap-enable

test-duration

Syntax

test-duration {[**hours** *hours*] [**minutes** *minutes*] [**seconds** *seconds*]}

Context

config>test-oam>testhead-profile

Platforms

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

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Description

This command specifies the total test duration to be used for throughput measurement. The **hours**, **minutes**, and **seconds** specify the total duration of the throughput measurement. If all the parameters are specified together, the total test duration is set to the sum of the values specified for **hours**, **minutes** and **seconds**.

The **no** form of this command sets the value to the default value

Default

3 minutes

Parameters

hours

Specifies the total number of hours to run the test. The total test duration is determined by the sum of the hours, minutes and seconds specified by the user.

Values 0 to 24

minutes

Specifies the total number of minutes to run the test. The total test duration is determined by the sum of the hours, minutes and seconds specified by the user.

Values 0 to 60

seconds

Specifies the total number of seconds to run the test. The total test duration is determined by the sum of the hours, minutes and seconds specified by the user.

Values 0 to 60

3.8.2.7.38 OAM testhead commands

testhead

Syntax

testhead *test-name* [**owner** *owner-name*] **testhead-profile** *profile-id* [**frame-payload** *frame-payload-id*] **sap** *sap-id* [**fc** *fc-name*] [**acceptance-criteria** *acceptance-criteria-id* [**color-aware enable** | **disable**]] [**enforce-fc-check enable** | **disable**]

testhead *test-name* [**owner** *owner-name*] **stop**

Context

oam

Platforms

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

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Description

This command executes the throughput test by generating traffic up to the configured rate and measuring the delay, delay-variation, and frame-loss ratio. At the end of the test run, the **testhead** command compares the measured values against the test acceptance criteria that is specified to determine whether the service is within bounds of the acceptance criteria. It reports a pass if the configured rate thresholds are achieved and the measured performance parameter (that is, latency, jitter, and FLR) values are less than the thresholds configured in the acceptance criteria. It reports a failure if the configured rate thresholds are not achieved or if any of the measured values for the performance parameters exceeds the thresholds configured in the acceptance criteria.

The user must specify the **testhead-profile** parameter, which determines traffic generation rate and the content of the frames used for traffic generation. If both the CIR and PIR is specified, or if only the PIR is specified (by setting CIR to zero), the tool generates traffic up to the configured PIR. If only the CIR is specified, the tool generates traffic up to the configured CIR.

If the **acceptance-criteria** parameter is not specified and **color-aware** is set to **disable** by default, the software displays the test result as "PASS" if the frame loss is zero and desired rate is achieved. For comparison with the measured rate, the test uses the configured CIR, if only the CIR is configured, or it uses the PIR, if either only the PIR is specified or both the CIR and PIR are set to non-zero values. Measured values of latency, jitter, and delay variation are not compared.

If the **acceptance-criteria** parameter is not specified and **color-aware** is set to **enable**, the software displays the test result as "PASS" if the measured CIR and PIR match the configured CIR and PIR values and frame loss is zero, or if one of the following is true:

- the measured throughput rate (CIR + PIR) is equal to the configured CIR rate and if no PIR rate is configured
- the measured throughput rate (CIR + PIR) is equal to the configured PIR rate and if either no CIR rate is configured or if the CIR rate is configured

Otherwise, the test is declared failed. Measured values of latency, jitter, and delay variation are not compared.

If **acceptance-criteria** is specified and **color-aware** is set to **enable**, the test uses the configured packet header marking values (dot1p) to identify the color of the packet and classify it as green (in-profile) or yellow (out-of-profile). It measures the green packet (CIR) and the green/in-profile packet performance parameter values and the yellow packet rate (PIR) and the yellow/out-of-profile packet performance parameter values individually based on the packet markings. In addition to comparing the measured performance parameter values against the normal performance parameter threshold values (if enabled), if the user has enabled in/out thresholds for performance parameters in the acceptance criteria, the tool uses these values to compare against the measured values and declare a pass or fail result. The tool uses the *cir-threshold* and *pir-threshold* to compare against the measured CIR and PIR throughput rates and declare pass or fail if the thresholds specified by the *cir-threshold* and *pir-threshold* are achieved.



Note:
When **color-aware** mode is set to **enable**, the marking values used to identify both in-profile/green packet and out-of-profile/yellow packet must be configured. If either of the packet header marking values (for example, dot1p) is not configured by the user, the CLI displays an error.

If **acceptance-criteria** is specified and **color-aware** is set to **disable**, the tests are color blind (not color-aware). The tool does not use the configured packet header marking values to identify the color of the packet and treats all packets the same. The tool uses the normal thresholds configured in the **acceptance-criteria** (that is, the threshold values other than the in/out profile thresholds) to compare the measured

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values and declare a pass or fail result. The tool does not attempt to compare the in/out thresholds against measured values. The tool uses the *cir-threshold* and *pir-threshold* as follows.

- If no PIR is configured and if the measured throughput rate is equal to the configured *cir-threshold* rate, the desired rate is said to have been achieved and the tests continue to compare the measured performance parameter thresholds with the configured performance parameter thresholds (if any).
- If PIR rate is configured and no CIR is configured and if the measured throughput rate is equal to the configured *pir-threshold* rate, the desired rate is said to have been achieved and the tests continue to compare the measured performance parameter thresholds with the configured performance parameter thresholds (if any).
- If PIR is configured and CIR is configured, and if the measured throughput rate is equal to the configured *pir-threshold* rate, the desired rate is said to have been achieved and the tests continue to compare the measured performance parameter thresholds with the configured performance parameter thresholds (if any).

The *test-name* and *owner-name* together uniquely identify a particular testhead invocation or session. The results of the testhead session are associated with the *test-name* and *owner-name*. Use these parameters to display the results of the testhead tool and to clear the results of a completed run. Multiple invocations of the testhead tool with the same *test-name* and *owner-name* is not allowed if the results of the old run using the same pair of *test-name* and *owner-name* are present. That is, the results are not overwritten when the testhead is invoked again with the same values for *test-name* and *owner-name*. The results must be cleared explicitly using the **clear** command before invoking the testhead tool with the same *test-name* and *owner-name*. Results for up to 100 unique sessions, each using a different *test-name* and *owner-name*, are saved in memory (that is, the results are not available for use after a reboot).

Note:
The **testhead** command is not saved in the configuration file after a reboot.

See Prerequisites for using the testhead tool for more information.

Parameters

test-name

Specifies the test name as an ASCII string up to 32 characters.

owner *test-owner*

Specifies the testhead operation owner as an ASCII string up to 32 characters.

testhead-profile *profile-id*

Specifies the testhead profile ID to use with this run or session of testhead invocation. The user must configure the testhead profile beforehand using the commands in **config**>**test-oam**>**testhead-profile** context.

Values 1 to 10

frame-payload *frame-payload-id*

Specifies the frame payload ID to use for this run. It configures the parameters used to construct the frame generated by the testhead tool. If this parameter is not specified, the run, by default, uses parameters configured under *frame-payload-id* 1.

Values 1 to 4

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acceptance-criteria *acceptance-criteria-id*

Specifies the test acceptance criteria parameters to use for this run. It identifies the parameters used to compare the measured performance values against the configured thresholds configured in the acceptance criteria. If this parameter is not specified, the run is declared pass if the throughput configured in the testhead-profile is achieved without any loss.

Values 1 to 4

color-aware enable | disable

Keyword to execute color-aware tests. If set to **enable**, the color-aware test is enabled. If set to **disable**, the non-color-ware test is enabled.

Default disable

sap *sap-id*

Specifies the test SAP. This parameter must be specified by the user.

See Configuration guidelines for more information.

Values null - <port-id|lag-id>

dot1q - <port-id|lag-id>:qtag1

qinq - <port-id|lag-id>:qtag1.qtag2

port-id - slot/mda/port

lag-id - lag-<id>

lag - keyword

id - [1 to 200]

qtag1 - [0 to 4094]

qtag2 - [*|1 to 4094]

fc *fc-name*

Specifies the forwarding class (FC) to use to send the frames generated by the testhead tool.

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

stop

Keyword to stop the currently running test, if there is one. All performance results based on the data available up to the time the test is stopped are used to determine the pass or fail criteria. Additionally, the test-status displays "Stopped" and test completion status is marked "Incomplete" or "No".

enforce-fc-check enable | disable

Keyword to enable or disable a check on the local node where the testhead OAM tool is run. The check ensures that the traffic generated by the testhead tool is received in the queue corresponding to the FC specified by the **fc** *fc-name* parameter.

Default disable

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3.8.2.8 OAM Performance Monitoring, bin group, and session commands

oam-pm

Syntax

oam-pm session *session-name* {**dmm** | **slm** | **twamp-light**} {**start** | **stop**}

Context

oam

Platforms

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

Description

This command allows the operator to start and stop on-demand OAM-PM sessions.

Parameters

session-name

Identifies the session name, up to 32 characters, that the test is associated with.

dmm

Specifies the DMM test that is affected by the command.

slm

Specifies the SLM test that is affected by the command.

twamp-light

Specifies the TWAMP-Light test that is affected by the command.

start

Keyword to manually start the test.

stop

Keyword to manually stop the test.

oam-pm

Syntax

oam-pm

Context

config

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Platforms

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

Description

Commands in this context configure storage parameters (including binning structures), availability/ resiliency, and the individual proactive and on-demand tests used to gather performance and statistical data.

bin-group

Syntax

bin-group *bin-group-number* [**fd-bin-count** *fd-bin-count* **fdr-bin-count** *fdr-bin-count* **ifdv-bin-count** *ifdv-bin-count* **create**]

no bin-group *bin-group-number*

Context

config>oam-pm

Platforms

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

Description

This command configures the parameters for a specific bin group. Bin-group 1 is a default bin group and cannot be modified. If no bin group is assigned to an OAM-PM session, bin-group 1 is assigned by default. The default values for bin-group 1 are **fd-bin-count** 3 **bin** 1 **lower-bound** 5000 **bin** 2 **lower-bound** 10000, **fdr-bin-count** 2 **bin** 1 **lower-bound** 5000, and **ifdv-bin-count** 2 **bin** 1 **lower-bound** 5000.

The **no** form of this command removes the specified bin group.

Parameters

bin-group-number

Specifies the numerical identifier for a bin group. A bin group can only shut down and modified when all of the PM sessions referencing the bin group have been shut down. The bin group **description** may still be modified for active bin groups.

Values 1 to 255

fd-bin-count

Specifies the number of frame delay bins that are created.

Values 2 to 10

fdr-bin-count

Specifies the number of frame delay range bins that are created.

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Values 2 to 10

ifdv-bin-count

Specifies the number of inter-frame delay variation bins that are created.

Values 2 to 10

create

Creates the specified bin group.

bin-type

Syntax

bin-type {**fd** | **fdr** | **ifdv**}

no bin-type

Context

config>oam-pm>bin-group

Platforms

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

Description

This command enables the specified delay metric configuration context.

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

Default

bin-type fd

Parameters

fd

Enters the frame delay bin threshold configuration context.

fdr

Enters the frame delay range bin threshold configuration context.

ifdv

Enters the inter-frame delay variation bin threshold configuration context.

bin

Syntax

bin *bin-number*

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Context

config>oam-pm>bin-group>bin

Platforms

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

Description

This command configures the floor threshold for an individual bin.

Parameters

bin-number

Specifies the bin to configure.

Values 1 to 9

lower-bound

Syntax

lower-bound *microseconds*

no lower-bound

Context

config>oam-pm>bin-group>bin-type>bin

Platforms

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

Description

This command configures the lower threshold for an individual bin. The operator does not have to specific a lower threshold for every bin that was previously defined by the bin-count for the specific type. By default, the lower threshold for each bin is the bin-number * 5000 microseconds. Lower thresholds in the previous adjacent bin must be lower than the threshold of the next higher bin threshold; otherwise, an error prevents the bin from entering the active state when the **no shutdown** command is issued for the bin group. Bin 0 is the result of the difference between 0 and the configured **lower-bound** of bin 1. The highest bin in the bin-count captures every result above the threshold. Any negative delay metric result is treated as zero and placed in bin 0.

The **no** form of this command restores the default threshold for the bin.

Parameters

microseconds

Specifies the lower threshold for the bin, in microseconds.

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Values 1 to 4294967295

Default bin-number * 5000

delay-event

Syntax

delay-event {**forward** | **backward** | **round-trip**} **lowest-bin** *bin-number*

threshold *raise-threshold* [**clear** *clear-threshold*]

[**no**] **delay-event** {**forward** | **backward** | **round-trip**}

Context

config>oam-pm>bin-group>bin-type

Platforms

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

Description

This command configures the bin number, threshold, and direction that are monitored to determine if a delay metric threshold crossing event has occurred or has cleared. It requires a bin number, a rising threshold value and a direction. If the [**clear** *threshold*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous window. When a raise threshold is reached, the log event is generated. Each unique threshold can only be raised once for the threshold within measurement interval. If the optional clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised another is not raised until a measurement interval completes, and the clear threshold has not been exceeded. A clear event is raised under that condition. In general, alarms are generated when there is a state change. The thresholds configured are applied to the count in specified bin and all higher number bins.

The **no** version of this command removes thresholding for this delay metric. The complete command must be configured to remove the specific threshold.

Default

[no] delay-events

Parameters

forward

Specifies that the threshold is applied to the forward direction bin.

backward

Specifies that the threshold is applied to the backward direction bin.

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round-trip

Specifies that the threshold is applied to the roundtrip direction bin.

lowest-bin *bin-number*

Specifies the number of the bin to which the threshold is applied. This bin and all higher bins monitor the sum total results in these bins to determine if they have reached or crossed the configured threshold.

Values 0 to 9

threshold *raise-threshold*

Specifies the rising numerical value in the range that determines when the event is to be generated, when value reached.

Values 1 to 864000

clear *clear-threshold*

Specifies an optional numerical value in the range threshold used to indicate stateful behavior that allows the operator to configure a lower value than the rising threshold that determines when the clear event should be generated. Clear is generated when the end of measurement interval count is less than or equal to the configured value. If this option is not configured, the behavior is stateless. Zero means no results can existing in the lower bin or any higher.

Values 0 to 863999

Default clear threshold disabled

description

Syntax

description *description-string*

no description

Context

config>oam-pm>bin-group

config>oam-pm>session

Platforms

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

Description

This command creates a text description stored in the configuration file for a configuration context. The description command associates a text string with a configuration context to help identify the content in the configuration file.

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

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Parameters

description-string

Specifies the description character string. Allowed values are any characters up to 80 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed in double quotes.

shutdown

Syntax

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

Context

config>oam-pm>bin-group

config>oam-pm>session>ethernet>dmm

config>oam-pm>session>ethernet>slm

Platforms

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

Description

This command activates and deactivates the bin group or test.

When a bin group is active, only the description of the bin group can be modified. The bin group can only be shut down and modified when all references in the various PM sessions or individual tests have been shut down. If an active PM session is referencing the bin group, it generates an error indicating there are a number of active tests referencing the bin group, and it cannot be shut down.

When a test is shut down, no active measurements are made and any outstanding requests are ignored. If the test is started or stopped during a measurement interval, the suspect flag is set to "yes" to indicate that the data for the specific data set is in questionable.

The **no** form of this command activates the bin group or test.

session

Syntax

session *session-name* [**test-family** {**ethernet** | **ip**} [**session-type** {**proactive** | **on-demand**}] **create**]

no session *session-name*

Context

config>oam-pm

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Platforms

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

Description

This command configures the individual session containers that house the test-specific configuration parameters. Since this session context provides only a container abstract to house the individual test functions, it cannot be shut down. Only individual tests sessions within the container may be shut down. No values, parameters, or configuration within this context may be changed if any individual test is active. Changes may only be made when all tests within the context are shut down, with the exception of the **description**.

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

Parameters

session-name

Specifies the name of the session container. 32 characters maximum.

ethernet

Specifies that the test is based on the Ethernet layer.

ip

Specifies that the test is based on the IP layer.

proactive

Specifies that the test is always on, with no stop. Tests are proactive by default.

on-demand

Specifies that the test runs on demand, with an immediate start and no stop, or a stop based on offset.

create

Creates the session container.

bin-group

Syntax

bin-group *bin-group-number*

no bin-group

Context

config>oam-pm>session

Platforms

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

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Description

This command links the individual test to the group of bins that map the probe responses.

The **no** form of this command installs the default **bin-group** 1 as the bin group for the session.

Default

bin-group 1

Parameters

bin-group-number

Specifies the number of the bin-group that is referenced during this session.

Values 1 to 255

ethernet

Syntax

ethernet

Context

config>oam-pm>session

Platforms

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

Description

Commands in this context configure Ethernet-specific source and destination information, priority, and Ethernet test tools on the launch point.

dest-mac

Syntax

dest-mac *ieee-address*

no dest-mac

Context

config>oam-pm>session>ethernet

Platforms

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

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Description

This command defines the destination MAC address of the peer MEP and sets the destination MAC address in the Layer 2 header to match. This must be a unicast address.

The **no** form of this command removes the session parameter.

Parameters

ieee-address

Specifies the Layer 2 unicast MAC address of the destination MEP.

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

dmm

Syntax

dmm [**test-id** *test-id*] [**create**]

no dmm

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command configures the test ID to be assigned to the delay test, and creates the container to allow the individual test parameters to be configured.

The **no** form of this command removes the DMM test function from the PM session.

Parameters

test-id

Specifies the value to be placed in the 4-byte test ID field of the ETH-DMM PDU.

Values 0 to 2147483647

create

Creates the test.

data-tlv-size

Syntax

data-tlv-size *octets*

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no data-tlv-size

Context

config>oam-pm>session>ethernet>dmm

config>oam-pm>session>ethernet>slm

Platforms

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

Description

This command is used to add an optional Data TLV to the PDU and increase the frame on the wire by the specified amount. This value is not the total size of the frame on the wire, but rather the size of the additional padding added to the PDU.

The **no** form of this command removes the optional TLV.

Default

data-tlv-size 0

Parameters

octets

Specifies the size of the optional Data TLV, in octets.

Values 0, 3 to 2000

interval

Syntax

interval *milliseconds*

no interval

Context

config>oam-pm>session>ethernet>dmm

Platforms

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

Description

This command configures the message period, or probe spacing, for the transmission of DMM frames.

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

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Default

interval 1000

Parameters

milliseconds

Specifies the number of milliseconds between the transmission of DMM frames. The default value for the DMM interval is intentionally different from the default value for the SLM interval.

Values 100, 1000, 10000 (7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-T)

50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000 (7210 SAS-Mxp)

test-duration

Syntax

test-duration *seconds*

no test-duration

Context

config>oam-pm>session>ethernet>dmm

config>oam-pm>session>ethernet>slm

Platforms

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

Description

This command defines the length of time the test runs before stopping automatically. This command is only a valid option when a **session** has been configured with a **session-type** of **on-demand**. This is not an option when the **session-type** is configured as **proactive**. All tests start immediately following the execution of a **no shutdown** command.

The test duration value, remaining time, or completed state, is not synchronized with the backup CPM. This means that a failover re-launches any active test without regard to the **test-duration** timer on the previously active CPM. When the test starts on the newly active CPM, the **test-duration** is reset to the beginning.

The **no** form of this command removes a previously configured **test-duration** and allows the test to execute until manually stopped.

Parameters

seconds

Specifies the interval, in seconds, during which the test continues to execute after the start time.

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Values 1 to 86400

priority

Syntax

priority *priority*

no priority

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command configures the CoS priority across all tests configured under this session. This CoS value is exposed to the various QoS policies the frame passes through and does not necessarily map directly to the CoS value on the wire.

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

Default

0

Parameters

priority

Specifies the CoS priority value.

Values 0 to 7

slm

Syntax

slm [**test-id** *test-id*] [**create**]

no slm

Context

config>oam-pm>session>ethernet

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Platforms

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

Description

This command configures the test ID to be assigned to the synthetic loss test, and creates the container to allow the individual test parameters to be configured.

The **no** form of this command removes the SLM test function from the PM session.

Parameters

test-id

Specifies the value to be placed in the 4-byte test ID field of the ETH-SLM PDU.

Values 0 to 2147483647

create

Creates the test.

flr-threshold

Syntax

flr-threshold *percentage*

no flr-threshold

Context

config>oam-pm>session>ethernet>slm

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

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

Description

This command configures the frame loss threshold that is used to determine whether the delta-t is available or unavailable. An individual delta-t with a frame loss threshold equal to or higher than the configured threshold is marked unavailable. An individual delta-t with a frame loss threshold lower than the configured threshold is marked as available.

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

Default

flr-threshold 50

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Parameters

percentage

Specifies the percentage of the threshold.

Values 50

loss-events

Syntax

loss-events

Context

config>oam-pm>session>ethernet>slm

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This context enables the context to define the loss events and thresholds that are to be tracked.

avg-flr-event

Syntax

avg-flr-event {**forward** | **backward**} **threshold** *raise-threshold-percent* [**clear** *clear-threshold-percent*]

[**no**] **avg-flr-event** {**forward** | **backward**}

Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

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

Description

This command sets the frame loss ratio threshold configuration that is applied and checked at the end of the measurement interval for the specified direction. This is a percentage based on average frame loss ratio over the entire measurement interval. If [**clear** *clear-threshold-percent*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous

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window. Each unique event can only be raised once within measurement interval. If the optional clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised, another is not raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** version of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

Default

no avg-flr-event forward

no avg-flr-event backward

Parameters

forward

Specifies that the threshold is applied to the forward direction value.

backward

Specifies that the threshold is applied to the backward direction value.

threshold *raise-threshold-percent*

Specifies the rising percentage that determines when the event is to be generated.

Values 0.001 to 100.000

clear *clear-threshold-percent*

Specifies an optional value used for stateful behavior that allows the operator to configure a percentage of loss value lower than the rising percentage to indicate when the clear event should be generated.

Values 0.000 to 99.999 A value 0.000 means there FLR must be 0.000.

chli-event

Syntax

chli-event {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

[**no**] **chli-event** {**forward** | **backward** | **aggregate**}

Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

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

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Description

This command sets the consecutive high loss interval (CHLI) threshold to be monitored and the associated thresholds using the counter of the specified direction. The aggregate is a function of summing forward and backward. This value is only used as a threshold mechanism and is not part of the stored statistics. If [**clear** *clear-threshold*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous window. Each unique event can only be raised once within measurement interval. If the optional clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised, another is not raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** version of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

Default

no chli-event forward

no chli-event backward

no chli-event aggregate

Parameters

forward

Specifies that the threshold is applied to the forward direction count.

backward

Specifies that the threshold is applied to the backward direction count.

aggregate

Specifies that the threshold is applied to the aggregate count (sum of forward and backward).

threshold *raise-threshold*

Specifies a numerical value compared to the CHLI counter that is the rising threshold that determines when the event is to be generated, when the percentage of loss value is reached.

Values 1 to 864000

clear *clear-threshold*

Specifies an optional numerical value compared to the CHLI counter used for stateful behavior that allows the operator to configure a value lower than the rising percentage to indicate when the clear event should be generated.

Values 0 to 863999 A value of zero means the CHLI counter must be 0.

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hli-event

Syntax

hli-event {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

[**no**] **hli-event** {**forward** | **backward** | **aggregate**}

Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

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

Description

This command sets the high loss interval (HLI) threshold to be monitored and the associated thresholds using the counter of the specified direction. The aggregate is a function of summing forward and backward. This value is only used as a threshold mechanism and is not part of the stored statistics. If the [**clear** *clear-threshold*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous window. Each unique event can only be raised once within measurement interval. If the optional clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised, another is not raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** version of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

Default

no hli-event backward

no hli-event aggregate

Parameters

forward

Specifies that the threshold is applied to the forward direction count.

backward

Specifies that the threshold is applied to the backward direction count.

aggregate

Specifies that the threshold is applied to the aggregate count (sum of forward and backward).

threshold *raise-threshold*

Specifies the rising threshold that determines when the event is to be generated, when the percentage of loss value is reached.

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Values 1 to 864000

clear *clear-threshold*

Specifies an optional value used for stateful behavior that allows the operator to configure a percentage of loss value lower than the rising percentage to indicate when the clear event should be generated.

Values 0 to 863999 A value of zero means the HLI counter must be 0.

unavailability-event

Syntax

unavailability-event {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

[**no**] **unavailability-event** {**forward** | **backward** | **aggregate**}

Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

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

Description

This command sets the threshold to be applied to the overall count of the unavailability indicators, not transitions, per configured direction. This value is compared to the 32 bit unavailability counter specific to the direction which tracks the number of individual delta-ts that have been recorded as unavailable. The aggregate is a function of summing forward and backward. This value is only used as a threshold mechanism and is not part of the stored statistics. If the [**clear** *clear-threshold*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous window. Each unique event can only be raised once within measurement interval. If the optional clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised, another is not raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** version of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

Default

no unavailable-event forward

no unavailable-event backward

no unavailable-event aggregate

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Parameters

forward

Specifies that the threshold is applied to the forward direction count.

backward

Specifies that the threshold is applied to the backward direction count.

aggregate

Specifies that the threshold is applied to the aggregate count (sum of forward and backward).

threshold

Specifies a numerical value compared to the unavailability counter that is the rising threshold that determines when the event is to be generated, when value reached

Values 1 to 864000

clear *clear-threshold*

an optional value used for stateful behavior that allows the operator to configure a percentage of loss value lower than the rising percentage to indicate when the clear event should be generated

Values 0 to 863999 A value of zero means the unavailability counter must be 0

undet-availability-event

Syntax

undet-availability-event {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

[**no**] **undet-availability-event** {**forward** | **backward** | **aggregate**}

Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

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

Description

This command sets the threshold to be applied to the overall count of the undetermined availability indicators, not transitions, per configured direction. This value is compared to the 32 bit unavailability counter specific to the direction which tracks the number of individual delta-ts that have been recorded as undetermined available. The aggregate is a function of summing forward and backward. This value is only used as a threshold mechanism and is not part of the stored statistics. If the [**clear** *clear-threshold*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous window. Each unique event can only be raised once within measurement interval. If the optional

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clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised, another is not raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** version of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

Default

no undetermined-available-event forward

no undetermined-available-event backward

no undetermined-available-event aggregate

Parameters

forward

Specifies that the threshold is applied to the forward direction count.

backward

Specifies that the threshold is applied to the backward direction count.

aggregate

Specifies that the threshold is applied to the aggregate count (sum of forward and backward).

threshold *raise-threshold*

Specifies the rising threshold that determines when the event is to be generated, when value reached.

Values 1 to 864000

clear *clear-threshold*

Specifies an optional value used for stateful behavior that allows the operator to configure a percentage of loss value lower than the rising percentage to indicate when the clear event should be generated

Values 0 to 863999 A value of zero means the undetermined availability counter must be 0.

undet-unavailability-event

Syntax

undet-availability-event {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

[**no**] **undet-availability-event** {**forward** | **backward** | **aggregate**}

Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

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Platforms

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

Description

This command sets the threshold to be applied to the overall count of the undetermined unavailability indicators, not transitions, per configured direction. This value is compared to the 32 bit unavailability counter specific to the direction which tracks the number of individual delta-ts that have been recorded as undetermined unavailable. The aggregate is a function of summing forward and backward. This value is only used as a threshold mechanism and is not part of the stored statistics. If the [**clear** *clear-threshold*] is not specified, the traffic crossing alarm is stateless. Stateless means the state is not carried forward to other measurement intervals. Each measurement interval is analyzed independently and without regard to any previous window. Each unique event can only be raised once within measurement interval. If the optional clear threshold is specified, the traffic crossing alarm uses stateful behavior. Stateful means each unique previous event state is carried forward to following measurement intervals. If a threshold crossing event is raised, another is not raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** version of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

Default

no undet-unavailable-event forward

no undet-unavailable-event backward

no undet-unavailable-event aggregate

Parameters

forward

Specifies that the threshold is applied to the forward direction count.

backward

Specifies that the threshold is applied to the backward direction count.

aggregate

Specifies that the threshold is applied to the aggregate count (sum of forward and backward).

threshold *raise-threshold*

Specifies the rising threshold that determines when the event is to be generated, when value reached.

Values 1 to 864000

clear *clear-threshold*

Specifies an optional value used for stateful behavior that allows the operator to configure a percentage of loss value lower than the rising percentage to indicate when the clear event should be generated.

Values 0 to 863999 A value of zero means the undetermined availability counter must be 0.

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timing

Syntax

timing frames-per-delta-t *frames* **consec-delta-t** *deltas* **interval** *milliseconds* **chli-threshold** *threshold*

no timing

Context

config>oam-pm>session>ethernet>slm

Platforms

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

Description

This command configures various availability parameters and the probe spacing (interval) for the SLM frames. The maximum size of the availability window must not exceed 10 s (10000 ms).

The **no** form of this command installs the default values for all timing parameters and uses those values to compute availability and set the SLM frequency. If an SLM test is active, it always has timing parameters, whether default or operator-configured.

Default

timing frames-per-delta-t 10 consec-delta-t 10 interval 100 chli-threshold 5

Parameters

frames

Specifies the number of frames that define the size of the delta-t. Each delta-t is marked as available or unavailable based on the **flr-threshold**. The size of the delta-t measurement is the product of the number of frames and the interval.

Values 1 to 50

deltas

Specifies the number of consecutive delta-ts that make up the sliding window over which availability and unavailability is determined. Transitions from one state to another occur when the consecutive delta-ts are in a new state.

Values 2 to 10

milliseconds

Specifies the number of milliseconds between the transmission of the SLM frames. The default value for the SLM interval is intentionally different from the default interval for DMM.

Values 100, 1000 (7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-T)

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50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000
(7210 SAS-Mxp)

threshold

Specifies the number of consecutive unavailable delta-ts that cause the CHLI counter to be incremented. A CHLI counter is an indication that the sliding window is available but has crossed a threshold of consecutive unavailable delta-t intervals. A CHLI can only be incremented once during a sliding window and is only incremented during times of availability.

Values 1 to 9

source

Syntax

source mep *mep-id* **domain** *md-index* **association** *ma-index*

no source

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command configures the source launch point for Y.1731 parameters that are used by the individual tests within the session. If an MEP matching the configuration does not exist, the session is allowed to become active; however, the frames sent and received as seen under the **show**>**oam-pm**>**statistics**>**session** *session-name* command are zero.

The **no** form of this command removes this session parameter.

Parameters

mep-id

Specifies the maintenance association end point identifier of the launch point.

Values 1 to 8191

md-index

Specifies the maintenance domain (MD) index value of the launch point.

Values 1 to 4294967295

ma-index

Specifies the maintenance association (MA) index value of the launch point.

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Values 1 to 4294967295

meas-interval

Syntax

meas-interval {**5-mins** | **15-mins** | **1-hour** | **1-day**} [**create**]

no meas-interval

Context

config>oam-pm>session

Platforms

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

Description

This command establishes the parameters of the individual measurement intervals used by the session. A maximum of three different measurement intervals may be configured under each session.

The **no** form of this command deletes the specified measurement interval.

Parameters

5-mins

Specifies a 5 minute measurement interval duration.

15-mins

Specifies a 15 minute measurement interval duration.

1-hour

Specifies a 1 hour measurement interval duration.

1-day

Specifies a 1 day measurement interval duration.

create

Creates the measurement interval.

accounting-policy

Syntax

accounting-policy *acct-policy-id*

no accounting-policy

Context

config>oam-pm>session>meas-interval

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Platforms

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

Description

This command assigns a record-type of complete-pm to the specified accounting policy (configured using the **config**>**log**>**accounting-policy** command). This runs the data collection process for completed measurement intervals in memory, file storage, and maintenance functions, moving data from memory to flash. A single accounting policy can be applied to a measurement interval.

The **no** form of this command removes the accounting policy.

Parameters

acct-policy-id

Specifies the accounting policy to be applied to the measurement interval.

Values 1 to 99

boundary-type

Syntax

boundary-type {**clock-aligned** | **test-relative**}

no boundary-type

Context

config>oam-pm>session>meas-interval

Platforms

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

Description

This command establishes the alignment of the start of the measurement interval with either the time of day clock or the start of the test.

Test-relative start times launch the measurement interval when the individual test enters the active **no shutdown** state.

Alignment with the time of day clock always defaults to the representative top of the hour. Clocks aligned at 15-minute measurement intervals divide the hour into four equal sections at 00, 15, 30, and 45. Clocks aligned at 1-hour measurement intervals start at 00. Clocks aligned at 1-day measurement intervals start at midnight. It is typical for the first measurement interval of a clock-aligned test to have the suspect flag set to yes because it is unlikely that the **no shutdown** command exactly corresponds to the clock-based measurement interval start time. Clock-aligned measurement intervals can include an additional offset. See the **clock-offset** command option under this context.

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

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Default

boundary-type clock-aligned

Parameters

clock-aligned

Aligns the start of the measurement interval with the time of day clock.

test-relative

Aligns the start of the measurement interval with the start of the test.

clock-offset

Syntax

clock-offset *seconds*

no clock-offset

Context

config>oam-pm>session>meas-interval

Platforms

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

Description

This command configures an offset between measurement intervals with a boundary-type of clock-aligned and the default time of day clock. The configured offset must be smaller than the size of the measurement interval. As an example, an offset of 300 seconds shifts the start times of the measurement intervals by 5 minutes from their default alignments with respect to the time of day clock.

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

Default

clock-offset 0

Parameters

seconds

Specifies the number of seconds to offset a clock-alignment measurement interval from its default.

Values 0 to 86399

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event-mon

Syntax

event-mon

Context

config>oam-pm>session>measurement-interval

Platforms

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

Description

This command enables different threshold events on a specific measurement interval. Only one measurement interval with a configured OAM PM session can have events enabled using the **no shutdown** command.

delay-events

Syntax

[**no**] **delay-events**

Context

config>oam-pm>session>measurement-interval>event-mon

Platforms

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

Description

This enables the monitoring of all configured delay events.

Configuring this command starts the monitoring of the configured delay events at the start of the next measurement interval. If the command is disabled using the **no** command, all monitoring of configured delay events, logging, and recording of new events for that session are suspended. Any existing events at the time of the shut down are maintained until the active measurement window in which the removal was performed has completed. The state of this monitoring function can be changed without needing to shut down all the tests in the session.

The **no** form of this command disables the monitoring of all configured delay events.

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loss-events

Syntax

[**no**] **loss-events**

Context

config>oam-pm>session>measurement-interval>event-mon

Platforms

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

Description

This enables the monitoring of all configured loss events.

Configuring this command starts the monitoring of the configured loss events at the start of the next measurement interval. If the command is disabled using the **no** command, all monitoring of configured loss events, logging, and recording of new events for that session are suspended. Any existing events at the time of the shut down are maintained until the active measurement window in which the removal was performed has completed. The state of this monitoring function can be changed without needing to shut down all the tests in the session.

The **no** form of this command disables the monitoring of all configured loss events.

intervals-stored

Syntax

intervals-stored *intervals*

no intervals-stored

Context

config>oam-pm>session>meas-interval

Platforms

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

Description

This command configures the number of completed measurement intervals per session to be stored in volatile system memory. The entire block of memory is allocated for the measurement interval when the test is active (**no shutdown**) to ensure that memory is available. The numbers increase from 1 to the configured value + 1. The active PM data is stored in interval number 1, and older runs are stored, in order, to the upper most number, with the oldest run being deleted when the number of completed measurement intervals exceeds the configured value + 1. As new test measurement intervals complete for the session, the stored intervals are renumbered to maintain the described order. Care must be taken when setting

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this value. There must be a balance between completed runs stored in volatile memory and the use of the write-to-flash function of the accounting policy.

The **5-mins** and **15-mins** measurement intervals share the same (1 to 96) retention pool. In the unlikely event that both intervals are required, the total of both cannot exceed 96. The **1-hour** and **1-day** measurement intervals use their own ranges. If this command is omitted when configuring the measurement interval, the default values are used.

Parameters

intervals

Specifies the number of stored intervals.

Values **5-mins** — 1 to 96 (default 32)

15-mins — 1 to 96 (default 32)

1-hour — 1 to 24 (default 8)

1-day — 1 (default 1)

3.8.2.9 Service Assurance Agent (SAA) commands

saa

Syntax

saa

Context

config

Platforms

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

Description

Commands in this context configure the Service Assurance Agent (SAA) tests.

test

Syntax

test *name* [**owner** *test-owner*]

no test *name*

Context

config>saa

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Platforms

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

Description

This command provides the test parameters for the named test. Subsequent to the creation of the test instance the test can be started in the OAM context.

A test can only be modified while it is shut down.

The **no** form of this command removes the test from the configuration. To remove a test it cannot be active at the time.

Parameters

name

Specifies the SAA test name to be created or edited.

owner *test-owner*

Specifies the owner of an SAA operation up to 32 characters.

Values If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

accounting-policy

Syntax

accounting-policy *acct-policy-id*

no accounting-policy

Context

config>saa>test

Platforms

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

Description

This command associates an accounting policy to the SAA test. The accounting policy must already be defined before it can be associated else an error message is generated.

When a test terminates, a notification trap is issued.

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

Parameters

acct-policy-id

Specifies the accounting *policy-id* as configured in the **config**>**log**>**accounting-policy** context.

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Values 1 to 99

continuous

Syntax

[**no**] **continuous**

Context

config>saa>test

Platforms

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

Description

This command specifies whether the SAA test is continuous. When the test is configured as continuous, it cannot be started or stopped by using the **saa** command.

The **no** form of this command disables the continuous running of the test. Use the **shutdown** command to disable the test.

description

Syntax

description *description-string*

no description

Context

config>saa>test

Platforms

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

Description

This command creates a text description stored in the configuration file for a configuration context.

The **description** command associates a text string with a configuration context to help identify the content in the configuration file.

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

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Parameters

string

Specifies the description character string. Allowed values are any string up to 80 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed within double quotes.

jitter-event

Syntax

jitter-event rising-threshold *threshold* [**falling-threshold** *threshold*] [**direction**]

no jitter-event

Context

config>saa>test

Platforms

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

Description

This command specifies that at the termination of an SAA test probe, the calculated jitter value is evaluated against the configured rising and falling jitter thresholds. SAA threshold events are generated as required.

When the threshold (rising/falling) is crossed, it is disabled from generating additional events until the opposite threshold is crossed. If a falling-threshold is not supplied, the rising threshold is re-enabled when it falls below the threshold after the initial crossing that generate the event.

The configuration of jitter event thresholds is optional.

Parameters

rising-threshold *threshold*

Specifies a rising threshold jitter value in milliseconds. When the test run is completed, the calculated jitter value is compared to the configured jitter rising threshold. If the test run jitter value is greater than the configured rising threshold value, an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483

Default 0

falling-threshold *threshold*

Specifies a falling threshold jitter value in milliseconds. When the test run is completed, the calculated jitter value is compared to the configured jitter falling threshold. If the test run jitter value is greater than the configured falling threshold value, an SAA threshold event is

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generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483

Default 0

direction

Specifies the direction for OAM ping responses received for an OAM ping test run.

Values **inbound** — Monitor the value of jitter calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run.

outbound — Monitor the value of jitter calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run.

roundtrip — Monitor the value of jitter calculated for the round trip, two-way, OAM ping requests and replies for an OAM ping test run.

Default roundtrip

latency-event

Syntax

latency-event rising-threshold *threshold* [**falling-threshold** *threshold*] [**direction**]

no latency-event

Context

config>saa>test

Platforms

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

Description

This command specifies that at the termination of an SAA test probe, the calculated latency event value is evaluated against the configured rising and falling latency event thresholds. SAA threshold events are generated as required.

When the threshold (rising/falling) is crossed, it is disabled from generating additional events until the opposite threshold is crossed. If a falling-threshold is not supplied, the rising threshold is re-enabled when it falls below the threshold after the initial crossing that generate the event.

The configuration of latency event thresholds is optional.

Parameters

rising-threshold *threshold*

Specifies a rising threshold latency value in milliseconds. When the test run is completed, the calculated latency value is compared to the configured latency rising threshold. If

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the test run latency value is greater than the configured rising threshold value, an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483

Default 0

falling-threshold ***threshold***

Specifies a falling threshold latency value in milliseconds. When the test run is completed, the calculated latency value is compared to the configured latency falling threshold. If the test run latency value is greater than the configured falling threshold value, an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483

Default 0

direction

Specifies the direction for OAM ping responses received for an OAM ping test run.

Values **inbound** — Monitor the value of jitter calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run.

outbound — Monitor the value of jitter calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run.

roundtrip — Monitor the value of jitter calculated for the round trip, two-way, OAM ping requests and replies for an OAM ping test run.

Default roundtrip

loss-event

Syntax

loss-event rising-threshold *threshold* [**falling-threshold** *threshold*] [**direction**]

no loss-event

Context

config>saa>test

Platforms

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

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Description

This command specifies that at the termination of an SAA testrun, the calculated loss event value is evaluated against the configured rising and falling loss event thresholds. SAA threshold events are generated as required.

The configuration of loss event thresholds is optional.

Parameters

rising-threshold *threshold*

Specifies a rising threshold loss event value in packets. When the test run is completed, the calculated loss event value is compared to the configured loss event rising threshold. If the test run loss event value is greater than the configured rising threshold value, an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483647

Default 0

falling-threshold *threshold*

Specifies a falling threshold loss event value in packets. When the test run is completed, the calculated loss event value is compared to the configured loss event falling threshold. If the test run loss event value is greater than the configured falling threshold value, an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483647

Default 0

direction

Specifies the direction for OAM ping responses received for an OAM ping test run.

Values **inbound** — Monitors the value of jitter calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run.

outbound — Monitors the value of jitter calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run.

roundtrip — Monitors the value of jitter calculated for the round trip, two-way, OAM ping requests and replies for an OAM ping test run.

Default roundtrip

probe-history

Syntax

probe-history [**auto** | **drop** | **keep**]

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Context

config>saa>test

Platforms

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

Description

This command defines history probe behavior. Defaults are associated with various configured parameters within the SAA test. Auto (keep) is used for test with probe counts of 100 or less, and intervals of 1 second and above. Auto (drop) only maintains summary information for tests marked as continuous with file functions, probe counts in excess of 100 and intervals of less than 1 second. SAA tests that are not continuous with a write to file defaults to Auto (keep). The operator is free to change the default behaviors for each type. Each test that maintains per probe history consumes more system memory. When per probe entries are required, the probe history is available at the completion of the test.

Default

auto

Parameters

auto

Specifies an auto selector that determines the storage of the history information.

drop

Specifies to store summarized min/max/ave data; not per probe information for test runs. This may be configured for all tests in an effort to conserve memory.

keep

Specifies to store per probe information for tests. This consumes significantly more memory than summary information and should only be used if necessary.

trap-gen

Syntax

trap-gen

Context

config>saa>test

Platforms

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

Description

Commands in this context configure trap generation for the SAA test.

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probe-fail-enable

Syntax

[**no**] **probe-fail-enable**

Context

config>saa>test>trap-gen

Platforms

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

Description

This command enables the generation of an SNMP trap when probe-fail-threshold consecutive probes fail during the execution of the SAA ping test. This command is not applicable to SAA trace route tests.

The **no** form of this command disables the generation of an SNMP trap.

probe-fail-threshold

Syntax

[**no**] **probe-fail-threshold** *threshold*

Context

config>saa>test>trap-gen

Platforms

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

Description

This command enables the generation of an SNMP trap when the probe-fail-threshold consecutive probes fail during the execution of the SAA ping test. This command is not applicable to SAA trace route tests. This command has no effect when probe-fail-enable is disabled.

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

Default

1

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test-completion-enable

Syntax

[**no**] **test-completion-enable**

Context

config>saa>test>trap-gen

Platforms

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

Description

This command enables the generation of a trap when an SAA test completes.

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

test-fail-enable

Syntax

[**no**] **test-fail-enable**

Context

config>saa>test>trap-gen

Platforms

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

Description

This command enables the generation of a trap when a test fails. In the case of a ping test, the test is considered failed (for the purpose of trap generation) if the number of failed probes is at least the value of the **test-fail-threshold** parameter.

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

test-fail-threshold

Syntax

[**no**] **test-fail-threshold** *threshold*

Context

config>saa>test>trap-gen

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Platforms

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

Description

This command configures the threshold for trap generation on test failure.

This command has no effect when **test-fail-enable** is disabled. This command is not applicable to SAA trace route tests.

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

Default

1

type

Syntax

type

no type

Context

config>saa>test

Platforms

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

Description

This command provides the test type for the named test. Only a single test type can be configured.

A test can only be modified while the test is in shutdown mode

When a test type has been configured, the command can be modified by re-entering the command, and the test type must be the same as the previously entered test type.

To change the test type, the old command must be removed using the **config**>**saa**>**test**>**no type** command.

cpe-ping

Syntax

cpe-ping service *service-id* **destination** *ip-address* **source** *ip-address* [**ttl** *vc-label-ttl*] [**return-control**] [**source-mac** *ieee-address*] [**fc** *fc-name*] [**interval** *interval*] [**send-count** *send-count*] [**send-control**]

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Context

oam

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode

Description

This command determines the IP connectivity to a CPE within a specified VPLS service.

Parameters

service *service-id*

Specifies the service ID of the service to diagnose or manage.

Values *service-id*: 1 to 2147483647 *svc-name*: 64 characters maximum

destination *ip-address*

Specifies the IP address to be used as the destination for performing an OAM ping operations.

source *ip-address*

Specifies an unused IP address in the same network that is associated with the VPLS.

ttl *vc-label-ttl*

Specifies the TTL value in the VC label for the OAM MAC request, expressed as a decimal integer.

Values 1 to 255

Default 255

return-control

Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply is sent using the data plane.

source-mac *ieee-address*

Specifies the source MAC address that is sent to the CPE. If not specified or set to 0, the MAC address configured for the CPMCFM is used.

fc-name

Specifies the forwarding class of the MPLS echo request encapsulation.

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

Default be

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interval ***interval***

Specifies the **interval** parameter, in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second where the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

send-count ***send-count***

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 255

Default 1

send-control

Specifies the MAC OAM request to be sent using the control plane instead of the data plane.

Default MAC OAM request sent using the data plane.

dns

Syntax

dns target-addr *dns-name* **name-server** *ip-address* [**source** *ip-address*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**record-type** {**ipv4-a-record** | **ipv6-aaaa-record**}]

Context

config>saa>test>type

Platforms

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

Description

This command configures a DNS name resolution test.

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Parameters

target-addr

Specifies the IP host address to be used as the destination for performing an OAM ping operation.

dns-name

Specifies the DNS name to be resolved to an IP address.

name-server *ip-address*

Specifies the server connected to a network that resolves network names into network addresses.

Values

ipv4-address - a.b.c.d

ipv6-address - x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x - [0..FFFF]H

d - [0..255]D

source *ip-address*

Specifies the IP address to be used as the source for performing an OAM ping operation.

Values

ipv4-address - a.b.c.d

ipv6-address - x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x - [0..FFFF]H

d - [0..255]D

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **send-count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 255

Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

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Values 1 to 120

Default 5

interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

record-type

Specifies a record type.

Values **ipv4-a-record** - A record specific mapping a host name to an IPv4 address.

ipv6-aaaa-record - A record specific to the Internet class that stores a single IPv6 address.

eth-cfm-linktrace

Syntax

eth-cfm-linktrace *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**ttl** *ttlvalue*]

[**fc** {*fc-name*}] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**record-type** {**ipv4-a-record**|**ipv6-aaaa-record**}]

Context

config>saa>test>type

Platforms

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

Description

This command configures a CFM linktrace test in SAA.

Parameters

mac-address

Specifies a unicast destination MAC address.

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mep *mep-id*

Specifies the target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association ma-index

Specifies the MA index.

Values 1 to 4294967295

ttl ttl-value

Specifies the maximum number of hops traversed in the linktrace.

Values 1 to 255

Default 64

fc *fc-name*

The **fc** parameter is used to indicate the forwarding class of the CFM Linktrace request messages.

The actual forwarding class encoding is controlled by the network egress mappings.

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

Default nc

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 10

Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded. The **timeout** value must be less than the **interval**.

Values 1 to 10

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Default 5

interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to "1" second, and the **timeout** value is set to "10" seconds, the maximum time between message requests is "10" seconds and the minimum is "1" second. This depends upon the receipt of a message reply corresponding to the outstanding message request. The **timeout** value must be less than the **interval**.

Values 1 to 10

Default 5

record-type

Specifies a record type.

Values **ipv4-a-record** — A record specific mapping a hostname to an IPv4 address.

ipv6-aaaa-record — A record specific to the Internet class that stores a single IPv6 address.

eth-cfm-loopback

Syntax

eth-cfm-loopback *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**size** *datasize*] [**fc** {*fc-name*}] [**count** *send-count*][**timeout** *timeout*] [**interval** *interval*]

Context

config>saa>test>type

Platforms

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

Description

This command configures an Ethernet CFM loopback test in SAA.

Parameters

mac-address

Specifies a unicast destination MAC address.

mep ***mep-id***

Specifies the target MAC address.

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Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

size *data-size*

The packet size in bytes, expressed as a decimal integer.

Values 0 to 1500

Default 0

fc *fc-name*

Specifies the **fc** parameter used to indicate the forwarding class of the CFM Loopback request messages.

The actual forwarding class encoding is controlled by the network egress mappings.

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

Default nc

count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded. The **timeout** value must be less than the **interval**.

Values 1 to 10

Default 5

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interval ***interval***

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to "1" second, and the **timeout** value is set to "10" seconds, the maximum time between message requests is "10" seconds and the minimum is "1" second. This depends upon the receipt of a message reply corresponding to the outstanding message request. The **timeout** value must be less than the **interval**.

Values 1 to 10

Default 5

eth-cfm-two-way-delay

Syntax

eth-cfm-two-way-delay *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**fc** {*fc-name*}] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]

Context

config>saa>test>type

Platforms

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

Description

This command configures an Ethernet CFM two-way delay test in SAA.

Parameters

mac-address

Specifies a unicast destination MAC address.

mep ***mep-id***

Specifies the target MAC address.

Values 1 to 8191

domain ***md-index***

Specifies the MD index.

Values 1 to 4294967295

association ***ma-index***

Specifies the MA index.

Values 1 to 4294967295

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ttl ttl-value

Specifies the maximum number of hops traversed in the linktrace.

Values 1 to 255

Default 64

fc *fc-name*

Specifies the **fc** parameter used to indicate the forwarding class of the CFM two-delay request messages.

The actual forwarding class encoding is controlled by the network egress mappings.

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

Default nc

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

timeout *timeout*

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded. The **timeout** value must be less than the **interval**.

Values 1 to 10

Default 5

interval *interval*

Specifies the **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to "1" second, and the **timeout** value is set to "10" seconds, the maximum time between message requests is "10" seconds and the minimum is "1" second. This depends upon the receipt of a message reply corresponding to the outstanding message request. The **timeout** value must be less than the **interval**.

Values [0.1, 0.2, .. 0.9] | [1, 2, .. 10]

Default 5

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eth-cfm-two-way-slm

Syntax

eth-cfm-two-way-delay *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**fc** *fc-name*] [**send-count** *send-count*] [**size** *data-size*] [**timeout** *timeout*] [**interval** *interval*]

Context

config>saa>test>type

Platforms

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

Description

This command configures an Ethernet CFM two-way SLM test in SAA.

Parameters

mac-address

Specifies a unicast destination MAC address.

mep *mep-id*

Specifies the target MAC address.

Values 1 to 8191

domain *md-index*

Specifies the MD index.

Values 1 to 4294967295

association *ma-index*

Specifies the MA index.

Values 1 to 4294967295

fc *fc-name*

Specifies the **fc** parameter used to indicate the forwarding class of the CFM SLM request messages. The actual forwarding class encoding is controlled by the network egress mappings.

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

Default nc

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request

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is sent. The message interval value must be expired before the next message request is sent.

Values 1 to 100

Default 1

size ***data-size***

Specifies the size of the data portion of the data TLV. If 0 is specified no data TLV is added to the packet.

Values 0 to 1500

Default 0

timeout ***timeout***

Specifies the timeout parameter, in seconds, expressed as a decimal integer. This value is used to override the default timeout value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded. The timeout value must be less than the interval.

Values 1 to 10

Default 5

interval ***interval***

Specifies the interval parameter, in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent. If the interval is set to 1 second, and the timeout value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request. The timeout value must be less than the interval.

Values [0.1, 0.2, .. 0.9] | [1, 2, .. 10]

Default 5

icmp-ping

Syntax

icmp-ping [*ip-address* | *dns-name*] [**rapid** | **detail**] [**ttl t***ime-to-live*] [**tos** *type-of-service*] [**size** *bytes*] [**pattern** *pattern*] [**source** *ip-address* | *dns-name*] [**interval** *seconds*] [{**next-hop** *ip-address*} | {**interface** *interface-name*} | **bypass-routing**] [**count** *requests*] [**do-not-fragment**] [**router** *router-instance* | **service-name** *service-name*] [**timeout** *timeout*]

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Context

config>saa>test>type

Platforms

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

Description

This command configures an ICMP ping test.

Parameters

ip-address

Specifies the far-end IP address to which to send the **svc-ping** request message in dotted decimal notation.

Values

ipv4-address:	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
	x:x:x:x:x:x:d.d.d.d
	x: [0 .. FFFF]H
	d: [0 .. 255]D

dns-name

Specifies the DNS name of the far-end device to which to send the **svc-ping** request message, expressed as a character string up to 63 characters maximum.

rapid

Specifies that packets are generated as fast as possible instead of the default 1 per second.

detail

Specifies the display of detailed information.

ttl *time-to-live*

Specifies the TTL value for the IP packet, expressed as a decimal integer.

Values 1 to 128

tos *type-of-service*

Specifies the service type.

Values 0 to 255

size *bytes*

Specifies the request packet size in bytes, expressed as a decimal integer.

Values 0 to 16384

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pattern *pattern*

Specifies the date portion in a ping packet are filled with the pattern value specified. If not specified, position info is filled instead.

Values 0 to 65535

source *ip-address*|*dns-name*

Specifies the IP address to be used.

Values ipv4-address: a.b.c.ddns-name: 128 characters max

interval *seconds*

Overrides the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 — 10

Default 1

next-hop *ip-address*

Specifies the next hop IP address for which to only display static routes.

Values ipv4-address: a.b.c.d (host bits must be 0)

interface *interface-name*

Specifies the name used to refer to the interface. The name must already exist in the **config**>**router**>**interface** context.

bypass-routing

Specifies whether to send the ping request to a host on a directly attached network bypassing the routing table.

count *requests*

Specifies the number of times to perform an OAM ping probe operation. Each OAM echo message request must either timeout or receive a reply before the next message request is sent.

Values 1 to 100000

Default 5

do-not-fragment

Sets the DF (Do Not Fragment) bit in the ICMP ping packet.

router *router-instance*

Specifies the router name or service ID.

Values *router-name*: Base, management

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service-id: 1 to 2147483647

Default Base

service-name *service-name*

Specifies the service name as an integer.

Values *service-id*: 1 to 2147483647

timeout *timeout*

Overrides the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

icmp-trace

Syntax

icmp-trace [*ip-address* | *dns-name*] [**ttl** *time-to-live*] [**wait** *milli-seconds*] [**tos** *type-of-service*] [**source** *ip-address*] [**tos** *type-of-service*] [**router** *router-instance* | **service-name** *service-name*]

Context

config>saa>test>type

Platforms

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

Description

This command configures an ICMP traceroute test.

Parameters

ip-address

Specifies the far-end IP address to which to send the **svc-ping** request message in dotted-decimal notation.

Values

ipv4-address:	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
	x:x:x:x:x:x:d.d.d.d
	x: [0 .. FFFF]H

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d: [0 .. 255]D

dns-name

Specifies the DNS name of the far-end device to which to send the **svc-ping** request message, expressed as a character string to 63 characters maximum.

ttl ***time-to-live***

Specifies the TTL value for the MPLS label, expressed as a decimal integer.

Values 1 to 255

wait ***milliseconds***

Specifies the time, in milliseconds, to wait for a response to a probe, expressed as a decimal integer.

Values 10 to 60000

Default 5000

tos ***type-of-service***

Specifies the service type.

Values 0 to 255

source ***ip-address***

Specifies the IP address to be used.

Values

ipv4-address: a.b.c.d

ipv6-address: x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x: [0 .. FFFF]H

d: [0 .. 255]D

router ***router-instance***

Specifies the router name or service ID.

Values *router-name*: Base, management

service-id: 1 to 2147483647

Default Base

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mac-ping

Syntax

mac-ping service *service-id* **destination** *dst-ieee-address* [**source** *src-ieee-address*] [**fc** *fc-name*] [**size** *octets*] [**ttl** *vc-label-ttl*] [**send-count** *send-count*] [**send-control**] [**return-control**] [**interval** *interval*] [**timeout** *timeout*]

Context

oam

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode

Description

This command determines the existence of an egress SAP binding of a specific MAC within a VPLS service.

A **mac-ping** packet can be sent via the control plane or the data plane. The **send-control** option specifies the request be sent using the control plane. If **send-control** is not specified, the request is sent using the data plane.

A **mac-ping** is forwarded along the flooding domain if no MAC address bindings exist. If MAC address bindings exist, the packet is forwarded along those paths, provided they are active. A response is generated only when there is an egress SAP binding for that MAC address or if the MAC address is a "local" OAM MAC address associated with the device's control plan.

A **mac-ping** reply can be sent using the data plane or the control plane. The **return-control** option specifies the reply be sent using the control plane. If **return-control** is not specified, the request is sent using the data plane.

A **mac-ping** with data plane reply can only be initiated on nodes that can have an egress MAC address binding. A node without a FIB and without any SAPs cannot have an egress MAC address binding, so it is not a node where replies in the data plane are trapped and sent up to the control plane.

A control plane request is responded to via a control plane reply only.

By default, MAC OAM requests are sent with the system or chassis MAC address as the source MAC. The **source** option allows overriding of the default source MAC for the request with a specific MAC address.

When a **source** *ieee-address* value is specified and the source MAC address is locally registered within a split horizon group (SHG), this SHG membership is used as if the packet originated from this SHG. In all other cases, SHG 0 (zero) is used. Note that if the **mac-trace** is originated from a non-zero SHG, such packets do not go out to the same SHG.

If EMG is enabled, mac-ping returns only the first SAP in each chain.

Parameters

service *service-id*

Specifies the service ID of the service to diagnose or manage.

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Values *service-id*: 1 to 2147483647

destination *ieee-address*

Specifies the destination MAC address for the OAM MAC request.

size *octets*

Specifies the MAC OAM request packet size in octets, expressed as a decimal integer. The request payload is padded to the specified size with a 6 byte PAD header and a byte payload of 0xAA as necessary. If the octet size specified is less than the minimum packet, the minimum sized packet necessary to send the request is used.

Values 1 to 65535

Default No OAM packet padding.

ttl *vc-label-ttl*

Specifies the TTL value in the VC label for the OAM MAC request, expressed as a decimal integer.

Values 1 to 255

Default 255

send-control

Specifies the MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM request sent using the data plane.

return-control

Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply sent using the data plane.

source src-*ieee-address*

Specifies the source MAC address from which the OAM MAC request originates. By default, the system MAC address for the chassis is used.

Values Any unicast MAC value.

Default The system MAC address.

fc *fc-name*

Specifies the **fc** parameter used to test the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

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

interval *interval*

Specifies the **interval** parameter, in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

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If the **interval** is set to 1 second where the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

send-count ***send-count***

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

timeout ***timeout***

Specifies the **timeout** parameter, in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

Output

Sample output

```
oam mac-ping service 1 destination 00:bb:bb:bb:bb:bb
Seq Node-id Path RTT
------------------------------------------------------------------------------
[Send request Seq. 1, Size 126]
1 2.2.2.2:sap1/1/1:1 In-Band 960ms
------------------------------------------------------------------------------
```

sdp-ping

Syntax

sdp-ping *orig-sdp-id* [**resp-sdp** *resp-sdp-id*] [**fc** *fc-name* [**profile** {**in** | **out**}]] [**timeout** *seconds*] [**interval** *seconds*] [**size** *octets*] [**send-count** *send-count*] [**interval <***interval***>**]

Context

oam

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config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode

Description

This command tests SDPs for unidirectional or round trip connectivity and performs SDP MTU Path tests.

The **sdp-ping** command accepts an originating SDP-ID and an optional responding SDP-ID. The size, number of requests sent, message time-out and message send interval can be specified. All **sdp-ping** requests and replies are sent with PLP OAM-Label encapsulation, as a *service-id* is not specified.

For round trip connectivity testing, the **resp-sdp** keyword must be specified. If **resp-sdp** is not specified, a unidirectional SDP test is performed.

To terminate an **sdp-ping** in progress, use the CLI break sequence <Ctrl-C>.

An **sdp-ping** response message indicates the result of the **sdp-ping** message request. When multiple response messages apply to a single SDP echo request/reply sequence, the response message with the highest precedence is displayed. The following table displays the response messages sorted by precedence.

Table 30: SDP ping response messages by precedence

Result of request	Displayed response message	Precedence
Request timeout without reply	Request Timeout	1
Request not sent because of non-existent *orig-sdp-id*	Orig-SDP Non-Existent	2
Request not sent because of administratively down *orig-sdp-id*	Orig-SDP Admin-Down	3
Request not sent because of operationally down *orig-sdp-id*	Orig-SDP Oper-Down	4
Request terminated by user before reply or timeout	Request Terminated	5
Reply received, invalid *origination-id*	Far End: Originator-ID Invalid	6
Reply received, invalid *responder-id*	Far End: Responder-ID Error	7
Reply received, non-existent *resp-sdp-id*	Far End: Resp-SDP Non-Existent	8
Reply received, invalid *resp-sdp-id*	Far End: Resp-SDP Invalid	9
Reply received, *resp-sdp-id* down (admin or oper)	Far-end: Resp-SDP Down	10
Reply received, No Error	Success	11

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Special Cases

Single Response Connectivity Tests

A single response sdp-ping test provides detailed test results.

Upon request timeout, message response, request termination, or request error the following local and remote information is displayed. Local and remote information is dependent upon SDP-ID existence and reception of reply.

Table 31: SDP ping information

Field	Description	Values
Request Result	The result of the **sdp-ping** request message.	Sent - Request Timeout
		Sent - Request Terminated
		Sent - Reply Received
		Not Sent - Non-Existent Local SDP-ID
		Not Sent - Local SDP-ID Down
Originating SDP-ID	The originating SDP-ID specified by **orig-sdp**.	orig-sdp-id
Originating SDP-ID Administrative State	The local administrative state of the originating SDP-ID. If the SDP-ID has been shutdown, Admin-Down is displayed. If the originating SDP-ID is in the no shutdown state, Admin-Up is displayed. If the *orig-sdp-id* does not exist, Non-Existent is displayed.	Admin-Up
		Admin-Down
		Non-Existent
Originating SDP-ID Operating State	The local operational state of the originating SDP-ID. If *orig-sdp-id* does not exist, N/A is displayed.	Oper-Up
		Oper-Down
		N/A
Originating SDP-ID Path MTU	The local **path-mtu** for *orig-sdp-id*. If *orig-sdp-id* does not exist locally, N/A is displayed.	orig-path-mtu
		N/A
Responding SDP-ID	The SDP-ID requested as the far-end path to respond to the **sdp-ping** request. If **resp-sdp** is not specified, the responding router does not use an SDP-ID as the return path and N/A is displayed.	resp-sdp-id
		N/A
Responding SDP-ID Path Used	Displays whether the responding 7210 SAS used the responding *sdp-id* to respond to the **sdp-ping** request. If *resp-sdp-id* is a valid, operational SDP-ID, it must be used for the SDP echo reply message. If the far-end uses the responding *sdp-id* as the return path, Yes is displayed. If the far-end does not use the responding *sdp-id* as the	Yes
		No
		N/A

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Field	Description	Values
	return path, No is displayed. If **resp-sdp** is not specified, N/A is displayed.	
Responding SDP-ID Administrative State	The administrative state of the responding *sdp-id*. When *resp-sdp-id* is administratively down, Admin-Down is displayed. When *resp-sdp-id* is administratively up, Admin-Up is displayed. When *resp-sdp-id* exists on the far-end 7210 SAS but is not valid for the originating router, Invalid is displayed. When *resp-sdp-id* does not exist on the far-end router, Non-Existent is displayed. When **resp-sdp** is not specified, N/A is displayed.	Admin-Down
		Admin-Up
		Invalid
		Non-Existent
		N/A
Responding SDP-ID Operational State	The operational state of the far-end *sdp-id* associated with the return path for *service-id*. When a return path is operationally down, Oper-Down is displayed. If the return *sdp-id* is operationally up, Oper-Up is displayed. If the responding *sdp-id* is non-existent, N/A is displayed.	Oper-Up
		Oper-Down
		N/A
Responding SDP-ID Path MTU	The remote **path-mtu** for *resp-sdp-id*. If *resp-sdp-id* does not exist remotely, N/A is displayed	resp-path-mtu
		N/A
Local Service IP Address	The local system IP address used to terminate remotely configured *sdp-id*s (as the *sdp-id* **far-end** address). If an IP address has not been configured to be the system IP address, N/A is displayed.	system-ip-addr
		N/A
Local Service IP Interface Name	The name of the local system IP interface. If the local system IP interface has not been created, N/A is displayed.	system-interface-name
		N/A
Local Service IP Interface State	The state of the local system IP interface. If the local system IP interface has not been created, Non-Existent is displayed.	Up
		Down
		Non-Existent
Expected Far End Address	The expected IP address for the remote system IP interface. This must be the **far-end** address configured for the *orig-sdp-id*.	orig-sdp-far-end-addr
		dest-ip-addr
		N/A
Actual Far End Address	The returned remote IP address. If a response is not received, the displayed value is N/A. If the far-end service IP interface is down or non-existent, a message reply is not expected.	resp-ip-addr
		N/A
Responders Expected Far End Address	The expected source of the originators *sdp-id* from the perspective of the remote terminating the *sdp-id*. If the far-end cannot detect the expected source of the ingress *sdp-id*, N/A is displayed.	resp-rec-tunnel-far-end-addr
		N/A

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Field	Description	Values
Round Trip Time	The round trip time between SDP echo request and the SDP echo reply. If the request is not sent, times out or is terminated, N/A is displayed.	delta-request-reply
		N/A

Multiple Response Connectivity Tests

When the connectivity test count is greater than one (1), a single line is displayed per SDP echo request send attempt.

The request number is a sequential number starting with 1 and ending with the last request sent, incrementing by one (1) for each request. This should not be confused with the *message-id* contained in each request and reply message.

A response message indicates the result of the message request. Following the response message is the round trip time value. If any reply is received, the round trip time is displayed.

After the last reply has been received or response timed out, a total is displayed for all messages sent and all replies received. A maximum, minimum and average round trip time is also displayed. Error response and timed out requests do not apply toward the average round trip time.

Parameters

orig-sdp-id

Specifies the SDP-ID to be used by **sdp-ping**, expressed as a decimal integer. The far-end address of the specified SDP-ID is the expected *responder-id* within each reply received. The specified SDP-ID defines the encapsulation of the SDP tunnel encapsulation used to reach the far end. This can be IP or MPLS. If *orig-sdp-id* is invalid or administratively down or unavailable for some reason, the SDP Echo Request message is not sent and an appropriate error message is displayed (when the **interval** timer expires, **sdp-ping** attempts to send the next request if required).

Values 1 to 17407

resp-sdp *resp-sdp-id*

Specifies the return SDP-ID to be used by the far-end 7210 SAS for the message reply for round trip SDP connectivity testing. If *resp-sdp-id* does not exist on the far-end 7210 SAS, terminates on another 7210 SAS different from the originating 7210 SAS, or another issue prevents the far-end router from using *resp-sdp-id*, the SDP echo reply is sent using generic IP OAM encapsulation. The received forwarding class (as mapped on the ingress network interface for the far end) defines the forwarding class encapsulation for the reply message.

Values 1 to 17407

Default null. Use the non-SDP return path for message reply.

fc *fc-name*

Specifies the **fc** parameter used to indicate the forwarding class of the SDP encapsulation. The actual forwarding class encoding is controlled by the network egress DSCP or LSP-EXP mappings.

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The DSCP or LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7210 SAS that receives the message request. The egress mappings of the egress network interface on the far-end 7210 SAS controls the forwarding class markings on the return reply message.

The DSCP or LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating 7210 SAS. This is displayed in the response message output upon receipt of the message reply.

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

Default be

timeout ***seconds***

Specifies the **timeout** parameter, in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. A 'request timeout' message is displayed by the CLI for each message request sent that expires. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

interval ***seconds***

Specifies the **interval** parameter, in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

size ***octets***

Specifies the **size** parameter in octets, expressed as a decimal integer. This parameter is used to override the default message size for the **sdp-ping** request. Changing the message size is a method of checking the ability of an SDP to support a **path-mtu**. The size of the message does not include the SDP encapsulation, VC-Label (if applied) or any DLC headers or trailers.

When the OAM message request is encapsulated in an IP/ SDP, the IP 'DF' (Do Not Fragment) bit is set. If any segment of the path between the sender and receiver cannot handle the message size, the message is discarded. MPLS LSPs are not expected to fragment the message either, as the message contained in the LSP is not an IP packet.

Values 72 to 9198

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Default 72

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Values 1 to 100

Default 1

Output

The following output is an example of Multiple Response Round Trip Connectivity Test.

Multiple response round trip connectivity test sample output

```
*A:DUT-A# oam sdp-ping 101 resp-sdp 102
Err SDP-ID Info             Local           Remote
-------------------------------------------------
    SDP-ID:                 101             102
    Administrative State:   Up              Up
    Operative State:        Up              Up
    Path MTU:               9186            N/A
    Response SDP Used:                      Yes

    IP Interface State:     Up
    Actual IP Address:      10.20.1.1       10.20.1.2
    Expected Peer IP:       10.20.1.2       10.20.1.1

    Forwarding Class        be              be
    Profile                 Out             Out

Request Result: Sent - Reply Received
RTT: 10(ms)

*A:DUT-A# oam sdp-ping 101 resp-sdp 102 count 10
Request     Response    RTT
-------------------------------------------------
1           Success     10ms
2           Success     0ms
3           Success     0ms
4           Success     0ms
5           Success     0ms
6           Success     0ms
7           Success     0ms
8           Success     0ms
9           Success     0ms
10          Success     0ms

Sent: 10    Received: 10
Min: 0ms   Max: 10ms   Avg: 1ms
*A:DUT-A#
```


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vccv-ping

Syntax

vccv-ping *sdp-id:vc-id* [**src-ip-address** *ip-addr* **dst-ip-address** *ip-addr* **pw-id** *pw-id*][**reply-mode** {**ip-routed**|**control-channel**}] [**fc** *fc-name*] [**size** *octets*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**ttl** *vc-label-ttl*]

vccv-ping saii-type2 *global-id:prefix:ac-id* **taii-type2** *global-id:prefix:ac-id* [**reply-mode** *ip-routed* | *control-channel*] [**src-ip-address** *ip-addr dst-ip-address ip-addr*]

vccv-ping spoke-sdp-fec *spoke-sdp-fec-id* [**reply-mode** *ip-routed* | *control-channel*] [**saii-type2** *global-id:prefix:ac-id* **taii-type2** *global-id:prefix:ac-id*] [**src-ip-address** *ip-addr dst-ip-address ip-addr*]

options common to all vccv-ping cases: [**count** *send-count*] [**fc** *fc-name* [**profile** *in* | *out*]] [**interval** *interval*] [**size** *octets*] [**timeout** *timeout*] [**ttl** *vc-label-ttl*]

Context

oam

config>saa>test

Platforms

Supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode

Description

This command configures a Virtual Circuit Connectivity Verification (VCCV) ping test. A **vccv-ping** test checks connectivity of a VLL inband. It checks to verify that the destination (target) PE is the egress for the Layer 2 FEC. It provides for a cross-check between the data plane and the control plane. It is inband which means that the vccv-ping message is sent using the same encapsulation and along the same path as user packets in that VLL. The **vccv-ping** test is the equivalent of the **lsp-ping** test for a VLL service. The vccv-ping reuses an lsp-ping message format and can be used to test a VLL configured over an MPLS.

Note that VCCV ping can be initiated on TPE or SPE. If initiated on the SPE, the **reply-mode** parameter must be used with the ip-routed value The ping from the TPE can have either values or can be omitted, in which case the default value is used.

If a VCCV ping is initiated from TPE to neighboring a SPE (one segment only) it is sufficient to only use the *sdpid:vcid* parameter. However, if the ping is across two or more segments, at least the *sdpId:vcId*, **src-ip-address** *ip-addr*, **dst-ip-address** *ip-addr*, **ttl** *vc-label-ttl*and **pw-id** *pw-id* parameters are used where:

- The **src-ip-address** is system IP address of the router preceding the destination router.
- The **pwid** is actually the VC ID of the last pseudowire segment.
- The *vc-label-ttl* must have a value equal or higher than the number of pseudowire segments.

Note that VCCV ping is a multi-segment pseudowire. For a single-hop pseudowire, only the peer VCCV CC bit of the control word is advertised when the control word is enabled on the pseudowire. VCCV ping on multi-segment pseudowires require that the control word be enabled in all segments of the VLL.

If the control word is not enabled on spoke SDP it does not signal peer VCCV CC bits to the far end, consequently VCCV ping cannot be successfully initiated on that specific spoke SDP.

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Parameters

sdp-id:vc-id

Specifies the VC ID of the pseudowire being tested. The VC ID needs to exist on the local router and the far-end peer needs to indicate that it supports VCCV to allow the user to send vccv-ping message.

Values 1 to 17407:1 to 4294967295

spoke-sdp-fec *spoke-sdp-fec-id*

Specifies the *spoke-sdp-fec-id* if a FEC 129 PW is being tested. The *spoke-sdp-fec-id* must exist on the local router and the far-end peer needs to indicate that it supports VCCV to allow the user to send vccv-ping messages.

spoke-sdp-fec is mutually exclusive with the *sdp-id:vc-id* parameter.

Values 1 to 4294967295

src-ip-address *ip-addr*

Specifies the source IP address.

Values ipv4-address: a.b.c.d

control-channel {ipv4 | non-ip}

Specifies the encapsulation format to use for the VCCV ping echo request and echo reply packet.

Values **ipv4** — IPv4 encapsulation in an IPv4 pseudowire associated channel (channel type 0x0021)

non-ip — MPLS-TP encapsulation without UDP/IP headers, in pseudowire associated channel using channel type 0x025.

Default non-ip

saii-type2 *global-id:prefix:ac-id*

Specifies the source attachment individual identifier (SAII) if a FEC129 AII Type 2 pseudowire is being tested.

The **saii-type2** parameter is mutually exclusive with the *sdp-id:vc-id* parameter.

Syntax: *global-id* — The global ID of this T-PE node.

Values: 1 to 4294967295

prefix — The prefix on this T-PE node that the spoke-SDP is associated with.

ac-id — An unsigned integer representing a locally unique identifier for the spoke-SDP.

Values: 1 to 4294967295

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taii-type2 ***global-id:prefix:ac-id***

Specifies the target attachment individual identifier (TAII) if a FEC129 AII Type 2 pseudowire is being tested. The **taii-type2** parameter is mutually exclusive with *sdp-id:vc-id*.

Syntax: *global-id* – The global ID of the far end T-PE node of the FEC129 pseudowire.

Values: 1 to 4294967295

prefix — The prefix on far end. T-PE node that the pseudowire being tested is associated with.

Values: ipv4-formatted address: a.b.c.d

ac-id — An unsigned integer representing a locally unique identifier for the pseudowire being tested at the far end T-PE.

Values: 1 to 4294967295

dst-ip-address ***ip-address***

Specifies the destination IP address.

Values ipv4-address: a.b.c.d

ipv6-address - x:x:x:x:x:x:x:x (eight 16-bit pieces)

pw-id ***pw-id***

Specifies the pseudowire ID to be used for performing a **vccv-ping** operation. The pseudowire ID is a non-zero 32-bit connection ID required by the FEC 128, as defined in RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*.

reply-mode {ip-routed | control-channel}

Specifies to the far-end how to send the reply message.The option control-channel indicates a reply mode in-band using vccv control channel.

Default control-channel

fc ***fc-name***

Specifies the **fc** parameter used to indicate the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

The LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7210 SAS that receives the message request. The egress mappings of the egress network interface on the far-end router controls the forwarding class markings on the return reply message. The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating SR.

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

Default be

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timeout *seconds*

Specifies the timeout parameter, in seconds, expressed as a decimal integer. This value is used to override the default timeout value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. A 'request timeout' message is displayed by the CLI for each message request sent that expires. Any response received after the request times out is silently discarded.

Values 1 to 10

Default 5

interval *seconds*

Specifies the interval parameter, in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the interval is set to 1 second, and the timeout value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 10

Default 1

size *octets*

Specifies the VCCV ping echo request packet size, in octets, expressed as a decimal integer. The request payload is padded with zeros to the specified size.

Values 88 to 9198

Default 88

send-count *send-count*

Specifies the number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message interval value must be expired before the next message request is sent.

Values 1 to 100

Default 1

ttl *vc-label-ttl*

Specifies the time-to-live value for the vc-label of the echo request message. The outer label TTL is still set to the default of 255 regardless of this value.

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vccv-trace

Syntax

vccv-trace *sdp-id:vc-id* [**fc** *fc-name* [**profile** {**in** | **out**}]] [**size** *octets*] [**reply-mode** *ip-routed* | *control-channel*] [**probe-count** *probe-count*] [**timeout** *timeout*] [**interval** *interval*] [**min-ttl** *min-vc-label-ttl*] [**max-ttl** *max-vc-label-ttl*] [**max-fail** *no-response-count*] [**detail**]

vccv-trace saii-type2 *global-id:prefix:ac-id* **taii-type2** *global-id:prefix:ac-id* [**reply-mode** *ip-routed* | *control-channel*]

vccv-trace spoke-sdp-fec *spoke-sdp-fec-id* [**reply-mode** *ip-routed* | *control-channel*] [**saii-type2** *global-id:prefix:ac-id* **taii-type2** *global-id:prefix:ac-id*]

options common to all vccv-trace cases: [**detail**] [**fc** *fc-name* [**profile** *in* | *out*]] [**interval** *interval-value*] [**max-fail** *no-response-count*] [**max-ttl** *max-vc-label-ttl*] [**min-ttl** *min-vc-label-ttl*] [**probe-count** *probe-count*] [**size** *octets*] [**timeout** *timeout-value*]

Context

oam

config>saa>test>type

Platforms

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

Description

This command configures a Virtual Circuit Connectivity Verification (VCCV) automated trace test. The automated VCCV-trace can trace the entire path of a PW with a single command issued at the T-PE or at an S-PE. This is equivalent to LSP-trace and is an iterative process by which the source T-PE or S-PE node sends successive VCCV-ping messages with incrementing the TTL value, starting from TTL=1.

In each iteration, the T-PE builds the MPLS echo request message in a way similar to **vccv-ping**. The first message with TTL=1 has the next-hop S-PE T-LDP session source address in the Remote PE Addressí field in the PW FEC TLV. Each S-PE which terminates and processes the message includes in the MPLS echo reply message the FEC 128 TLV corresponding the PW segment to its downstream node. The source T-PE or S-PE node can build the next echo reply message with TTL=2 to test the next-next hop for the MS-PW. It copies the FEC TLV it received in the echo reply message into the new echo request message. The process is terminated when the reply is from the egress T-PE or when a timeout occurs.

The user can specify to display the result of the VCCV-trace for a fewer number of PW segments of the end-to-end MS-PW path. In this case, the **min-ttl** and **max-ttl** parameters are configured accordingly. However, the T-PE/S-PE node still probes all hops up to **min-ttl** to correctly build the FEC of the desired subset of segments.

Parameters

sdpid:vcid

Specifies the VC ID of the pseudowire being tested. The VC ID needs to exist on the local 7210 SAS and the **far-end** peer needs to indicate that it supports VCCV to allow the user to send **vccv-ping** message.

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Values 1 to 17407:1 to 4294967295

reply-mode {*ip-routed* | *control-channel*}

Specifies the **reply-mode** parameter to indicate to the far-end how to send the reply message. The option **control-channel** indicates a reply mode in-band using the VCCV control channel.

Note that when a VCCV trace message is originated from an S-PE node, the user should use the IPv4 reply mode because the replying node does not know how to set the TTL to reach the sending S-PE node. If the user attempts this, a warning is issued to use the ipv4 reply mode.

Default control-channel

control-channel {none | non-ip}

Specifies the encapsulation format to use for the VCCV ping echo request and echo reply packet.

Values **none** — IPv4 encapsulation in an IPv4 pseudowire associated channel (channel type 0x0021)

non-ip — MPLS-TP encapsulation without UDP/IP headers, in pseudowire associated channel using channel type 0x025.

Default non-ip

spoke-sdp-fec *spoke-sdp-fec-id*

Specifies the *spoke-sdp-fec-id* if a FEC 129 PW is being tested. The *spoke-sdp-fec-id* must exist on the local router and the far-end peer needs to indicate that it supports VCCV to allow the user to send vccv-ping messages.

spoke-sdp-fec is mutually exclusive with the *sdp-id:vc-id* parameter.

Values 1 to 4294967295

saii-type2 *global-id:prefix:ac-id*

Specifies the source attachment individual identifier (SAII) if a FEC129 AII Type 2 pseudowire is being tested.

The **saii-type2** parameter is mutually exclusive with the *sdp-id:vc-id* parameter.

Syntax: *global-id* — The global ID of this 7210 T-PE node.

Values: 1 to 4294967295

prefix — The prefix on this 7210 T-PE node that the spoke-SDP is associated with.

ac-id — An unsigned integer representing a locally unique identifier for the spoke-SDP.

Values: 1 to 4294967295

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taii-type2 *global-id:prefix:ac-id*

Specifies the target attachment individual identifier (TAII) if a FEC129 AII Type 2 pseudowire is being tested. The taii-type2 parameter is mutually exclusive with sdp-id:vc-id.

Syntax: *global-id* – The global ID of the far end T-PE of the FEC129 pseudowire.

Values: 1 to 4294967295

prefix — The prefix on far end T-PE that the pseudowire being tested is associated with.

Values: ipv4-formatted address: a.b.c.d

ac-id — An unsigned integer representing a locally unique identifier for the pseudowire being tested at the far end T-PE.

Values: 1 to 4294967295

fc *fc-name* [profile {in | out}

Specifies the **fc** and **profile** parameters used to indicate the forwarding class of the VCCV trace echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

The LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end router that receives the message request. The egress mappings of the egress network interface on the far-end router controls the forwarding class markings on the return reply message. The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating router.

fc-name

Specifies the forwarding class of the VCCV trace echo request encapsulation.

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

Default be

profile {in | out}

Specifies the profile state of the VCCV trace echo request encapsulation.

Default out

size *octets*

Specifies the VCCV ping echo request packet size in octets, expressed as a decimal integer. The request payload is padded with zeros to the specified size.

Values 88 to 9198

Default 88

probe-count *probe-count*

Specifies the number of VCCV trace echo request messages to send per TTL value.

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Values 1 to 10

Default 1

timeout ***timeout***

Specifies the **timeout** parameter in seconds, expressed as a decimal integer. This value is used to override the default **timeout** value and is the amount of time that the router waits for a message reply after sending the message request. Upon the expiration of message timeout, the requesting router assumes that the message response has not been received. A request timeout message is displayed by the CLI for each message request sent that expires. Any response received after the request times out is silently discarded.

Values 1 to 60

Default 3

interval ***interval***

The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

Values 1 to 255

Default 1

min-ttl ***min-vc-label-ttl***

Specifies the TTL value for the VC label of the echo request message for the first hop of the MS-PW for which the results are to be displayed. This is expressed as a decimal integer. Note that the outer label TTL is still set to the default of 255 regardless of the value of the VC label.

Values 1 to 255

Default 1

max-ttl ***max-vc-label-ttl***

Specifies the TTL value for the VC label of the echo request message for the last hop of the MS-PW for which the results are to be displayed. This is expressed as a decimal integer. Note that the outer label TTL is still set to the default of 255 regardless of the value of the VC label.

Values 1 to 255

Default 8

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max-fail ***no-response-count***

Specifies the maximum number of consecutive VCCV trace echo requests, expressed as a decimal integer that do not receive a reply before the trace operation fails for a specific TTL value.

Values 1 to 255

Default 5

3.8.2.10 OAM SAA commands

saa

Syntax

saa *test-name* [**owner** *test-owner*] {**start** | **stop**} [**no-accounting**]

Context

oam

Platforms

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

Description

This command starts or stops an SAA test.

Parameters

test-name

Specifies the name of the SAA test. The test name must already be configured in the **config**>**saa**>**test** context.

owner ***test-owner***

Specifies the owner of an SAA operation up to 32 characters.

Values If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

start

Starts the test. A test cannot be started if the same test is still running.

A test cannot be started if it is in a shut-down state. An error message and log event are generated to indicate a failed attempt to start an SAA test run. A test cannot be started if it is in a continuous state.

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stop

Stops a test in progress. A test cannot be stopped if it is not in progress. A log message is generated to indicate that an SAA test run has been aborted. A test cannot be stopped if it is in a continuous state.

no-accounting

Disables the recording results in the accounting policy. If **no-accounting** is specified, the MIB record produced at the end of the test is not added to the accounting file. It does however use up one of the three MIB rows available for the accounting module to be collected.

3.8.2.11 LDP treetrace commands

ldp-treetrace

Syntax

ldp-treetrace {**prefix** *ip-prefixImask*} [**max-ttl** *ttl-value*] [**max-path** *max-paths*] [**timeout** *timeout*] [**retry-count** *retry-count*] [**fc** *fc-name* [**profile** *profile*]] [**downstream-map-tlv** {**dsmap**|**ddmap**}]

Context

oam

Platforms

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

Description

This command configures LDP treetrace to perform a single run of the LDP ECMP OAM tree trace. LDP treetrace tests are run to discover all ECMP paths of an LDP FEC

Parameters

prefix *ip-prefix/mask*

Specifies the address prefix and subnet mask of the target BGP IPv4 label route.

max-ttl *max-label-ttl*

Specifies the maximum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer.

Values 1 to 255

Default 30

max-paths *max-paths*

Specifies the maximum number of paths for an LDP treetrace test, expressed as a decimal integer.

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Values 1 to 255

Default 128

timeout *timeout*

Specifies the **timeout**, in seconds, expressed as a decimal integer. This value overrides the default **timeout** value. It specifies the amount of time the router will wait for a message reply after sending the message request. When the message timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out is silently discarded.

Values 1 to 60

Default 3

fc *fc-name*

Specifies the forwarding class of the MPLS echo request packet.

When an MPLS echo request packet is generated in the CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the specified **fc** and *profile* parameter values. The LSP-EXP mappings on the outgoing interface control the marking of the packet EXP.

When the MPLS echo request packet is received on the responding node, the LSP-EXP mappings of the incoming interface determine the **fc** parameter values.

When an MPLS echo reply packet is generated in the CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the **fc** parameter. The parameter values is determined by the classification of the echo request packet being replied to at the incoming interface control the marking of the packet. The LSP-EXP mappings on the outgoing interface. The TOS byte is not modified. The following table summarizes the MPLS echo request packet behavior.

Table 32: Request packet and behavior for sender and responder nodes

Node	Packet and description of behavior
CPM (sender node)	echo request packet: • packet{tos=1, fc1} • fc1 and profile1 are as entered by user in OAM command or default values • tos1 as per mapping of {fc1} to IP precedence in network egress QoS policy of outgoing interface
Outgoing interface (sender node)	echo request packet: • pkt queued as {fc1} • ToS field=tos1 not remarked • EXP=exp1, as per mapping of {fc1} to EXP in network egress QoS policy of outgoing interface
Incoming interface (responder node)	echo request packet:

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Node	Packet and description of behavior
	• packet{tos1, exp1} • exp1 mapped to {fc2} as per classification in network QoS policy of incoming interface
CPM (responder node)	echo reply packet: • packet{tos=1, fc2}
Outgoing interface (responder node)	echo reply packet: • pkt queued as {fc2} • ToS filed= tos1 not remarked (reply inband or out-of-band) • EXP=exp2, if reply is inband, remarked as per mapping of {fc2, profile2} to EXP in network egress QoS policy of outgoing interface
Incoming interface (sender node)	echo reply packet: • packet{tos1, exp2} • exp2 mapped to {fc1, profile1} as per classification in network QoS policy of incoming interface

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

Default be

profile *profile*

Specifies the profile state of the MPLS echo request packet.

Values in, out

Default out

retry-count *retry-count*

Specifies the maximum number of consecutive MPLS echo requests, expressed as a decimal integer, that do not receive a reply before the trace operation fails for a specific TTL.

Values 1 to 255

Default 5

downstream-map-tlv {dsmap | ddmap}

Specifies which format of the Downstream Mapping TLV to use in the LSP trace packet. Use **dsmap** for the original DSMAP TLV format defined in RFC 4379. Use **ddmap** for the enhanced DDMAP TLV format defined in RFC 6424.

Default inherited from global configuration of downsteamn mapping TLV in option **mpls-echo-request-downstream-map** {**dsmap** | **ddmap**}

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Output

The following output is an example of LDP treetrace information.

Sample output

```
*A:Dut-A# oam ldp-treetrace prefix 10.20.1.6/32

ldp-treetrace for Prefix 10.20.1.6/32:

         127.0.0.1, ttl =   3 dst =      127.1.0.255 rc = EgressRtr status = Done
    Hops:         127.0.0.1         127.0.0.1

         127.0.0.1, ttl =   3 dst =      127.2.0.255 rc = EgressRtr status = Done
    Hops:         127.0.0.1         127.0.0.1

ldp-treetrace discovery state: Done
ldp-treetrace discovery status: ' OK '
Total number of discovered paths: 2
Total number of failed traces: 0
```

test-oam

Syntax

test-oam

Context

config

Platforms

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

Description

Commands in this context configure Operations, Administration, and Maintenance test parameters.

ldp-treetrace

Syntax

[**no**] **ldp-treetrace**

Context

config>test-oam

Platforms

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

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Description

This command configures the LDP ECMP OAM tree trace which consists of an LDP ECMP path discovery and an LDP ECMP path probing features.

The **no** option deletes the configuration for the LDP ECMP OAM tree discovery and path probing under this context.

Output

The following outputs are examples of LDP treetrace information over a numbered IP interface.

Sample output

```
*A:Dut-B# oam ldp-treetrace prefix 10.20.1.5/32

ldp-treetrace for Prefix 10.20.1.5/32:

       10.10.131.2, ttl =   2 dst =      127.1.0.253 rc = EgressRtr status = Done
    Hops:          11.1.0.2

       10.10.132.2, ttl =   2 dst =      127.1.0.255 rc = EgressRtr status = Done
    Hops:          11.1.0.2

       10.10.131.2, ttl =   2 dst =      127.2.0.255 rc = EgressRtr status = Done
    Hops:          11.2.0.2

       10.10.132.2, ttl =   2 dst =      127.2.0.253 rc = EgressRtr status = Done
    Hops:          11.2.0.2

ldp-treetrace discovery state: Done
ldp-treetrace discovery status: ' OK '
Total number of discovered paths: 4
Total number of failed traces: 0
```

fc

Syntax

fc *fc-name*

no fc

Context

config>test-oam>ldp-treetrace

Platforms

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

Description

This command configures the forwarding class of the MPLS echo request packet.

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When an MPLS echo request packet is generated in the CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the specified **fc** parameter values. The LSP-EXP mappings on the outgoing interface control the marking of the packet EXP.

When the MPLS echo request packet is received on the responding node, the LSP-EXP mappings of the incoming interface determine the **fc** parameter values.

When an MPLS echo reply packet is generated in the CPM and forwarded to the outgoing interface, the packet is queued in the egress network queue corresponding to the **fc** parameter. The classification of the echo request packet being replied to at the incoming interface determines the value of the **fc** parameter. The LSP-EXP mappings on the outgoing interface control the marking of the packet EXP. The TOS byte is not modified. Table 32: Request packet and behavior for sender and responder nodes summarizes this behavior.

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

Default

be

Parameters

fc-name

Specifies the forwarding class of the MPLS echo request packets.

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

path-discovery

Syntax

path-discovery

Context

config>test-oam>ldp-treetrace

Platforms

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

Description

Commands in this context configure LDP ECMP OAM path discovery.

The ingress LER sends LSP Trace messages, including the LDP IPv4 Prefix FEC TLV and DSMAP TLV to the downstream LSR to build the ECMP tree for a specific FEC (egress FEC). It also inserts an IP address range drawn from the 127/8 space. The downstream LSR uses the address range to determine the ECMP path exercised by an IP address or a subrange of addresses within the specified range based on its internal hash routine. When the ingress LER receives the MPLS echo reply, it records this information and proceeds with the next echo request message targeted for a node downstream of the first LSR node along one of the ECMP paths. The subrange of IP addresses indicated in the initial reply allows the LSR downstream of the ingress LER to pass this message to its downstream node along the first ECMP path.

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Use the interval command to configure the frequency of running tree discovery.

The ingress LER gets the list of FECs from the LDP FEC database. New FECs are added to the discovery list at the next tree discovery, and not when they are learned and added into the FEC database. Use the policy-statement command to configure FECs to include or exclude the use of a policy profile.

interval

Syntax

interval *minutes*

no interval

Context

config>test-oam>ldp-treetrace>path-discovery

Platforms

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

Description

This command configures the frequency of the LDP ECMP OAM path-discovery process. At every interval, the node sends LSP trace messages to discover the entire ECMP path tree for a specific destination FEC.

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

Default

60

Parameters

minutes

Specifies the number of minutes to wait before repeating the LDP tree auto-discovery process.

Values 60 to 1440

max-path

Syntax

max-path *max-paths*

Context

config>test-oam>ldp-treetrace>path-discovery

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Platforms

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

Description

This command configures the maximum number of ECMP paths the path discovery attempts to discover for each run every interval minutes.

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

Default

16

Parameters

max-paths

Specifies the maximum number of paths for the tree discovery.

Values 1 to 16

max-ttl

Syntax

max-ttl *ttl-value*

Context

config>test-oam>ldp-treetrace>path-discovery

Platforms

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

Description

This command configures the maximum number of hops that are traced in the path of each FEC to be discovered.

The **no** form of this command reverts to the maximum time-to-live (TTL) default value.

Default

255

Parameters

ttl-value

Specifies the maximum label TTL value for an LSP trace request during the tree discovery.

Values 1 to 255

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policy-statement

Syntax

policy-statement *policy-name* [**...**(up to 5 max)]

Context

config>test-oam>ldp-treetrace>path-discovery

Platforms

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

Description

This command configures FEC policy to determine which routes are imported from the LDP FEC database for the purpose of discovering its paths and probing them.

If no policy is specified, the ingress LER imports the full list of FECs from the LDP FEC database. New FECs are added to the discovery list at the next path discovery, and not when they are learned and added into the FEC database. A maximum of 500 FECs can be discovered using path discovery.

The user can configure the FECs to include or exclude.

Policies are configured in the **config**>**router**>**policy-options** context. A maximum of five policy names can be specified.

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

Default

no policy-statement

Parameters

policy-name

Specifies the route policy name to filter LDP imported address FECs. Allowed values are any string up to 32 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed within double quotes. The specified policy names must already be defined.

retry-count

Syntax

retry-count *retry-count*

no retry-count

Context

config>oam-test>ldp-treetrace>path-discovery

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config>oam-test>ldp-treetrace>path-probing

Platforms

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

Description

In the **config**>**oam-test**>**ldp-treetrace**>**path-discovery** context, this command configures the number of retransmissions of an LSP trace message to discover the path of an LDP FEC when no response is received within the **timeout** period.

In the **config**>**oam-test**>**ldp-treetrace**>**path-probing** context, this command configures the number of retransmissions of an LSP ping message to probe the path of an LDP FEC when no response is received within the **timeout** period.

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

Default

3

Parameters

retry-count

Specifies the maximum number of consecutive timeouts allowed before failing a path probe (ping).

Values 1 to 10

timeout

Syntax

timeout *timeout*

no timeout

Context

config>test-oam>ldp-treetrace>path-discovery

Platforms

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

Description

This command configures the maximum amount of time, in seconds, that the node will wait for a response after sending an LSP Trace message sent to discover the path of an LDP FEC before it declares failure. After consecutive failures equal to the value configured for the retry-count command, the node gives up.

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

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Default

30

Parameters

timeout

Specifies the timeout period, in seconds.

Values 1 to 60

path-probing

Syntax

path-probing

Context

config>test-oam>ldp-treetrace

Platforms

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

Description

Commands in this context configure LDP tree trace path probing.

The periodic path exercising runs in the background to test the LDP ECMP paths discovered by the path discovery capability. The probe used is an LSP Ping message with an IP address drawn from the subrange of 127/8 addresses indicated by the output of the tree discovery for this FEC.

Use the interval command to configure the frequency of running path probes. If an interface is down on the ingress LER that is performing the LDP tree trace, LSP ping probes tfrom the interface are not sent, but the ingress LER node does not raise alarms.

The LSP ping routine updates the content of the MPLS echo request message, specifically the IP address, as soon as the LDP ECMP path discovery phase has output the results of a new computation for the path in question.

interval

Syntax

interval *minutes*

no interval

Context

config>test-oam>ldp-treetrace>path-probing

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Platforms

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

Description

This command configures the frequency of the LSP Ping messages used to probe the paths of all LDP FECs discovered by the LDP tree trace path discovery.

The **no** option resets the interval to its default value.

Default

1

Parameters

minutes

Specifies the number of minutes to wait between probing all active ECMP paths for each LDP FEC.

Values 1 to 60

timeout

Syntax

timeout *timeout*

no timeout

Context

config>test-oam>ldp-treetrace>path-probing

Platforms

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

Description

This command configures the maximum amount of time, in minutes, that the node waits for a response after sending an LSP Ping message to probe the path of an LDP FEC before declaring failure. After consecutive failures equal to the value configured for the retry-count command, the node gives up.

The **no** form of this command resets the timeout period to its default value.

Default

1

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Parameters

timeout

Specifies the timeout parameter, in minutes.

Values 1 to 3

mpls-echo-request-downstream-map

Syntax

mpls-echo-request-downstream-map {**dsmap** | **ddmap**}

no mpls-echo-request-downstream-map

Context

config>test-oam

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command specifies which format of the DSMAP TLV to use in all LSP trace packets and LDP tree trace packets originated on this node. The DSMAP TLV is the original format defined in RFC 4379 and is the default value. The Downstream Detailed Mapping (DDMAP) TLV is the enhanced format, as defined in RFC 6424.

This command applies to the LSP trace of an RSVP P2P LSP, MPLS-TP LSP, or LDP unicast FEC, and to LDP tree trace of a unicast LDP FEC. It does not apply to LSP trace of an RSVP P2MP LSP, which always uses the DDMAP TLV.

The global DSMAP and DDMAP setting impacts the behavior of both OAM LSP trace packets and SAA test packets of type lsp-trace and is used by the sender node when one of the following events occurs.

1. An SAA test of type **lsp-trace** is created (not modified) and no value is specified for the per-test **downstream-map-tlv** {**dsmap** | **ddmap** | **none**} option. In this case, the SAA test **downstream-map-tlv** value defaults to the global **mpls-echo-request-downstream-map** value.
2. An OAM test of type **lsp-trace** test is executed and no value is specified for the per-test **downstream-map-tlv** {**dsmap** | **ddmap** | **none**} option. In this case, the OAM test **downstream-map-tlv** value defaults to the global **mpls-echo-request-downstream-map** value.

A consequence of the preceding rules is that a change to the value of **mpls-echo-request-downstream-map** does not affect the value inserted in the DSMAP TLV of existing tests.

The following are the details of the processing of the new DDMAP TLV.

1. When either the DSMAP TLV or the DDMAP TLV is received in an echo request message, the responder node includes the same type of TLV in the echo reply message with the correct downstream interface and label stack information.
2. If an echo request message without a DSMAP or DDMAP TLV expires at a node that is not the egress for the target FEC stack, the responder node always includes the DSMAP TLV in the echo reply message. This can occur in the following cases.

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a. The user issues an LSP trace from a sender node with a **min-ttl** value higher than 1 and a **max-ttl** value lower than the number of hops to reach the egress of the target FEC stack. This is the sender node behavior when the global configuration or the per-test setting of the DSMAP or DDMAP is set to DSMAP.

b. The user issues an LSP ping from a sender node with a **ttl** value lower than the number of hops to reach the egress of the target FEC stack. This is the sender node behavior when the global configuration of the DSMAP or DDMAP is set to DSMAP.

c. The behavior in 2.a is changed when the global configuration or the per-test setting of the DSMAP TLV is set to DDMAP. In this case, the sender node includes the DDMAP TLV with the Downstream IP address field set to the all-routers multicast address, as defined in Section 3.3 of RFC 4379. The responder node bypasses the interface and label stack validation and replies with a DDMAP TLV with the correct downstream information for the target FEC stack.

3. A sender node never includes the DSMAP or DDMAP TLV in an LSP Ping message.

In addition to performing the same features as the DSMAP TLV, the new DDMAP TLV addresses the following scenarios:

1. full validation of an LDP FEC stitched to a BGP IPv4 label route; in this case, the LSP trace message is inserted from the LDP LSP segment or from the stitching point

2. full validation of a BGP IPv4 label route stitched to an LDP FEC

3. full validation of an LDP FEC that is stitched to a BGP LSP and stitched back into an LDP FEC; in this case, the LSP trace message is inserted from the LDP segments or the or from the stitching points

4. full validation of an LDP FEC tunneled over an RSVP LSP using LSP trace

To correctly check a target FEC that is stitched to another FEC (stitching FEC) of the same or a different type, or that is tunneled over another FEC (tunneling FEC), the responding nodes must provide details about the FEC manipulation back to the sender node. This is achieved using the FEC stack change sub-TLV in the DDMAP TLV, as defined in RFC 6424.

When the user configures the use of the DDMAP TLV on a trace for an LSP that does not undergo stitching or tunneling in the network, the procedures at the sender and responder nodes are the same as for the DSMAP TLV.

This feature introduces changes to the target FEC stack validation procedures at the sender and responder nodes in the case of LSP stitching and LSP hierarchy. These changes pertain to the processing of the new FEC stack change sub-TLV in the new DDMAP TLV and the new return code of value 15 Label switched with FEC change.

The **no** form of this command reverts to the default behavior of using the DSMAP TLV in a LSP trace packet and LDP tree trace packet.

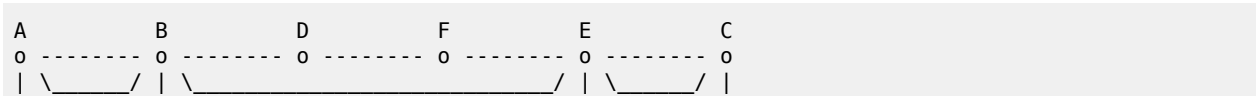
Default

dsmap

Output

The following output is an example of DSMAP TLV information.

LDP-over-RSVP



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```
 \  RSVP  /               LDP                \  RSVP  /
  \______/                                    \______/
    LDP                                         LDP

Testing LDP FEC of Node C with DSMAP TLV
----------------------------------------
*A:Dut-A#
*A:Dut-A# oam lsp-trace prefix 10.20.1.3/32 downstream-map-tlv dsmap detail
lsp-trace to 10.20.1.3/32: 0 hops min, 0 hops max, 104 byte packets
1  10.20.1.2  rtt=3.90ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.4.4 ifaddr=10.10.4.4 iftype=ipv4Numbered MRU=1500
           label[1]=131068 protocol=3(LDP)
2  10.20.1.4  rtt=5.69ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1500
           label[1]=131066 protocol=3(LDP)
3  10.20.1.6  rtt=7.88ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.10.5 ifaddr=10.10.10.5 iftype=ipv4Numbered MRU=1500
           label[1]=131060 protocol=3(LDP)
4  10.20.1.5  rtt=23.2ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.5.3 ifaddr=10.10.5.3 iftype=ipv4Numbered MRU=1496
           label[1]=131071 protocol=3(LDP)
5  10.20.1.3  rtt=12.0ms rc=3(EgressRtr) rsc=1
*A:Dut-A#


Testing LDP FEC of Node C with DDMAP TLV
----------------------------------------
*A:Dut-A# oam lsp-trace prefix 10.20.1.3/32 downstream-map-tlv ddmap detail
lsp-trace to 10.20.1.3/32: 0 hops min, 0 hops max, 136 byte packets
1  10.20.1.2  rtt=4.00ms rc=3(EgressRtr) rsc=2
1  10.20.1.2  rtt=3.48ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.4.4 ifaddr=10.10.4.4 iftype=ipv4Numbered MRU=1500
           label[1]=131068 protocol=3(LDP)
2  10.20.1.4  rtt=5.34ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1500
           label[1]=131066 protocol=3(LDP)
3  10.20.1.6  rtt=7.78ms rc=8(DSRtrMatchLabel) rsc=1
     DS 1: ipaddr=10.10.10.5 ifaddr=10.10.10.5 iftype=ipv4Numbered MRU=1500
           label[1]=131060 protocol=3(LDP)
4  10.20.1.5  rtt=12.8ms rc=15(LabelSwitchedWithFecChange) rsc=1
     DS 1: ipaddr=10.10.5.3 ifaddr=10.10.5.3 iftype=ipv4Numbered MRU=1496
           label[1]=131054 protocol=4(RSVP-TE)
           label[2]=131071 protocol=3(LDP)
           fecchange[1]=PUSH fectype=RSVP IPv4 prefix=10.20.1.3 remotepeer=10.10.5.3

5  10.20.1.3  rtt=12.8ms rc=3(EgressRtr) rsc=2
5  10.20.1.3  rtt=13.4ms rc=3(EgressRtr) rsc=1
*A:Dut-A#



D          F          E          C          A          B
o -------- o -------- o -------- o -------- o -------- o
  \_________________/ | \_________________/ | \______/ |
          LDP          \     RSVP ECA      / \  RSVP  /
                        \_________________/   \______/
                                 LDP            LDP

Testing LDP FEC of Node B with DDMAP TLV
----------------------------------------
*A:Dut-D#
*A:Dut-D# oam lsp-trace prefix 10.20.1.2/32 downstream-map-tlv ddmap detail
lsp-trace to 10.20.1.2/32: 0 hops min, 0 hops max, 108 byte packets
1  10.20.1.6  rtt=3.17ms rc=8(DSRtrMatchLabel) rsc=1
```


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```
     DS 1: ipaddr=10.10.10.5 ifaddr=10.10.10.5 iftype=ipv4Numbered MRU=1500
           label[1]=131065 protocol=3(LDP)
2  10.20.1.5  rtt=8.27ms rc=15(LabelSwitchedWithFecChange) rsc=1
     DS 1: ipaddr=10.10.5.3 ifaddr=10.10.5.3 iftype=ipv4Numbered MRU=1496
           label[1]=131068 protocol=4(RSVP-TE)
           label[2]=131065 protocol=3(LDP)
           fecchange[1]=PUSH fectype=RSVP IPv4 prefix=10.20.1.1 remotepeer=10.10.5.

3  10.20.1.3  rtt=9.50ms rc=8(DSRtrMatchLabel) rsc=2
     DS 1: ipaddr=10.10.2.1 ifaddr=10.10.2.1 iftype=ipv4Numbered MRU=1500
           label[1]=131068 protocol=4(RSVP-TE)
4  10.20.1.1  rtt=10.4ms rc=3(EgressRtr) rsc=2
4  10.20.1.1  rtt=10.2ms rc=15(LabelSwitchedWithFecChange) rsc=1
     DS 1: ipaddr=10.10.1.2 ifaddr=10.10.1.2 iftype=ipv4Numbered MRU=1496
           label[1]=131066 protocol=4(RSVP-TE)
           label[2]=131071 protocol=3(LDP)
           fecchange[1]=PUSH fectype=RSVP IPv4 prefix=10.20.1.2 remotepeer=10.10.1.

5  10.20.1.2  rtt=13.7ms rc=3(EgressRtr) rsc=2
5  10.20.1.2  rtt=13.6ms rc=3(EgressRtr) rsc=1
*A:Dut-D#

Testing LDP FEC of Node F with DSMAP TLV
----------------------------------------
*A:Dut-A# *A:Dut-A# oam lsp-trace prefix 10.20.1.6/32 downstream-map-
tlv dsmap detail lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 104 byte packets
1  10.20.1.2  rtt=2.65ms rc=8(DSRtrMatchLabel) rsc=1
2  10.20.1.3  rtt=4.89ms rc=8(DSRtrMatchLabel) rsc=1
3  10.20.1.4  rtt=6.49ms rc=5(DSMappingMismatched) rsc=1
*A:Dut-A#

Testing LDP FEC of Node F with DDMAP TLV
----------------------------------------
*A:Dut-A# oam lsp-trace prefix 10.20.1.6/32 downstream-map-tlv ddmap detail lsp-
trace to 10.20.1.6/32: 0 hops min, 0 hops max, 108 byte packets
1  10.20.1.2  rtt=3.50ms rc=15(LabelSwitchedWithFecChange) rsc=1
      DS 1: ipaddr=10.10.3.3 ifaddr=10.10.3.3 iftype=ipv4Numbered MRU=1496
            label[1]=131068 protocol=3(LDP)
            label[2]=131060 protocol=2(BGP)
            fecchange[1]=POP  fectype=LDP IPv4 prefix=10.20.1.6 remotepeer=0.0.0.0 (
Unknown)
            fecchange[2]=PUSH fectype=BGP IPv4 prefix=10.20.1.6 remotepeer=10.20.1.5
            fecchange[3]=PUSH fectype=LDP IPv4 prefix=10.20.1.5 remotepeer=10.10.3.3
2  10.20.1.3  rtt=6.53ms rc=15(LabelSwitchedWithFecChange) rsc=2
      DS 1: ipaddr=10.10.11.4 ifaddr=10.10.11.4 iftype=ipv4Numbered MRU=1496
            label[1]=131060 protocol=4(RSVP-TE)
            label[2]=131070 protocol=3(LDP)
            label[3]=131060 protocol=2(BGP)
            fecchange[1]=PUSH fectype=RSVP IPv4 prefix=10.20.1.4 remotepeer=10.10.11
.4
3  10.20.1.4  rtt=7.94ms rc=3(EgressRtr) rsc=3
3  10.20.1.4  rtt=6.69ms rc=8(DSRtrMatchLabel) rsc=2
      DS 1: ipaddr=10.10.6.5 ifaddr=10.10.6.5 iftype=ipv4Numbered MRU=1500
            label[1]=131071 protocol=3(LDP)
            label[2]=131060 protocol=2(BGP)
4  10.20.1.5  rtt=10.1ms rc=3(EgressRtr) rsc=2
4  10.20.1.5  rtt=8.97ms rc=15(LabelSwitchedWithFecChange) rsc=1
      DS 1: ipaddr=10.10.10.6 ifaddr=10.10.10.6 iftype=ipv4Numbered MRU=1500
            label[1]=131071 protocol=3(LDP)
            fecchange[1]=POP  fectype=BGP IPv4 prefix=10.20.1.6 remotepeer=0.0.0.0 (
Unknown)
            fecchange[2]=PUSH fectype=LDP IPv4 prefix=10.20.1.6 remotepeer=10.10.10.
6
5  10.20.1.6  rtt=11.8ms rc=3(EgressRtr) rsc=1 *A:Dut-A#
```


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```
A         B          C           D         E
o ------- o -------- o --------- o ---3--- o
  \_____/ |            \_______/           |
    LDP   |              RSVP              |
          |\_______________________________/|
          |               LDP               |
           \_______________________________/
                          BGP
Testing BGP Label Route of Node E with DDMAP TLV
------------------------------------------------
*A:Dut-B# oam lsp-trace prefix 11.20.1.5/32 bgp-label downstream-map-
tlv ddmap detail lsp-trace to 11.20.1.5/32: 0 hops min, 0 hops max, 124 byte packets
1  10.20.1.3  rtt=2.35ms rc=15(LabelSwitchedWithFecChange) rsc=2
      DS 1: ipaddr=10.10.11.4 ifaddr=10.10.11.4 iftype=ipv4Numbered MRU=1496
            label[1]=131060 protocol=4(RSVP-TE)
            label[2]=131070 protocol=3(LDP)
            label[3]=131070 protocol=2(BGP)
            fecchange[1]=PUSH fectype=RSVP IPv4 prefix=10.20.1.4 remotepeer=10.10.11
.4
2  10.20.1.4  rtt=4.17ms rc=3(EgressRtr) rsc=3
2  10.20.1.4  rtt=4.50ms rc=8(DSRtrMatchLabel) rsc=2
      DS 1: ipaddr=10.10.6.5 ifaddr=10.10.6.5 iftype=ipv4Numbered MRU=1500
            label[1]=131071 protocol=3(LDP)
            label[2]=131070 protocol=2(BGP)
3  10.20.1.5  rtt=7.78ms rc=3(EgressRtr) rsc=2
3  10.20.1.5  rtt=6.80ms rc=3(EgressRtr) rsc=1 *A:Dut-B#

B          C           D         E         F
o -------- o --------- o ---3--- o ---3--- o
|            \_______/           | \_____/
|              RSVP              |
|\______________________________/|
|              LDP               |
 \______________________________/
                BGP

Testing with DDMAP TLV LDP FEC of Node F when stitched to a BGP Label Route
---------------------------------------------------------------------------

*A:Dut-B# oam lsp-trace prefix 10.20.1.6/32 bgp-label downstream-map-
tlv ddmap detail lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 124 byte packets
1  10.20.1.3  rtt=3.21ms rc=15(LabelSwitchedWithFecChange) rsc=2
      DS 1: ipaddr=10.10.11.4 ifaddr=10.10.11.4 iftype=ipv4Numbered MRU=1496
            label[1]=131060 protocol=4(RSVP-TE)
            label[2]=131070 protocol=3(LDP)
            label[3]=131060 protocol=2(BGP)
            fecchange[1]=PUSH fectype=RSVP IPv4 prefix=10.20.1.4 remotepeer=10.10.11
.4
2  10.20.1.4  rtt=5.50ms rc=3(EgressRtr) rsc=3
2  10.20.1.4  rtt=5.37ms rc=8(DSRtrMatchLabel) rsc=2
      DS 1: ipaddr=10.10.6.5 ifaddr=10.10.6.5 iftype=ipv4Numbered MRU=1500
            label[1]=131071 protocol=3(LDP)
            label[2]=131060 protocol=2(BGP)
3  10.20.1.5  rtt=7.82ms rc=3(EgressRtr) rsc=2
3  10.20.1.5  rtt=6.11ms rc=15(LabelSwitchedWithFecChange) rsc=1
      DS 1: ipaddr=10.10.10.6 ifaddr=10.10.10.6 iftype=ipv4Numbered MRU=1500
            label[1]=131071 protocol=3(LDP)
            fecchange[1]=POP  fectype=BGP IPv4 prefix=10.20.1.6 remotepeer=0.0.0.0 (
Unknown)
           fecchange[2]=PUSH fectype=LDP IPv4 prefix=10.20.1.6 remotepeer=10.10.10.6
4  10.20.1.6  rtt=10.2ms rc=3(EgressRtr) rsc=1 *A:Dut-B#
```


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3.8.2.12 TWAMP commands

twamp

Syntax

twamp

Context

config>test-oam

Platforms

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

Description

Commands in this context configure TWAMP functionality.

Default

no twamp

server

Syntax

server

Context

config>test-oam>twamp

Platforms

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

Description

Commands in this context configure the node for TWAMP server functionality.

prefix

Syntax

prefix {*ip-prefix* | *mask*} [**create**]

no prefix

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Context

config>test-oam>twamp>server

Platforms

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

Description

This command configures an IP address prefix containing one or more TWAMP clients. In order for a TWAMP client to connect to the TWAMP server (and subsequently conduct tests) it must establish the control connection using an IP address that is part of a configured prefix

Default

no prefix

Parameters

prefix ip-prefix/mask

Specifies the address prefix and subnet mask of the destination node.

ip-prefix

Specifies the IPv4 address in dotted-decimal notation.

Values a.b.c.d

Default none

mask

Specifies the prefix length.

Values 0 to 32

Default none

create

Creates an entry.

description

Syntax

description *description-string*

no description

Context

config>test-oam>twamp>server>prefix

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Platforms

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

Description

This command creates a text description for the current configuration context that is stored in the configuration file. The **description** command associates a text string with a configuration context to help identify the content in the configuration file.

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

Parameters

description-string

Specifies the description character string. Allowed values are any character strings up to 80 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed in double quotes.

max-conn-prefix

Syntax

max-conn-prefix *count*

no max-conn-prefix

Context

config>test-oam>twamp>server>prefix

Platforms

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

Description

This command configures the maximum number of TWAMP control connections by clients with an IP address in a specific prefix. A new control connection is rejected if accepting it would cause either the prefix limit defined by this command or the server limit (**max-conn-server**) to be exceeded.

The **no** form of this command sets the default value.

Default

no max-conn-prefix

Parameters

count

Specifies the maximum number of control connections.

Values 16 (7210 SAS-Sx/S 1/10GE)

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Default 8

Values 32 (7210 SAS-T, 7210 SAS-Sx 10/100GE, 7210 SAS-R6, and 7210 SAS-R12)

Default 16

max-sess-prefix

Syntax

max-sess-prefix *count*

no max-sess-prefix

Context

config>test-oam>twamp>server>prefix

Platforms

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

Description

This command configures the maximum number of concurrent TWAMP-Test sessions by clients with an IP address in a specific prefix. A new test session (described by a Request-TW-Session message) is rejected if accepting it would cause either the limit defined by this command or the server limit (**max-sess-server**) to be exceeded.

The **no** form of this command instructs the system to go with the default value.

Default

no max-sess-prefix

Parameters

count

Specifies the maximum number of concurrent test sessions.

Values 16 (7210 SAS-Sx/S 1/10GE)

Default 8

Values 32 (7210 SAS-T, 7210 SAS-Sx 10/100GE, 7210 SAS-R6, and 7210 SAS-R12)

Default 16

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inactivity-timeout

Syntax

inactivity-timeout *seconds*

no inactivity-timeout

Context

config>test-oam>twamp>server

Platforms

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

Description

This command configures the inactivity timeout for all TWAMP-control connections. If no TWAMP control message is exchanged over the TCP connection for this duration of time the connection is closed and all tests in progress are terminated.

The **no** form of this command instructs the system to go with the default value.

Default

no inactivity-timeout

Parameters

retry-count

Specifies the duration of the inactivity timeout.

Values 60 to 3600

Default 900

max-conn-server

Syntax

max-conn-server *count*

no max-conn-server

Context

config>test-oam>twamp>server

Platforms

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

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Description

This command configures the maximum number of TWAMP control connections from all TWAMP clients.

A new control connection is rejected if accepting it would cause either this limit or a prefix limit (max-conn-prefix) to be exceeded.

The **no** form of this command sets the default value.

Default

no max-conn-server

Parameters

count

Specifies the maximum number of control connections.

Values 16 (7210 SAS-Sx/S 1/10GE)

Default 8

Values 32 (7210 SAS-T, 7210 SAS-Sx 10/100GE, 7210 SAS-R6, and 7210 SAS-R12)

Default 16

max-sess-server

Syntax

max-sess-server *count*

no max-sess-server

Context

config>test-oam>twamp>server

Platforms

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

Description

This command configures the maximum number of concurrent TWAMP-Test sessions across all allowed clients.

A new test session (described by a Request-TW-Session message) is rejected if accepting it would cause either the limit defined by this command or a prefix limit (**max-sess-prefix**) to be exceeded.

The **no** form of this command instructs the system to go with the default value.

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Default

no max-sessions

Parameters

count

Specifies the maximum number of concurrent test sessions.

Values 16 (7210 SAS-Sx/S 1/10GE)

Default 8

Values 32 (7210 SAS-T, 7210 SAS-R6, and 7210 SAS-R12)

Default 16

shutdown

Syntax

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

Context

config>test-oam>twamp>server

Platforms

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

Description

This command administratively disables the TWAMP server.

The **no** form of this command administratively enables the TWAMP server.

Default

shutdown

3.8.2.13 TWAMP Light commands

twamp-light

Syntax

twamp-light

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Context

config>router

config>service>vprn

config>test-oam>twamp

Platforms

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

Description

Commands in this context configure TWAMP Light functionality.

Note:
The **config**>**service**>**vprn** context is supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

reflector

Syntax

reflector [**udp-port** *udp-port-number*] [**create**]

no reflector

Context

config>router>twamp-light

config>service>vprn>twamp-light

Platforms

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

Description

This command configures TWAMP Light session reflector-specific parameters. To create a reflector, the user must configure the *udp-port-number* value and include the **create** keyword.

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

Note:
The **config**>**service**>**vprn**>**twamp-light** context is supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

Parameters

udp-port-number

Specifies the destination UDP port that the session reflector listens to for TWAMP Light packets. The session controller that is launching the TWAMP Light packets must have the same destination UDP port configured as part of the TWAMP Light test. IES services use

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the destination UDP port that is configured under the router context. Only one UDP port may be configured per unique context. An error message is generated if the specified UDP port is unavailable.

Values 862, 64364 to 64373

create

Creates the reflector.

description

Syntax

description *description-string*

no description

Context

config>router>twamp-light>reflector

config>router>twamp-light>reflector>prefix

config>service>vprn>twamp-light>reflector

config>service>vprn>twamp-light>reflector>prefix

Platforms

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

Description

Note:
The **config>service>vprn>twamp-light>reflector** and **config>service>vprn>twamp-light>reflector>prefix** contexts are supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

This command creates a text description for the current configuration context that is stored in the configuration file. The **description** command associates a text string with a configuration context to help identify the content in the configuration file.

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

Parameters

description-string

Specifies the description character string. Allowed values are any character strings up to 80 characters composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, and so on), the entire string must be enclosed in double quotes.

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prefix

Syntax

prefix *ip-prefix*/*prefix-length* [**create**]

no prefix *ip-prefix*/*prefix-length*

Context

config>router>twamp-light>reflector

config>service>vprn>twamp-light>reflector

Platforms

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

Description

This command configures the IP prefixes that the reflector accepts TWAMP Light packets from and respond to. Each prefix requires its own configuration entry.

The **no** form of this command removes the specifies prefix.

Note:
The **config**>**service**>**vprn**>**twamp-light**>**reflector** context is supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

Parameters

ip-prefix

Specifies the IP address.

Values IPv4 address in the form a.b.c.d

IPv6 address in the form x:x:x:x:x:x:x:x (eight 6-bit pieces) (no multicast addresses)

x:x:x:x:x:x:d.d.d.d

x [0..FFFF]H

d [0..255]D

prefix-length

Specifies the length of the IP prefix.

Values IPv4 — 0 to 32

IPv6 — 0 to 128

create

Keyword used to create the IP prefix entry.

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shutdown

Syntax

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

Context

config>router>twamp-light>reflector

config>service>vprn>twamp-light>reflector

Platforms

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

Description

This command disables the TWAMP Light reflector functionality within the current context.

The **no** form of this command enables the TWAMP Light reflector functionality within the current context.

Note:
The **config**>**service**>**vprn**>**twamp-light**>**reflector** context is supported on all 7210 SAS platforms as described in this document, except those operating in access-uplink mode.

Default

shutdown

inactivity-timeout

Syntax

inactivity-timeout *seconds*

no inactivity-timeout

Context

config>test-oam>twamp>twamp-light

Platforms

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

Description

This command configures the length of time to maintain stale states on the session reflector. A stale state occurs when test data information has not been refreshed or updated by newly arriving probes for that specific test in a predetermined amount of time. Any single reflector can maintain an up state for a

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maximum of 12000 tests. If the maximum value is exceeded, the session reflector does not have memory to allocate to new tests.

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

Default

inactivity-timer 100

Parameters

seconds

Specifies the number of seconds to maintain a stale state.

Values 10 to 100

session

Syntax

session *session-name* [**test-family** {**ethernet** | **ip**} [**session-type** {**proactive** | **on-demand**}] **create**]

no session *session-name*

Context

config>oam-pm

Platforms

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

Description

This command configures the individual session containers that house the test-specific configuration parameters. Because this session context provides only a container abstract to house the individual test functions, it cannot be shut down. Only individual tests sessions within the container may be shut down. No values, parameters, or configuration within this context may be changed if any individual test is active. Changes may only be made when all tests within the context are shut down, with the exception of the **description**.

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

Parameters

session-name

Specifies the name of the session container. 32 characters maximum.

ethernet

Specifies that the test is based on the Ethernet layer.

ip

Specifies that the test is based on the IP layer.

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proactive

Specifies that the test is always on, with no stop. Tests are proactive by default.

on-demand

Specifies that the test runs on demand, with an immediate start and no stop, or a stop based on offset.

create

Keyword to create the session container.

ip

Syntax

ip

Context

config>oam-pm>session

Platforms

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

Description

Commands in this context configure the IP-specific source and destination information, the priority, and the IP test tools on the launch point.

destination

Syntax

destination *ip-address*

no destination

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the destination IP address to which the TWAMP Light packets are addressed. The destination address must be included in the prefix list on the session reflector within the context to allow the reflector to process the inbound TWAMP Light packets.

The **no** form of this command removes the destination parameters.

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Default

no destination

Parameters

ip-address

Specifies the IP address of the peer to which the packets are directed.

Values IPv4 address in the form a.b.c.d

IPv6 address in the form x:x:x:x:x:x:x:x (eight 6-bit pieces) (no multicast addresses)

x:x:x:x:x:d.d.d.d

x [0..FFFF]H

d [0..255]D

dest-udp-port

Syntax

dest-udp-port *udp-port-number*

no dest-udp-port

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the destination UDP port to which the TWAMP Light packets are sent from the session controller. This value must match the **udp-port** *udp-port number* configured on the TWAMP Light reflector that responds to this specific TWAMP Light test.

The **no** form of this command removes the destination UDP port configuration.

Parameters

udp-port-number

Specifies the destination UDP port.

Values 1 to 65535

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fc

Syntax

fc *fc-name*

no fc

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the forwarding class designation for TWAMP Light packets that are sent through the node and exposed to the various QoS functions on the network element.

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

Default

fc be

Parameters

fc-name

Specifies the forwarding class.

Values be — best effort
l2 — low-2
af — assured
l1 — low-1
h2 — high-2
ef — expedited
h1 — high-1
nc — network control

forwarding

Syntax

forwarding bypass-routing

forwarding interface *interface-name*

forwarding next-hop *ip-address*

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no forwarding

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures influence for the forwarding decision of the TWAMP Light packet. When this command is used, only one of the forwarding options can be enabled at any time.

The **no** form of this command removes the configured influence and enables the default forwarding logic.

Default

no forwarding

Parameters

bypass-routing

Specifies that packets should be sent to a host on a directly attached network, bypassing the routing table.

interface-name

Specifies the name of the interface from which the packet is sent. The name must already exist in the **config**>**router**>**interface** context or within the appropriate **config**>**service** context. 32 characters maximum.

ip-address

Specifies the IP address of the next hop.

Values IPv4 address in the form a.b.c.d

IPv6 address in the form x:x:x:x:x:x:x:x (eight 6-bit pieces) (no multicast addresses)

x:x:x:x:x:x:d.d.d.d

x [0..FFFF]H

d [0..255]D

profile

Syntax

profile {**in** | **out**}

no profile

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Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures whether TWAMP Light PDUs are treated as in-profile or out-of-profile.

The **no** form of this command restores the default value. The default has been selected because the forwarding class defaults to best effort.

Default

profile out

Parameters

in

Specifies that TWAMP Light PDU packets are treated as in-profile.

out

Specifies that TWAMP Light PDU packets are treated as out-of-profile.

router

Syntax

router *router-instance*

router service-name *service-name*

no router

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the source context from which TWAMP Light packets are launched. The routing instance and service name must be a VPRN instance.

Note:
VPRN instances may only be specified on 7210 SAS platforms that support VPRN services. See the platform-specific *7210 SAS-Mxp, R6, R12, S, Sx, T Quality of Service Guide* for information about platform support for VPRN services.

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

Default

router base

Parameters

router-instance

Specifies the routing instance from which the TWAMP Light packets are launched.

Values *router-name* | *service-id*

router-name — "base"

service-id — 1 to 2147483647

service-name

Specifies the name of the service from which the TWAMP Light packets are launched. 64 characters maximum.

source

Syntax

source *ip-address*

no source

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the source IP address that the session controller (launch point) uses for the test. The source address must be a local resident IP address in the context; otherwise, the response packets are not processed by the TWAMP Light application. Only source addresses configured as part of TWAMP tests are able to process the reflected TWAMP packets from the session reflector.

The **no** form of this command removes the source address parameters.

Parameters

ip-address

Specifies the source IP address.

Values IPv4 address in the form a.b.c.d

IPv6 address in the form x:x:x:x:x:x:x:x (eight 6-bit pieces) (no multicast addresses)

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x:x:x:x:x:x:d.d.d.d

x [0..FFFF]H

d [0..255]D

source-udp-port

Syntax

source-udp-port *udp-port-number*

no source-udp-port

Context

config>oam-pm>session>ip

Platforms

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

Description

This command restricts the source UDP range. When this command is omitted, the source UDP port is dynamically allocated by the system. This command should only be used if a TWAMP Client is used to establish a TCP connection and communicate the test parameters to a TWAMP Server over TWAMP TCP Control, and the test is launched from OAM-PM (Session-Sender). This command should not be used when the reflection point is a TWAMP Light reflector that does not require TCP TWAMP Control.

The **no** form of this command removes the source UDP port configuration and enables default allocation.

Default

no source-udp-port

Parameters

udp-port-number

Specifies the source UDP port.

Values 64374 to 64383

ttl

Syntax

ttl *time-to-live*

no ttl

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Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the value of the TTL (time to live) field in the IP header.

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

Default

ttl 255

Parameters

time-to-live

Specifies the numerical value to place in the TTL field.

Values 1 to 255

twamp-light

Syntax

twamp-light [**test-id** *test-id*] [**create**]

no twamp-light

Context

config>oam-pm>session>ip

Platforms

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

Description

This command assigns an identifier to the TWAMP Light test and creates the individual test.

The **no** form of this command removes the TWAMP Light test function from the OAM-PM session.

Default

no twamp-light

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Parameters

test-id

Specifies the value of the 4-byte local test identifier that is not sent in TWAMP Light packets.

Values 0 to 2147483647

create

Creates the test.

interval

Syntax

interval *milliseconds*

no interval

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This command configures the message period, or probe spacing, for the transmission of TWAMP Light frames.

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

Parameters

milliseconds

Specifies the number of milliseconds between the transmission of TWAMP Light frames.

Values 100, 1000, 10000 (7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE, 7210 SAS-Sx 10/100GE, 7210 SAS-T)

100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000 (7210 SAS-Mxp)

loss

Syntax

loss

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Context

config>oam-pm>session>ip>twamp-light

Description

Commands in this context configure loss parameters for the TWAMP-Light test.

pad-size

Syntax

pad-size *octets*

no pad-size

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This command configures the amount by which the TWAMP Light packets are padded. TWAMP session-controller packets are 27 bytes smaller than TWAMP session-reflector packets. If symmetrical packet sizes in the forward and backward direction are required, a minimum padding of 27 bytes must be configured.

The **no** form of this command removes all padding.

Default

pad-size 0

Parameters

padding

Specifies the size of the padding, in octets.

Values 0 to 2000

record-stats

Syntax

record-stats {**delay** | **loss** | **delay-and-loss**}

no record-stats

Context

config>oam-pm>session>ip>twamp-light

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Platforms

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

Description

This command configures the statistics that are recorded and reported for the TWAMP-Light PDU.

The TWAMP-Light PDU can report on both delay and loss using a single packet. The user can choose which statistics to report. Only delay recording is enabled by default. All other metrics are ignored.

To change the record statistics configuration, the user must shut down the TWAMP-Light session. This is required because base statistics are shared among various datasets as a result of the single packet approach of the TWAMP-Light PDU. Issuing a **no shutdown** command clears all previous non-volatile memory for the session and allocates new memory blocks.

All command parameters are mutually exclusive.

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

Default

record-stats delay

Parameters

delay

Specifies to report on delay using a single packet.

loss

Specifies to report on loss using a single packet.

delay-and-loss

Specifies to report on both delay and loss using a single packet.

shutdown

Syntax

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

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This command starts or stops the test.

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Default

shutdown

test-duration

Syntax

test-duration *seconds*

no test-duration

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This optional command configures the length of time that the test runs before stopping automatically. This command is only a valid option when a **session-type** is configured as **on-demand**. This command is not an option when the **session-type** is configured as **proactive**.

The **no** form of this command removes a previously configured **test-duration** value and allows the TWAMP Light test to execute until it is stopped manually.

Default

test-duration 0

Parameters

seconds

Specifies the length of time, in seconds, that the TWAMP light test runs.

Values 1 to 86400

3.8.2.14 Show commands

twamp-light

Syntax

twamp-light

Context

show>router

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show>service

Platforms

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

Description

This command displays TWAMP Light information.

Output

The following output is an example of TWAMP light information, and Table 33: Output fields: TWAMP Light describes the output fields.

Sample output

```
show router twamp-light
-------------------------------------------------------------------------------
TWAMP-Light Reflector
-------------------------------------------------------------------------------
Admin State          : Up                     UDP Port         : 15000
Description          : (Not Specified)
Up Time              : 0d 00:02:24
Test Frames Received : 0                      Test Frames Sent : 0
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
TWAMP-Light Reflector Prefixes
-------------------------------------------------------------------------------
Prefix                                    Description
-------------------------------------------------------------------------------
172.16.1.0/24
-------------------------------------------------------------------------------
No. of TWAMP-Light Reflector Prefixes: 1
-------------------------------------------------------------------------------


show service id 500 twamp-light
-------------------------------------------------------------------------------
TWAMP-Light Reflector
-------------------------------------------------------------------------------
Admin State          : Up                     UDP Port         : 15000
Description          : TWAMP Light reflector VPRN 500
Up Time              : 0d 01:47:12
Test Frames Received : 6431                   Test Frames Sent : 6431
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
TWAMP-Light Reflector Prefixes
-------------------------------------------------------------------------------
Prefix                                    Description
-------------------------------------------------------------------------------
10.2.1.1/32                               Process only 10.2.1.1 TWAMP Light
                                          Packets
172.16.1.0/24                             Process all 172.16.1.0 TWAMP
                                          Light packets
-------------------------------------------------------------------------------
No. of TWAMP-Light Reflector Prefixes: 2
-------------------------------------------------------------------------------
```


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Table 33: Output fields: TWAMP Light

Label	Description
TWAMP Light Reflector	
Admin State	Up—Specifies that the server or prefix is administratively enabled (**no shutdown**) in configuration. Down—Specifies that the server or prefix is administratively disabled (**shutdown**) in configuration.
Decription	Text string to describe the context of the protocol.
Up Time	The time since the server process was started, measured in days (d), hours, minutes, and seconds
UDP Port	The UDP port number used
Test Frames Received	The total number of frames received from session senders
Test Frames Sent	The total number of frames sent to session senders
Prefixes	The time since the server process was started, measured in days (d), hours, minutes, and seconds

saa

Syntax

saa [*test-name*] [**owner** *test-owner*]

Context

show>saa

Platforms

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

Description

This command displays information about the SAA test.

If no specific test is specified, a summary of all configured tests is displayed.

If a specific test is specified, detailed test results for that test are displayed for the last three occurrences that this test has been executed, or since the last time the counters have been reset via a system reboot or clear command.

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Parameters

test-name

Specifies the name of the SAA test for which the information needs to be displayed. The test name must already be configured in the **config**>**saa**>**test** context.

owner *test-owner*

Specifies the owner of an SAA operation up to 32 characters.

Values 32 characters maximum.

Default If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

Output

The following output is an example of SAA information, and Table 34: Output fields: SAA describes the output fields.

Sample output

```
*A:7210 SAS>show# saa

===============================================================================
SAA Test Information
===============================================================================
Test name                    : abc
Owner name                   : TiMOS CLI
Description                  : test
Accounting policy            : None
Administrative status        : Disabled
Test type                    : Not configured
Trap generation              : None
Test runs since last clear   : 0
Number of failed test runs   : 0
Last test result             : Undetermined
-------------------------------------------------------------------------------
Threshold
Type        Direction Threshold  Value      Last Event          Run #
-------------------------------------------------------------------------------
Jitter-in   Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-out  Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-rt   Rising    100        None       Never               None
            Falling   10.0       None       Never               None
Latency-in  Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-out Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-rt  Rising    100        None       Never               None
            Falling   20.0       None       Never               None
Loss-in     Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-out    Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-rt     Rising    300        None       Never               None
            Falling   30         None       Never               None

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


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```
===============================================================================
*A:7210 SAS>show#
```

Table 34: Output fields: SAA

Label	Description
Test Name	Specifies the name of the test.
Owner Name	Specifies the owner of the test.
Description	Specifies the description for the test type.
Accounting policy	Specifies the associated accounting policy ID.
Administrative status	Specifies whether the administrative status is enabled or disabled.
Test type	Specifies the type of test configured.
Trap generation	Specifies the trap generation for the SAA test.
Test runs since last clear	Specifies the total number of tests performed since the last time the tests were cleared.
Number of failed tests run	Specifies the total number of tests that failed.
Last test run	Specifies the last time a test was run.
Threshold type	Indicates the type of threshold event being tested, jitter-event, latency-event, or loss-event, and the direction of the test responses received for a test run: in — inbound out — outbound rt — roundtrip
Direction	Indicates the direction of the event threshold, rising or falling.
Threshold	Displays the configured threshold value.
Value	Displays the measured crossing value that triggered the threshold crossing event.
Last event	Indicates the time that the threshold crossing event occurred.
Run #	Indicates what test run produced the specified values.

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test-oam

Syntax

test-oam

Context

show

Platforms

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

Description

Commands in this context display Operations, Administration, and Maintenance test parameters

Output

The following output is an example of OAM test parameters information.

Sample output

```
*A:Dut-A# show saa "Dut-A:1413:1501" owner "TiMOS"
===============================================================================
SAA Test Information
===============================================================================
Test name                   : Dut-A:1413:1501
Owner name                  : TiMOS
Administrative status       : Enabled
Test type                   : vccv-ping 1413:1501 fc "nc" timeout 10 size 200
                              count 2
Test runs since last clear  : 1
Number of failed test runs  : 0
Last test result            : Success
-------------------------------------------------------------------------------
Threshold
Type        Direction Threshold  Value      Last Event          Run #
-------------------------------------------------------------------------------
Jitter-in   Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-out  Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-rt   Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-in  Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-out Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-rt  Rising    100        None       Never               None
            Falling   None       None       Never               None
Loss-in     Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-out    Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-rt     Rising    2          None       Never               None
            Falling   None       None       Never               None
```


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```
===============================================================================
Test Run: 144
Total number of attempts: 2
Number of requests that failed to be sent out: 0
Number of responses that were received: 2
Number of requests that did not receive any response: 0
Total number of failures: 0, Percentage: 0
 (in ms)            Min         Max     Average      Jitter
Outbound  :           0           0           0           0
Inbound   :          10          20          15           0
Roundtrip :          10          20          15           0
Per test packet:
  Sequence    Outbound     Inbound   RoundTrip Result
         1           0          20          20 EgressRtr(10.20.1.4)
         2           0          10          10 EgressRtr(10.20.1.4)
===============================================================================
*A:Dut-A#
```

eth-cfm

Syntax

eth-cfm

Context

show

Platforms

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

Description

Commands in this context display CFM information.

association

Syntax

association [*ma-index*] [**detail**]

Context

show>eth-cfm

Platforms

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

Description

This command displays eth-cfm association information.

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Parameters

ma-index

Specifies the MA index.

Values 1 to 4294967295

detail

Specifies detailed information for the eth-cfm association.

Output

The following output is an example of ETH-CFM information, and Table 35: Output fields: ETH-CFM association describes the output fields.

Sample output

```
A:dut-b# show eth-cfm association

===============================================================================
CFM Association Table
===============================================================================
Md-index   Ma-index   Name                      CCM-interval Bridge-id
-------------------------------------------------------------------------------
1          1          a1                        1            1
1          2          a2                        1            2
2          1          a1                        1            2
2          2          a2                        1            1
===============================================================================
A:dut-b#
```

Table 35: Output fields: ETH-CFM association

Label	Description
Md-index	Displays the MD index
Ma-index	Displays the MA index
Name	Displays the name of the MA
CCM-interval	Displays the CCM interval (in seconds)
Bridge-id	Displays the bridge ID for the MA. The bridge ID is the same value as the service ID of the service to which the MEP belongs.

cfm-stack-table

Syntax

cfm-stack-tableup | **down**[**port** [*port-id* [**vlan** *vlan-id*]]|**sdp** *sdp-id*[**:***vc-id*]] [**level** *0..7*] [**direction up** | **down**]

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Context

show>eth-cfm

Platforms

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

Description

This command displays stack-table information. This stack-table is used to display the various management points MEPs and MIPs that are configured on the system. These can be Service based or facility based. If no parameters are included, the entire stack-table is displayed.

Parameters

port *port-id*

Specifies the bridge port or aggregated port on which MEPs or MHFs are configured.

vlan *vlan-id*

Specifies the associated VLAN ID.

Values 0 to 4094

level

Specifies the MD level of the maintenance point.

Values 0 to 7

direction up | down

Specifies the direction in which the MP faces on the bridge port.

Output

The following output is an example of CFM stack-table information, and Table 36: Output fields: CFM stack table describes the output fields.

Sample output

```
A:dut-b# show eth-cfm cfm-stack-table

===============================================================================
CFM SAP Stack Table
===============================================================================
Sap            Level Dir  Md-index   Ma-index   Mep-id Mac-address
-------------------------------------------------------------------------------
1/1/9:1        6     Down 1          1          1      00:25:ba:01:c3:6a
1/1/9:1        7     Down 2          2          1      00:25:ba:01:c3:6a
1/1/9:2        6     Down 1          2          1      00:25:ba:01:c3:6a
1/1/9:2        7     Down 2          1          1      00:25:ba:01:c3:6a
===============================================================================

===============================================================================
CFM Ethernet Tunnel Stack Table
===============================================================================
Eth-tunnel     Level Dir  Md-index   Ma-index   Mep-id Mac-address
-------------------------------------------------------------------------------
===============================================================================
```


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```
===============================================================================
CFM SDP Stack Table
===============================================================================
Sdp            Level Dir  Md-index   Ma-index   Mep-id Mac-address
-------------------------------------------------------------------------------
No Matching Entries
===============================================================================

===============================================================================
CFM Virtual Stack Table
===============================================================================
Service        Level Dir  Md-index   Ma-index   Mep-id Mac-address
-------------------------------------------------------------------------------
No Matching Entries
===============================================================================
A:dut-b#
```

Table 36: Output fields: CFM stack table

Label	Description
Sap	Displays the SAP identifier
Level	Displays the MD level of the domain
Dir (direction)	Displays the direction of OAMPDU transmission
Md-index	Displays the MD index of the domain
Ma-index	Displays the MA index of the domain
Mep-id	Displays the MEP identifier
Mac-address	Displays the MAC address of the MEP

domain

Syntax

domain [*md-index*] [**association** *ma-index* | **all-associations**] [**detail**]

Context

show>eth-cfm

Platforms

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

Description

This command displays domain information.

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Parameters

md-index

Specifies the index of the MD to which the MP is associated, or 0, if none.

Values [1..4294967295]

association *ma-index*

Specifies the index to which the MP is associated, or 0, if none.

all-associations

Specifies all associations to the MD.

detail

Specifies detailed domain information.

Output

The following output is an example of ETH-CFM domain information, and Table 37: Output fields: ETH-CFM domain describes the output fields.

Sample output

```
A:dut-b# show eth-cfm domain

===============================================================================
CFM Domain Table
===============================================================================
Md-index   Level Name                                        Format
-------------------------------------------------------------------------------
1          6     d1                                        charString
2          7     d2                                        charString
===============================================================================
A:dut-b#
```

Table 37: Output fields: ETH-CFM domain

Label	Description
Domain	
Md-index	Displays the MD index of the domain
Level	Displays the MD level of the domain
Name	Displays the name of the MD
Name Format	Displays the format for the MD name

mep

Syntax

mep *mep-id* **domain** *md-index* **association** *ma-index* [**loopback**] [**linktrace**] [**eth-bandwidth-notification**]

mep *mep-id* **domain** *md-index* **association** *ma-index* [**remote-mepid** *mep-id* | **all-remote-mepids**]

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mep *mep-id* **domain** *md-index* **association** *ma-index* **eth-test-results** [**remote-peer** *mac-address*]

mep *mep-id* **domain** *md-index* **association** *ma-index* **one-way-delay-test** [**remote-peer** *mac-address*]

mep *mep-id* **domain** *md-index* **association** *ma-index* **two-way-delay-test** [**remote-peer** *mac-address*]

mep *mep-id* **domain** *md-index* **association** *ma-index* **two-way-slm-test** [**remote-peer** *mac-address*]

Context

show>eth-cfm

Platforms

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

Description

This command displays information for a specified Maintenance Endpoint (MEP).

Parameters

domain *md-index*

Specifies the index of the MD to which the MP is associated, or 0, if none.

association *ma-index*

Specifies the index of the MA to which the MP is associated, or 0, if none.

loopback

Specifies loopback information for the MEP.

linktrace

Specifies linktrace information for the MEP.

eth-bandwidth-notification

Specifies the active ETH-BN notification parameters received from the peer and reported to the rate function on the associated port. This keyword is only supported on the 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12.

remote-mepid

Specifies remote MEP ID information for the MEP.

remote-peer *mac-address*

Specifies remote peer information for the MEP.

one-way-delay-test

Specifies one-way delay test information for the MEP.

two-way-delay-test

Specifies two-way delay test information for the MEP.

two-way-slm-test

Specifies two-way SLM test information for the MEP.

eth-test-results

Specifies ETH test result information for the MEP.

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all-remote-mepids

Specifies all remote MEP information for the MEP.

statistics

Specifies MEP statistics.

detail

Specifies detailed MEP information.

Output

The following outputs are examples of MEP information, and the associated tables describe the output fields:

- Sample output 1, Table 38: Output fields: MEP
- Sample output 2, Table 39: Output fields: MEP ETH-BN

Sample output 1

```
A:dut-b# show eth-cfm mep 1 domain 1 association 1 linktrace
-------------------------------------------------------------------------------
Mep Information
-------------------------------------------------------------------------------
Md-index           : 1                       Direction         : Down
Ma-index           : 1                       Admin             : Enabled
MepId              : 1                       CCM-Enable        : Enabled
IfIndex            : 35946496                PrimaryVid        : 1
FngState           : fngReset                ControlMep        : False
LowestDefectPri    : macRemErrXcon           HighestDefect     : none
Defect Flags       : None
Mac Address        : 00:25:ba:01:c3:6a       CcmLtmPriority    : 7
CcmTx              : 0                       CcmSequenceErr    : 0
Eth-1Dm Threshold  : 3(sec)
Eth-Ais:           : Disabled
Eth-Tst:           : Disabled
CcmLastFailure Frame:
    None
XconCcmFailure Frame:
    None
-------------------------------------------------------------------------------
Mep Linktrace Message Information
-------------------------------------------------------------------------------
LtRxUnexplained    : 0                       LtNextSequence    : 2
LtStatus           : False                   LtResult          : False
TargIsMepId        : False                   TargMepId         : 0
TargMac            : 00:00:00:00:00:00       TTL               : 64
EgressId           : 00:00:00:25:ba:01:c3:6a SequenceNum       : 1
LtFlags            : useFDBonly
-------------------------------------------------------------------------------
Mep Linktrace Replies
-------------------------------------------------------------------------------
SequenceNum        : 1                       ReceiveOrder      : 1
Ttl                : 63                      Forwarded         : False
LastEgressId       : 00:00:00:25:ba:01:c3:6a TerminalMep       : True
NextEgressId       : 00:00:00:25:ba:00:5e:bf Relay             : rlyHit
ChassisIdSubType   : unknown value (0)
ChassisId:
    None
ManAddressDomain:
    None
ManAddress:
    None
```


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```
IngressMac          : 00:25:ba:00:5e:bf        Ingress Action    : ingOk
IngrPortIdSubType   : unknown value (0)
IngressPortId:
    None
EgressMac           : 00:00:00:00:00:00        Egress Action     : egrNoTlv
EgrPortIdSubType    : unknown value (0)
EgressPortId:
    None
Org Specific TLV:
    None
A:dut-b#
A:dut-b#

A:dut-b# show eth-cfm mep 1 domain 1 association 1 loopback
-------------------------------------------------------------------------------
Mep Information
-------------------------------------------------------------------------------
Md-index            : 1                        Direction         : Down
Ma-index            : 1                        Admin             : Enabled
MepId               : 1                        CCM-Enable        : Enabled
IfIndex             : 35946496                 PrimaryVid        : 1
FngState            : fngReset                 ControlMep        : False
LowestDefectPri     : macRemErrXcon            HighestDefect     : none
Defect Flags        : None
Mac Address         : 00:25:ba:01:c3:6a        CcmLtmPriority    : 7
CcmTx               : 0                        CcmSequenceErr    : 0
Eth-1Dm Threshold   : 3(sec)
Eth-Ais:            : Disabled
Eth-Tst:            : Disabled
CcmLastFailure Frame:
    None
XconCcmFailure Frame:
    None
-------------------------------------------------------------------------------
Mep Loopback Information
-------------------------------------------------------------------------------
LbRxReply           : 1                        LbRxBadOrder      : 0
LbRxBadMsdu         : 0                        LbTxReply         : 0
LbSequence          : 2                        LbNextSequence    : 2
LbStatus            : False                    LbResultOk        : True
DestIsMepId         : False                    DestMepId         : 0
DestMac             : 00:00:00:00:00:00        SendCount         : 0
VlanDropEnable      : True                     VlanPriority      : 7
Data TLV:
    None
A:dut-b#

*A:dut-b# show eth-cfm mep 1 domain 4 association 4 two-way-delay-test remote-
peer 00:25:ba:00:5e:bf

===============================================================
Eth CFM Two-way Delay Test Result Table
===============================================================
Peer Mac Addr         Delay (us)          Delay Variation (us)
---------------------------------------------------------------
00:25:ba:00:5e:bf     507                 507
===============================================================
*A:dut-b#
*A:dut-b# show eth-cfm mep 1 domain 4 association 4 two-way-delay-test

===============================================================
Eth CFM Two-way Delay Test Result Table
===============================================================
Peer Mac Addr         Delay (us)          Delay Variation (us)
```


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```
-------------------------------------------------------------------
00:25:ba:00:5e:bf     507                 507
===================================================================
*A:dut-b#
*A:dut-a# show eth-cfm mep 2 domain 4 association 4  eth-test-results remote-
peer 00:25:ba:01:c3:6a

===============================================================
Eth CFM ETH-Test Result Table
===============================================================
                              Current        Accumulate
                  FrameCount  ErrBits        ErrBits
Peer Mac Addr     ByteCount   CrcErrs        CrcErrs
---------------------------------------------------------------
00:25:ba:01:c3:6a 6           0              0
                  384         0              0
===============================================================
*A:dut-a#
*A:dut-a# show eth-cfm mep 2 domain 4 association 4  eth-test-results

===============================================================
Eth CFM ETH-Test Result Table
===============================================================
                              Current        Accumulate
                  FrameCount  ErrBits        ErrBits
Peer Mac Addr     ByteCount   CrcErrs        CrcErrs
---------------------------------------------------------------
00:25:ba:01:c3:6a 6           0              0
                  384         0              0
===============================================================
*A:dut-a# show eth-cfm mep 2 domain 4 association 4 one-way-delay-test remote-
peer 00:25:ba:01:c3:6a

===================================================================
Eth CFM One-way Delay Test Result Table
===================================================================
Peer Mac Addr         Delay (us)          Delay Variation (us)
-------------------------------------------------------------------
00:25:ba:01:c3:6a     402                 402
===================================================================
*A:dut-a#

*A:dut-a# show eth-cfm mep 2 domain 4 association 4 one-way-delay-test

===================================================================
Eth CFM One-way Delay Test Result Table
===================================================================
Peer Mac Addr         Delay (us)          Delay Variation (us)
-------------------------------------------------------------------
00:25:ba:01:c3:6a     402                 402
===================================================================
*A:dut-a#

show eth-cfm mep 28 domain 14 association 2 all-remote-mepids detail
================================================================================
Eth-CFM Remote-MEP Information
================================================================================
Remote MEP ID    : 30                  State            : True/Grace
Auto Discovered  : False               RDI              : False
Port Status TLV  : Up                  I/F Status TLV   : Up
MAC Address      : 00:00:00:00:00:30   CCM Last Change  : 02/06/2014 21:37:00
Chass. ID SubType: local
Chassis ID       : access-012-west
Man Addr Domain  : (Not Specified)
```


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```
Remote MEP ID    : 32                   State            : True/Grace
Auto Discovered  : True                 RDI              : False
Port Status TLV  : Up                   I/F Status TLV   : Up
MAC Address      : 00:00:00:00:00:32    CCM Last Change  : 02/06/2014 21:37:00
Chass. ID SubType: chassisComponent
Chassis ID       : (Not Specified)
Man Addr Domain  : (Not Specified)
===============================================================================

show eth-cfm mep 28 domain 14 association 2 remote-mepid 30 detail
===============================================================================
Eth-CFM Remote-MEP Information
===============================================================================
Remote MEP ID    : 30                   State            : True/Grace
Auto Discovered  : False                RDI              : False
Port Status TLV  : Up                   I/F Status TLV   : Up
MAC Address      : 00:00:00:00:00:30    CCM Last Change  : 02/06/2014 21:37:00
Chass. ID SubType: local
Chassis ID       : access-012-west
Man Addr Domain  : (Not Specified)
===============================================================================

show eth-cfm mep 28 domain 14 association 2 remote-mepid 30
===============================================================================
Eth-CFM Remote-Mep Table
===============================================================================
R-mepId AD Rx CC RxRdi Port-Tlv If-Tlv Peer Mac Addr     CCM status since
-------------------------------------------------------------------------------
30      F  True  False Up       Up     00:00:00:00:00:30 02/06/2014 21:37:00
===============================================================================
Entries marked with a 'T' under the 'AD' column have been auto-discovered.
```

Table 38: Output fields: MEP

Label	Description
Mep Information	
Md-index	Displays the MD index of the domain
Direction	Displays the direction of OAMPDU transmission
Ma-index	Displays the MA index of the association
Admin	Displays the administrative status of the MEP
MepId	Displays the MEP identifier
CCM-Enable	Displays the status of the CCM (enabled or disabled)
IfIndex	Displays the index of the interface
PrimaryVid	Displays the identifier of the primary VLAN
FngState	Indicates the different states of the Fault Notification Generator
LowestDefectPri	Displays the lowest priority defect (a configured value) that is allowed to generate a fault alarm

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Label	Description
HighestDefect	Identifies the highest defect that is present (for example, if defRDICCM and defXconCCM are present, the highest defect is defXconCCM)
Defect Flags	Displays the number of defect flags
Mac Address	Displays the MAC address of the MEP
CcmLtmPriority	Displays the priority value transmitted in the linktrace messages (LTM)s and CCMs for this MEP. The MEP must be configured on a VLAN.
CcmTx	Displays the number of Continuity Check Messages (CCM) sent. The count is taken from the last polling interval (every 10 s).
CcmSequenceErr	Displays the number of CCM errors
Eth-1DM Threshold	Displays the one-way-delay threshold value
Eth-Ais	Displays the state of the ETH-AIS test (enabled or disabled)
Eth-Test	Displays the state of the ETH-Test (enabled or disabled)
CcmLastFailure Frame	Displays the frame that caused the last CCM failure
XconCcmFailure Frame	Displays the frame that caused the XconCCMFailure
Mep Loopback Information	
LbRxReply	Displays the number of received loopback (LB) replies
LbRxBadOrder	Displays the number of received loopback messages that are in a bad order
LbRxBadMsdu	Displays the number of loopback replies that have been received with the wrong destination MAC address (MSDU = MAC Service Data Unit)
LbTxReply	Displays the number of loopback replies transmitted out this MEP
LbTxReply (Total)	Displays the total number of LBRs (loopback replies) transmitted from this MEP
LbTxReplyNoTLV	Displays the number of LBRs (loopback replies) transmitted from this MEP with no TLV. Because only LBMs with no TLVs are used for throughput testing, the LbTxReply (Total), LbTxReplyNoTLV, and LbTxReplyWithTLV counters can help debug problems if throughput testing is not working

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Label	Description
LbTxReplyWithTLV	Displays the number of LBRs (loopback replies) transmitted from this MEP with TLV
LbSequence	Displays the sequence number in the loopback message
LbNextSequence	Displays the next loopback sequence
LbStatus	Displays the loopback status as True or False: True — loopback is in progress False — no loopback is in progress
LbResultOk	Displays the result of the loopback test
DestIsMepId	Identifies whether the destination interface has a MEP-ID (true or false)
DestMepId	Displays the MEP-ID of the destination interface
DestMac	Displays the MAC address of the destination interface
SendCount	Indicates the number of loopback messages sent
VlanDropEnable	Identifies whether the VLAN drop is enabled (true or false)
VlanPriority	Displays the VLAN priority
Data TLV	Displays the data TLV information
Mep Linktrace Message Information	
LtRxUnexplained	Displays the number of unexplained linktrace messages (LTM) that have been received
LtNextSequence	Displays the sequence number of the next linktrace message
LtStatus	Displays the status of the linktrace
LtResult	Displays the result of the linktrace
TargIsMepId	Identifies whether the target interface has a MEP-ID (true or false)
TargMepId	Displays the MEP-ID of the target interface
TargMac	Displays the MAC address of the target interface
TTL	Displays the TTL value
EgressId	Displays the egress ID of the linktrace message
SequenceNum	Displays the sequence number of the linktrace message

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Label	Description
LtFlags	Displays the linktrace flags
Mep Linktrace Replies	
SequenceNum	Displays the sequence number returned by a previous transmit linktrace message, indicating which linktrace message response is returned
ReceiveOrder	Displays the order in which the linktrace initiator received the linktrace replies
Ttl	Displays the TTL field value for a returned linktrace reply
Forwarded	Indicates whether the linktrace message was forwarded by the responding MEP
LastEgressId	Displays the last egress identifier returned in the linktrace reply egress identifier TLV of the linktrace reply The last egress identifier identifies the MEP linktrace initiator that initiated, or the linktrace responder that forwarded, the linktrace message for which this linktrace reply is the response. This is the same value as the egress identifier TLV of that linktrace message.
TerminalMep	Indicates whether the forwarded linktrace message reached a MEP enclosing its MA
NextEgressId	Displays the next egress identifier returned in the linktrace reply egress identifier TLV of the linktrace reply. The next egress identifier identifies the linktrace responder that transmitted this linktrace reply and can forward the linktrace message to the next hop. This is the same value as the egress identifier TLV of the forwarded linktrace message, if any.
Relay	Displays the value returned in the Relay Action field
ChassisIdSubType	Displays the format of the chassis ID returned in the Sender ID TLV of the linktrace reply, if any. This value is meaningless if the chassis ID has a length of 0
ChassisId	Displays the chassis ID returned in the Sender ID TLV of the linktrace reply, if any. The format is determined by the value of the ChassisIdSubType.
ManAddressDomain	Displays the TDomain that identifies the type and format of the related ManAddress, used to access the SNMP agent of the system transmitting the linktrace reply

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Label	Description
	Received in the linktrace reply Sender ID TLV from that system
ManAddress	Displays the TAddress that can be used to access the SNMP agent of the system transmitting the CCM Received in the CCM Sender ID TLV from that system
IngressMac	Displays the MAC address returned in the ingress MAC address field
Ingress Action	Displays the value returned in the Ingress Action field of the linktrace message
IngressPortIdSubType	Displays the format of the ingress port ID
IngressPortId	Displays the ingress port ID; the format is determined by the value of the IngressPortIdSubType
EgressMac	Displays the MAC address returned in the egress MAC address field
Egress Action	Displays the value returned in the Egress Action field of the linktrace message
EgressPortIdSubType	Displays the format of the egress port ID
EgressPortId	Displays the egress port ID; the format is determined by the value of the EgressPortIDSubType
Org Specific TLV	Displays all organization-specific TLVs returned in the linktrace reply, if any Includes all octets including and following the TLV length field of each TLV, concatenated
Eth-Test	
Peer Mac Addr	Displays the MAC address of the peer (remote) entity
FrameCount	Displays the number of test frames sent between the MEP and the peer entity
ByteCount	Displays the number of bytes sent between the MEP and the peer entity
Current ErrBits	Displays the number of bit errors in the current test
Current CrcErrs	Displays the number of CRC errors in the current test
Accumulate ErrBits	Displays the accumulated number of bit errors in the current test

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Label	Description
Accumulate CrcErrs	Displays the accumulated number of CRC errors in the current test
Delay Measurement Test	
Peer Mac Addr	Displays the MAC address of the peer (remote) entity
Delay (us)	Displays the measured delay (in microseconds) for the DM test
Delay Variation (us)	Displays the measured delay variation (in microseconds) for the DV test

Sample output 2

```
A:Dut-A>config>port>ethernet# show eth-cfm mep 1 domain 1 association 1 eth-
bandwidth-notification
===============================================================================
Eth-Cfm MEP Configuration Information
===============================================================================
Md-index          : 1                         Direction         : Down
Ma-index          : 1                         Admin             : Enabled
MepId             : 1                         CCM-Enable        : Enabled
Port              : 1/1/5                     VLAN              : 0
Description       : (Not Specified)
FngAlarmTime      : 0                         FngResetTime      : 0
FngState          : fngReset                  ControlMep        : False
LowestDefectPri   : macRemErrXcon             HighestDefect     : none
Defect Flags      : None
Mac Address       : d0:99:d5:80:51:a6
                                              CcmPaddingSize    : 0 octets
CcmTx             : 169                       CcmSequenceErr    : 0
CcmIgnoreTLVs     : (Not Specified)
Fault Propagation: disabled
MA-CcmInterval    : 1                         MA-CcmHoldTime    : 0ms
MA-Primary-Vid    : Disabled
                                              MD-Level          : 0
Eth-Ais           : Disabled
Eth-Ais Tx defCCM: allDef
Eth-BNM Receive   : Enabled                   Eth-BNM Rx Pacing : 5
Redundancy:
    MC-LAG State : n/a
CcmLastFailure Frame:
    None
XconCcmFailure Frame:
    None
```

Table 39: Output fields: MEP ETH-BN

Label	Description
Md-index	Displays the MD index of the domain
Direction	Displays the direction of OAM PDU transmission
Ma-index	Displays the MA index of the association

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Label	Description
Admin	Displays the administrative status of the MEP
MepId	Displays the MEP ID
CCM-Enable	Displays the status of the CCM (enabled or disabled)
Port	Displays the port number
VLAN	Displays the configured VLAN on the MEP
Description	Displays the description
FngAlarmTime	Displays the fault alarm time
FngResetTime	Displays the fault alarm reset time
FngState	Displays the different states of the Fault Notification Generator
LowestDefectPri	Displays the lowest priority defect (a configured value) that is allowed to generate a fault alarm
HighestDefect	Displays the highest defect that is present (for example, if defRDICCM and defXconCCM are present, the highest defect is defXconCCM)
Defect Flags	Displays the number of defect flags
Mac Address	Displays the MAC address of the MEP
CcmTx	Displays the total number of CCM transmitted
CcmPaddingSize	Displays the number of octets used to pad a CCM packet
CcmSequenceErr	Displays the total number of out-of-sequence CCMs received
Fault Propagation	Displays the fault propagation configuration for the MEP
MA-CcmInterval	Displays the CCM transmission interval for all MEPs in the association
MA-CcmHoldTime	Displays the CCM hold time for all MEPs in the association
MD-Level	Displays the MD level
Eth-Ais	Displays the state of the ETH-AIS test (enabled or disabled)
Eth-BNM Receive	Displays whether ETH-BN receive is enabled or disabled
Eth-BNM Rx Pacing	Displays the ETH-BN receive update pacing interval time
MC-LAG State	Displays the MC-LAG state

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Label	Description
CcmLastFailure Frame	Displays the frame that caused the last CCM failure
XconCcmFailure Frame	Displays the frame that caused the XconCCMFailure

mip

Syntax

mip

Context

show>eth-cfm

Platforms

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

Description

This command displays SAPs/bindings provisioned for allowing the default MIP creation.

Output

The following output is an example of MIP information.

Sample output

```
*A:node-1# show eth-cfm mip
===============================================================================
CFM SAP MIP Table
===============================================================================
Sap Mip-Enabled Mip Mac Address
-------------------------------------------------------------------------------
1/1/1:1.1 yes Not Configured
===============================================================================
===============================================================================
CFM SDP MIP Table
===============================================================================
Sdp Mip-Enabled Mip Mac Address
-------------------------------------------------------------------------------
No Matching Entries
```

statistics

Syntax

statistics

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Context

show>eth-cfm

Platforms

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

Description

This command displays the ETH-CFM statistics counters.

Output

The following output is an example of ETH-CFM statistics information.

Sample output

```
# show eth-cfm system-config
===============================================================================
CFM System Configuration
===============================================================================
Redundancy
MC-LAG Standby MEP Shutdown: true
MC-LAG Hold-Timer : 1 second(s)
Synthetic Loss Measurement
Inactivity Timer : 100 second(s)
===============================================================================
```

system-config

Syntax

system-config

Context

show>eth-cfm

Platforms

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

Description

This command shows various system level configuration parameters. These global eth-cfm commands are those which are configured directly under the config>eth-cfm context.

Output

The following output is an example of ETH-CFM system configuration information.

Sample output

```
# show eth-cfm system-config
```


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```
===============================================================================
CFM System Configuration
===============================================================================
Redundancy
MC-LAG Standby MEP Shutdown: true
MC-LAG Hold-Timer : 1 second(s)
Synthetic Loss Measurement
Inactivity Timer : 100 second(s)
===============================================================================
```

ldp-treetrace

Syntax

ldp-treetrace [**prefix** *ip-prefix/mask*] [**detail**]

Context

show>test-oam

Platforms

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

Description

This command displays OAM LDP treetrace information.

Parameters

prefix *ip-prefix/mask*

Specifies the address prefix and subnet mask of the destination node.

detail

Displays detailed information.

Output

The following output is an example of OAM LDP treetrace information.

Sample output

```
*A:ALA-48# show test-oam ldp-treetrace
Admin State              : Up             Discovery State      : Done
Discovery-intvl (min)    : 60             Probe-intvl (min)    : 2
Probe-timeout (min)      : 1              Probe-retry          : 3
Trace-timeout (sec)      : 60             Trace-retry          : 3
Max-TTL                  : 30             Max-path             : 128
Forwarding-class (fc)    : be             Profile              : Out
Total Fecs               : 400            Discovered Fecs      : 400
Last Discovery Start     : 12/19/2006 05:10:14
Last Discovery End       : 12/19/2006 05:12:02
Last Discovery Duration  : 00h01m48s
Policy1                  : policy-1
Policy2                  : policy-2

*A:ALA-48# show test-oam ldp-treetrace detail
```


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```
Admin State              : Up             Discovery State      : Done
Discovery-intvl (min)    : 60             Probe-intvl (min)    : 2
Probe-timeout (min)      : 1              Probe-retry          : 3
Trace-timeout (sec)      : 60             Trace-retry          : 3
Max-TTL                  : 30             Max-path             : 128
Forwarding-class (fc)    : be             Profile              : Out
Total Fecs               : 400            Discovered Fecs      : 400
Last Discovery Start     : 12/19/2006 05:10:14
Last Discovery End       : 12/19/2006 05:12:02
Last Discovery Duration  : 00h01m48s
Policy1                  : policy-1
Policy2                  : policy-2
===============================================================================
Prefix (FEC) Info
===============================================================================
Prefix              Path Last                 Probe  Discov    Discov
                    Num  Discovered           State  State     Status
-------------------------------------------------------------------------------
10.11.11.1/32       54   12/19/2006 05:10:15  OK     Done      OK
10.11.11.2/32       54   12/19/2006 05:10:15  OK     Done      OK
10.11.11.3/32       54   12/19/2006 05:10:15  OK     Done      OK
.............
10.14.14.95/32      72   12/19/2006 05:11:13  OK     Done      OK
10.14.14.96/32      72   12/19/2006 05:11:13  OK     Done      OK
10.14.14.97/32      72   12/19/2006 05:11:15  OK     Done      OK
10.14.14.98/32      72   12/19/2006 05:11:15  OK     Done      OK
10.14.14.99/32      72   12/19/2006 05:11:18  OK     Done      OK
10.14.14.100/32     72   12/19/2006 05:11:20  OK     Done      OK
===============================================================================
Legend: uP - unexplored paths, tO - trace request timed out
        mH - max hop exceeded, mP - max path exceeded
        nR - no internal resource


*A:ALA-48# show test-oam ldp-treetrace prefix 10.12.12.10/32
Discovery State  : Done                Last Discovered  : 12/19/2006 05:11:02
Discovery Status : ' OK '
Discovered Paths : 54                  Failed Hops      : 0
Probe State      : OK                  Failed Probes    : 0


*A:ALA-48# show test-oam ldp-treetrace prefix 10.12.12.10/32  detail
Discovery State  : Done                Last Discovered  : 12/19/2006 05:11:02
Discovery Status : ' OK '
Discovered Paths : 54                  Failed Hops      : 0
Probe State      : OK                  Failed Probes    : 0
===============================================================================
Discovered Paths
===============================================================================
PathDest            Egr-NextHop         Remote-RtrAddr      Discovery-time
  DiscoveryTtl        ProbeState          ProbeTmOutCnt       RtnCode
-------------------------------------------------------------------------------
127.1.0.5           10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.9           10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.15          10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.19          10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.24          10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.28          10.10.1.2           10.12.12.10         12/19/2006 05:11:01
```


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```
……..

127.1.0.252         10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.255         10.10.1.2           10.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
===============================================================================
*A:ALA-48#
```

twamp

Syntax

twamp

Context

show>test-oam

Platforms

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

Description

Commands in this context request TWAMP information.

twamp-light

Syntax

twamp-light

Context

show>test-oam>twamp

Platforms

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

Description

Commands in this context request TWAMP Light information.

reflectors

Syntax

reflectors

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Context

show>test-oam>twamp>twamp-light

Platforms

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

Description

This command displays TWAMP Light reflector information.

Output

The following output is an example of OAM TWAMP light information, and Table 40: Output fields: TWAMP Light reflectors describes the output fields.

Sample output

```
show test-oam twamp twamp-light reflectors
===============================================================================
TWAMP-Light Reflectors
===============================================================================
Router/VPRN    Admin    UDP Port    Prefixes    Frames Rx    Frames Tx
-------------------------------------------------------------------------------
Base              Up       15000           1            0            0
500               Up       15000           2         6340         6340
-------------------------------------------------------------------------------
No. of TWAMP-Light Reflectors: 2
===============================================================================
```

Table 40: Output fields: TWAMP Light reflectors

Label	Description
TWAMP Light Reflector	
Router/VPRN	The TWAMP Light clients
Admin	Displays one of the following: Up—the server or prefix is administratively enabled (**no shutdown**) in configuration Down—the server or prefix is administratively disabled (**shutdown**) in configuration
UDP Port	The UDP port number used
Prefixes	The time since the server process was started, measured in days (d), hours, minutes, and seconds
Frames Rx	The total number of frames received from session senders
Frames Tx	The total number of frames sent to session senders

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server

Syntax

server all

server prefix *ip-prefix/mask*

server

Context

show>test-oam>twamp

Platforms

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

Description

This command displays information about the TWAMP server. It displays summary information for the ip-prefix in use.

Parameters

all

Specifies to display all information about the TWAMP server.

ip-prefix/mask

Specifies the destination address of the static route and the prefix length.

Values

ip-prefix/mask	ipv4-prefix	a.b.c.d (host bits must be 0)
	ipv4-prefix-le	[0 to 32]
	ipv6-prefix	x:x:x:x:x:x:x:x: (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x - [0 to FFFF]H
		d - [0 to 255]D
	ipv6-prefix-le	[0 to 128]

Output

The following outputs are examples of TWAMP server information, and Table 41: Output fields: TWAMP server describes the output fields.

Sample output

```
*A:Dut-G>show>test-oam# twamp server
```


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```
===============================================================================
TWAMP Server
===============================================================================
Admin State          : Down               Operational State   : Down
Up Time              : 0d 00:00:00
Current Connections  : 0                  Max Connections     : 8
Connections Rejected : 0                  Inactivity Time Out : 900 seconds
Current Sessions     : 0                  Max Sessions        : 8
Sessions Rejected    : 0                  Sessions Aborted    : 0
Sessions Completed   : 0
Test Packets Rx      : 0                  Test Packets Tx     : 0
===============================================================================

===============================================================================
TWAMP Server Prefix Summary
===============================================================================
Prefix             Current     Current  Description
                   Connections Sessions
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
No. of TWAMP Server Prefixes: 0
===============================================================================
*A:Dut-G>show>test-oam#
```

Sample output: all

The following output is an example of all TWAMP server information.

```
7210SAS# show  test-oam twamp server all

===============================================================================
TWAMP Server
===============================================================================
Admin State          : Up                 Operational State   : Up
Up Time              : 0d 08:17:34
Current Connections  : 0                  Max Connections     : 16
Connections Rejected : 0                  Inactivity Time Out : 900 seconds
Current Sessions     : 0                  Max Sessions        : 16
Sessions Rejected    : 0                  Sessions Aborted    : 0
Sessions Completed   : 0
Test Packets Rx      : 0                  Test Packets Tx     : 0
===============================================================================

===============================================================================
TWAMP Server Prefix 10.1.1.0/24
===============================================================================
Description          : (Not Specified)
Current Connections  : 0                  Max Connections     : 16
Connections Rejected : 0
Current Sessions     : 0                  Max Sessions        : 16
Sessions Rejected    : 0                  Sessions Aborted    : 0
Sessions Completed   : 0
Test Packets Rx      : 0                  Test Packets Tx     : 0
===============================================================================

===============================================================================
Connection information for TWAMP server prefix 10.1.1.0/24
===============================================================================
Client          State      Curr Sessions  Sessions Rejected  Sessions Completed
                           Idle Time (s)    Test Packets Rx     Test Packets Tx
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
No. of TWAMP Server Connections for Prefix 10.1.1.0/24: 0
```


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

===============================================================================
TWAMP Server Prefix 10.1.1.0/24
===============================================================================
Description          : (Not Specified)
Current Connections  : 0                   Max Connections     : 16
Connections Rejected : 0
Current Sessions     : 0                   Max Sessions        : 16
Sessions Rejected    : 0                   Sessions Aborted    : 0
Sessions Completed   : 0
Test Packets Rx      : 0                   Test Packets Tx     : 0
===============================================================================

===============================================================================
Connection information for TWAMP server prefix 10.1.1.0/24
===============================================================================
Client          State      Curr Sessions  Sessions Rejected  Sessions Completed
                           Idle Time (s)    Test Packets Rx     Test Packets Tx
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
No. of TWAMP Server Connections for Prefix 10.1.1.0/24: 0
===============================================================================
===============================================================================
No. of TWAMP Server Prefixes: 2
===============================================================================
```

Sample output: prefix
The following output is an example of TWAMP server prefix information.

```
*A:7210SAS# show test-oam twamp server  prefix 10.1.1.0/24

===============================================================================
TWAMP Server Prefix 10.1.1.0/24
===============================================================================
Description          : (Not Specified)
Current Connections  : 0                   Max Connections     : 16
Connections Rejected : 0
Current Sessions     : 0                   Max Sessions        : 16
Sessions Rejected    : 0                   Sessions Aborted    : 0
Sessions Completed   : 0
Test Packets Rx      : 0                   Test Packets Tx     : 0
===============================================================================

===============================================================================
Connection information for TWAMP server prefix 10.1.1.0/24
===============================================================================
Client          State      Curr Sessions  Sessions Rejected  Sessions Completed
                           Idle Time (s)    Test Packets Rx     Test Packets Tx
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
No. of TWAMP Server Connections for Prefix 10.1.1.0/24: 0
===============================================================================
```

Table 41: Output fields: TWAMP server

Label	Description
Admin State	Displays one of the following:

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Label	Description
	Up — The server or prefix is administratively enabled (**no shutdown**) in configuration. Down — The server or prefix is administratively disabled (**shutdown**) in configuration.
Operational State	Displays one of the following: Up — The server or prefix is operationally enabled. Down — The server or prefix is operationally disabled.
Up Time	Displays the time since the server process was started, measured in days (d), hours, minutes, and seconds.
Current Connections	Displays the total number of currently connected clients.
Max Connections	Displays the maximum number of connected clients.
Connections Rejected	Displays the number of connection rejections.
Inactivity Timeout	Displays the configured inactivity timeout for all TWAMP-control connections (**inactivity-timeout**).
Current Sessions	Displays the number of current sessions.
Max Sessions	Displays the maximum number of sessions.
Sessions Rejected	Displays the number of rejected sessions for the TWAMP client.
Sessions Aborted	Displays the number of manually aborted sessions for the TWAMP client.
Sessions Completed	Displays the number of completed sessions for the TWAMP client.
Test Packets Rx	Displays the number of test packets received.
Test Packets Tx	Displays the number of test packets transmitted.
Description	Displays the configured description of the TWAMP server.
Connection information for TWAMP server prefix	Displays the IP address prefix of a TWAMP server.
Client	Displays the IP address of the TWAMP client.
State	Displays the operational state of the TWAMP client.
Curr Sessions	Displays the number of current sessions for the TWAMP client.
Idle Time (s)	Displays the total idle time, in seconds, of the TWAMP client.

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Label	Description
No. of Conns for Prefix	Displays the total number of connections for the TWAMP server with the displayed IP address prefix.
No. of TWAMP Server Prefixes	Displays the total number of displayed TWAMP server IP address prefixes.

testhead-profile

Syntax

testhead-profile *profile-id*

Context

show>test-oam

Platforms

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

Description

This command specifies the testhead profile ID to use with this run or session of testhead invocation. The testhead profile must be configure before using the commands under **config**> **test-oam**> **testhead-profile** context.

Output

The following output is an example of testhead profile information, and Table 42: Output fields: test OAM testhead profile describes the output fields.

Sample output

```
*A:7210SAS>config>test-oam># show test-oam testhead-profile 1

===============================================================================
Y.1564 Testhead Profile
===============================================================================
Description        : Testhead_Profile_1
Profile Id         : 1                        Frame Size        : 512
CIR Configured     : 100                      CIR Operational   : 96
PIR Configured     : 200                      PIR Operational   : 200
CIR Rule           : max                      Ref. Count        : 0
InPrf Dot1p        : 2                        OutPrf Dot1p      : 4
Duration Hrs       : 0
Duration Mins      : 3
Duration Secs      : 0

-------------------------------------------------------------------------------
Acceptance Criteria Id 1
-------------------------------------------------------------------------------
Loss TH            : 0.000100                 Jitter TH         : 100
InProf Loss TH     : 0.000100                 InProf Jitter TH  : 100
OutProf Loss TH    : 0.000100                 OutProf Jitter TH : 100
```


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```
Latency TH         : 100                    Ref. Count        : 0
InProf Latency TH  : 100                    CIR TH            : 1000
OutProf Latency TH : 100                    PIR TH            : 200

-------------------------------------------------------------------------------
Frame Payload Id 1
-------------------------------------------------------------------------------
Payload Type       : tcp-ipv4
Description        : Frame_Payload_1
Dst Mac            : 00:00:00:00:00:02
Src Mac            : 00:00:00:00:00:01
Vlan Tag 1         : Not configured
Vlan Tag 2         : Not configured
Ethertype          : 0x0800                 DSCP              : af11
TOS                : 8                      TTL               : 64
Src. IP            : 10.1.1.1               Dst. IP           : 10.2.2.2
L4 Dst Port        : 50                     L4 Src Port       : 40
Protocol           : 6                      Ref. Count        : 0
Data Pattern       : a1b2c3d4e5f6
===============================================================================
*A:7210SAS>config>test-oam>#
```

Table 42: Output fields: test OAM testhead profile

Label	Description
Description	Displays the description configured by the user for the test.
Profile Id	Displays the profile identifier.
CIR Configured	Displays the value of the CIR configured.
PIR Configured	Displays the value of the PIR configured.
Frame Size	Displays the size of the frame.
CIR Operational	Displays the value of the CIR operational rate configured.
PIR Operational	Displays the value of the PIR operational rate configured.
CIR Rule	Displays the adaptation rule configured by the user.
InPrf Dot1p	Displays the dot1p value used to identify green or in-profile packets.
Ref. Count	Displays the total number of testhead (completed or running) sessions pointing to a profile or acceptance criteria or a frame payload.
OutPrf Dot1p	Displays the dot1p value used to identify green or out-of-profile packets.
Duration Hrs, mins, and secs	Displays the test duration in hours, minutes, and seconds.

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Label	Description
Loss TH	Displays the user configured loss threshold value for comparison with measured value.
Jitter TH	Displays the user configured jitter threshold value for comparison with measured value.
InProf Loss TH	Displays the user configured in-profile loss threshold value for comparison with measured value.
OutProf Loss TH	Displays the user configured out-of-profile loss threshold value for comparison with measured value.
Latency TH	Displays the user configured latency threshold value for comparison with measured value.
InProf Latency TH	Displays the user configured in-profile latency threshold value for comparison with measured value.
OutProf Latency TH	Displays the user configured out-of-profile latency threshold value for comparison with measured value.
InProf Jitter TH	Displays the user configured in-profile jitter threshold value for comparison with measured value.
OutProf Jitter TH	Displays the user configured out-of-profile jitter threshold value for comparison with measured value.
CIR TH	Displays the user configured CIR threshold value for comparison with measured value.
PIR TH	Displays the user configured PIR threshold value for comparison with measured value.
Payload Type	Identifies the type of the payload.
Dst Mac	Displays the value of destination MAC configured by the user to use in the frame generated by the testhead tool
Src Mac	Displays the value of source MAC configured by the user to use in the frame generated by the testhead tool
Vlan Tag 1	Displays the values of the outermost vlan-tag configured by the user to use in the frame generated by the testhead tool.
Vlan Tag 2	Displays the values of the second vlan-tag configured by the user to use in the frame generated by the testhead tool.
Ethertype	Displays the values of the ethertype configured by the user to use in the frame generated by the testhead tool.
TOS	Displays the values of the IP TOS (Type of Service) configured by the user to use in the frame generated by the testhead tool.

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Label	Description
Src. IP	Displays the values of the source IPv4 address configured by the user to use in the frame generated by the testhead tool.
L4 Dst Port	Displays the values of the TCP header configured by the user to use in the frame generated by the testhead tool.
Protocol	Displays the values of the IP protocol value configured by the user to use in the frame generated by the testhead tool.
Data Pattern	Displays the values of the data pattern configured by the user to use in the frame generated by the testhead tool.
DSCP	Displays the values of the DSCP configured by the user to use in the frame generated by the testhead tool.
TTL	Displays the values of the IP TTL (Time-to-Live) value configured by the user to use in the frame generated by the testhead tool.
Dst. IP	Displays the values of the destination IPv4 address configured by the user to use in the frame generated by the testhead tool.
L4 Src Port	Displays the values of the source port configured by the user to use in the frame generated by the testhead tool.

testhead

Syntax

testhead *test-name* **owner** *test-owner*

Context

show

Platforms

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

Description

This command displays the testhead test identified by the test name and owner.

Parameters

test-name

Name of the SAA test. The test name must already be configured in the **config**>**saa**>**test** context.

owner ***test-owner***

Specifies the owner of an SAA operation up to 32 characters.

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Default If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

Output

The following output is an example of testhead information, and Table 43: Output fields: testhead describes the output fields.

Sample output

```
*A:7210SAS# show testhead test-me  owner owner-me

===============================================================================
Y.1564 Testhead Session
===============================================================================
Owner              : owner-me
Test               : test-me
Profile Id         : 1                        SAP              : 1/1/2:100
Accept. Crit. Id   : 0                        Completed        : Yes
Frame Payload Id   : 1                        Stopped          : No
Frame Payload Type : tcp-ipv4                 FC               : be
Color Aware Test   : Yes
Start Time         : 08/08/2001 19:37:11
End Time           : 08/08/2001 19:40:16
Total time taken   : 0d 00:03:05

-------------------------------------------------------------------------------
Latency Results
-------------------------------------------------------------------------------
 (total pkts in us):       Min       Max   Average    Jitter
         Roundtrip :         0         0         0         0

(OutPrf pkts in us):       Min       Max   Average    Jitter
         Roundtrip :         0         0         0         0

 (InPrf pkts in us):       Min       Max   Average    Jitter
         Roundtrip :         0         0         0         0

-------------------------------------------------------------------------------
Packet Count
-------------------------------------------------------------------------------
Total Injected     : 42273637
Total Received     : 0

OutPrf Injected    : 16898179
OutPrf Received    : 0

InPrf Injected     : 25375450
InPrf Received     : 0

-------------------------------------------------------------------------------
Test Compliance Report
-------------------------------------------------------------------------------
Throughput Configd : 962388
Throughput Oper    : 962384
Throughput Measurd : 0

PIR Tput Threshld  : Not configured
PIR Tput Meas      : 0

CIR Tput Threshld  : Not configured
CIR Tput Meas      : 0
```


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```
FLR Configured     : None
FLR Measurd        : Not Applicable
FLR Acceptance     : Fail

OutPrf FLR Conf    : None
OutPrf FLR Meas    : Not Applicable
OutPrf FLR Acep    : Not Applicable

InPrf FLR Conf     : None
InPrf FLR Meas     : Not Applicable
InPrf FLR Acep     : Not Applicable

Latency Configd(us): None
Latency Measurd(us): None
Latency Acceptance : Not Applicable

OutPrf Lat Conf(us): None
OutPrf Lat Meas(us): None
OutPrf Lat Acep    : Not Applicable

InPrf Lat Conf(us) : None
InPrf Lat Meas(us) : None
InPrf Lat Acep     : Not Applicable

Jitter Configd(us) : None
Jitter Measurd(us) : None
Jitter Acceptance  : Not Applicable

OutPrf Jit Conf(us): None
OutPrf Jit Meas(us): None
OutPrf Jit Acep    : Not Applicable

InPrf Jit Conf(us) : None
InPrf Jit Meas(us) : None
InPrf Jit Acep     : Not Applicable

Total Pkts. Tx.    : 13                      Latency Pkts. Tx. : 8
OutPrf Latency Pkt*: 0                       InPrf Latency Pkt*: 0
Total Tx. Fail     : 0 ============================================================
==================
*A:7210SAS# show testhead test-me  owner owner-me
```

Table 43: Output fields: testhead

Label	Description
Owner	Displays the owner of the test.
Name	Displays the name of the test.
Description	Displays the description for the test type.
Profile Id	Displays the associated profile ID.
Accept. Crit. Id	Displays the test acceptance criteria ID to be used by the testhead OAM tool to declare the PASS/FAIL result at the completion of the test.

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Label	Description
Frame Payload Id	Displays frame payload ID, that determines the frame content of the frames generated by the tool.
Frame Payload Type	Displays the type of frame payload to be used in frames generated by testhead tool.
Color Aware Test	Displays if color aware tests need to be executed.
SAP	Displays the SAP ID configured.
Completed	Displays if the test has been completed.
Stopped	Displays if the test has been stopped.
FC	Displays the forwarding class (FC) to use to send the frames generated by the testhead tool.
Start Time	Displays the start time of the test.
End Time	Displays the end time of the test.
Total time taken	Displays the total time taken to execute the test.
total pkts in us	Displays the total packets in microseconds.
OutPrf pkts in us	Displays the out-of-profile packets in microseconds.
InPrf pkts in us	Displays the in-profile packets in microseconds.
Total Injected	Displays the running count of total injected packets, including marker packets.
Total Received	Displays the running count of total received packets, including marker packets.
OutPrf Injected	Displays the running count of total out-of-profile packets, excluding marker packets.
OutPrf Received	Displays the running count of total out-of-profile packets received, including marker packets.
InPrf Injected	Displays the running count of total in-profile packets, excluding marker packets.
InPrf Received	Displays the running count of total in-profile packets received, including marker packets.
Throughput Configd	Displays the CIR Throughput rate Threshold Configured (in Kbps).
Throughput Oper	Displays the operational rate used for the configured rate.

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Label	Description
	Operational rate is arrived considering the adaptation rule configured by the user and supported hardware rate.
Throughput Measurd	Displays the CIR Throughput Measured Value (in Kbps).
PIR Tput Threshld	Displays the PIR Throughput rate Threshold Configured (in Kbps).
PIR Tput Meas	Displays the PIR Throughput rate Measured Value (in Kbps).
FLR Configured	Displays the Frame Loss Ratio Threshold Configured (in-profile).
FLR Measurd	Displays the Frame Loss Ratio Measured (in-profile).
FLR Acceptance	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the FLR criteria is not used to determine whether the test is in Passed or Failed status.
OutPrf FLR Conf	Displays the out-of-profile Frame Loss Ratio configured.
OutPrf FLR Meas	Displays the out-of-profile Frame Loss Ratio measured.
OutPrf FLR Acep	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the out-of-profile FLR criteria is not used to determine whether the test is in Passed or Failed status.
InPrf FLR Conf	Displays the in-profile Frame Loss Ratio configured.
InPrf FLR Meas	Displays the in-profile Frame Loss Ratio measured.
InPrf FLR Acep	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the in-profile FLR criteria is not used to determine whether the test is in Passed or Failed status.
Latency Configd(us)	Displays the Latency Threshold configured (in microseconds)
Latency Measurd(us)	Displays the Average Latency measured (in microseconds)
Latency Acceptance	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the latency criteria is not used to determine whether the test is in Passed or Failed status.
OutPrf Lat Conf(us)	Displays the out-of-profile latency configured.
OutPrf Lat Meas(us)	Displays the out-of-profile latency measured.

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Label	Description
OutPrf Lat Acep	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the out-of-profile latency criteria is not used to determine whether the test is in Passed or Failed status.
InPrf Lat Conf(us)	Displays the in-profile latency configured.
InPrf Lat Meas(us)	Displays the in-profile latency measured.
InPrf Lat Acep	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the in-profile latency criteria is not used to determine whether the test is in Passed or Failed status.
Jitter Configd(us)	Displays the Jitter Threshold Configured (in microseconds).
Jitter Measurd(us)	Displays the Jitter Measured (in microseconds).
Jitter Acceptance	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the jitter criteria is not used to determine whether the test is in Passed or Failed status.
OutPrf Jit Conf(us)	Displays the out-of-profile Jitter configured.
OutPrf Jit Meas(us)	Displays the out-of-profile Jitter measured.
OutPrf Jit Acep	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the out-of-profile jitter criteria is not used to determine whether the test is in Passed or Failed status.
InPrf Jit Conf(us)	Displays the in-profile Jitter configured.
InPrf Jit Meas(us)	Displays the in-profile Jitter measured.
InPrf Jit Acep	Displays Pass, Fail, or Not Applicable. It displays Pass, if the measured value is less than or equal to the configured threshold and displays "Fail" otherwise, and displays "Not Applicable", if the in-profile jitter criteria is not used to determine whether the test is in Passed or Failed status.
Total Pkts. Tx.	Displays the total number of packets (that is, data and marker) transmitted by the testhead session for the duration of the test.
OutPrf Latency Pkt*	Displays the total number of out-of-profile marker packets received by the testhead session for the duration of the test.

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Label	Description
Total Tx. Fail	Displays the total number of failed transmission attempts by the testhead session for the duration of the test.
Latency Pkts. Tx	Displays the total number of marker packets transmitted by the testhead session for the duration of the test.
InPrf Latency Pkt*	Displays the total number of in-profile marker packets received by the testhead session for the duration of the test.

bin-group

Syntax

bin-group [*bin-group-number*]

Context

show>oam-pm

Platforms

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

Description

This command displays data for one or all OAM-PM bin groups.

Parameters

bin-group-number

Specifies an OAM-PM bin group.

Values 1 to 255

Output

The following output is an example of OAM-PM bin group information.

Sample output

```
show oam-pm bin-group
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                    Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
1     OAM PM default bin group (not*    Up   0          0          0          0
                                             1       5000       5000       5000
                                             2      10000          -          -
-------------------------------------------------------------------------------
2                                       Up   0          0          0          0
                                             1       1000       5000        100
```


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```
                                        2       2000          -        200
                                        3       3000          -        300
                                        4       4000          -        400
                                        5       5000          -        500
                                        6       6000          -        600
                                        7       7000          -        700
                                        8       8000          -        800
                                        9      10000          -       1000
-------------------------------------------------------------------------------
3                                  Down   0          0          0          0
                                          1       6000       5000       8000
                                          2      10000      10000      10000
                                          3      15000      15000          -
                                          4      22000          -          -
-------------------------------------------------------------------------------
10    base                           Up   0          0          0          0
                                          1       5000       5000       5000
                                          2      10000      10000      10000
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
* indicates that the corresponding row element may have been truncated.


show oam-pm bin-group 2
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                  Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
2                                    Up   0          0          0          0
                                          1       1000       5000        100
                                          2       2000          -        200
                                          3       3000          -        300
                                          4       4000          -        400
                                          5       5000          -        500
                                          6       6000          -        600
                                          7       7000          -        700
                                          8       8000          -        800
                                          9      10000          -       1000
-------------------------------------------------------------------------------
```

bin-group-using

Syntax

bin-group-using [**bin-group** *bin-group-number*]

Context

show>oam-pm

Platforms

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

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Description

This command displays the list of sessions configured against one or all OAM-PM bin groups.

Parameters

bin-group-number

Specifies an OAM-PM bin group.

Values 1 to 255

Output

The following output is an example of OAM-PM bin group sessions information.

Sample output

```
show oam-pm bin-group-using
===============================================================================
OAM Performance Monitoring Bin Group Configuration for Sessions
===============================================================================
Bin Group       Admin   Session                             Session State
-------------------------------------------------------------------------------
2               Up      eth-vpls-00005                          Inact
                        eth-pm-service-4                          Act
-------------------------------------------------------------------------------
3               Down    eth-epipe-000001                        Inact
-------------------------------------------------------------------------------
10              Up      eth-epipe-00002                         Inact
-------------------------------------------------------------------------------
===============================================================================
Admin: State of the bin group
Session State: The state of session referencing the bin-group


show oam-pm bin-group-using bin-group 2
===============================================================================
OAM Performance Monitoring Bin Group Configuration for Sessions
===============================================================================
Bin Group       Admin   Session                             Session State
-------------------------------------------------------------------------------
2               Up      eth-vpls-00005                          Inact
                        eth-pm-service-4                          Act
-------------------------------------------------------------------------------
===============================================================================
Admin: State of the bin group
Session State: The state of session referencing the bin-group
```

session

Syntax

session *session-name* [{**all** | **base** | **bin-group** | **event-mon** | **meas-interval**}]

Context

show>oam-pm

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Platforms

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

Description

This command displays the configuration and status information for an OAM-PM session.

Parameters

session-name

Specifies the name of the session. 32 characters maximum.

all

Specifies all attributes.

base

Specifies the base configuration option for the session.

bin-group

Specifies the associated bin group and its attributes.

event-mon

Specifies configured event monitoring and last TCA information.

meas-interval

Specifies the associated measured interval and its attributes.

Output

The following output is an example of OAM-PM session information.

Sample output

```
show oam-pm session "eth-pm-service-4" all
-------------------------------------------------------------------------------
Basic Session Configuration
-------------------------------------------------------------------------------
Session Name      : eth-pm-service-4
Description       : (Not Specified)
Test Family       : ethernet            Session Type       : proactive
Bin Group         : 2
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Ethernet Configuration
-------------------------------------------------------------------------------
Source MEP        : 28                  Priority           : 0
Source Domain     : 12                  Dest MAC Address   : 00:00:00:00:00:30
Source Assoc'n    : 4
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
DMM Test Configuration and Status
-------------------------------------------------------------------------------
Test ID           : 10004               Admin State        : Up
Oper State        : Up                  Data TLV Size      : 1000 octets
On-Demand Duration: Not Applicable      On-Demand Remaining: Not Applicable
Interval          : 1000 ms
-------------------------------------------------------------------------------
```


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```
-------------------------------------------------------------------------------
SLM Test Configuration and Status
-------------------------------------------------------------------------------
Test ID           : 10004              Admin State        : Up
Oper State        : Up                 Data TLV Size      : 1000 octets
On-Demand Duration: Not Applicable     On-Demand Remaining: Not Applicable
Interval          : 100 ms
CHLI Threshold    : 4 HLIs             Frames Per Delta-T : 10 SLM frames
Consec Delta-Ts   : 10                 FLR Threshold      : 50%
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
15-mins Measurement Interval Configuration
-------------------------------------------------------------------------------
Duration          : 15-mins            Intervals Stored   : 32
Boundary Type     : clock-aligned      Clock Offset       : 0 seconds
Accounting Policy : none
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                   Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
2                                   Up   0          0          0          0
                                         1       1000       5000        100
                                         2       2000          -        200
                                         3       3000          -        300
                                         4       4000          -        400
                                         5       5000          -        500
                                         6       6000          -        600
                                         7       7000          -        700
                                         8       8000          -        800
                                         9      10000          -       1000
-------------------------------------------------------------------------------

show oam-pm session "eth-pm-service-4" base
-------------------------------------------------------------------------------
Basic Session Configuration
-------------------------------------------------------------------------------
Session Name      : eth-pm-service-4
Description       : (Not Specified)
Test Family       : ethernet           Session Type       : proactive
Bin Group         : 2
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Ethernet Configuration
-------------------------------------------------------------------------------
Source MEP        : 28                 Priority           : 0
Source Domain     : 12                 Dest MAC Address   : 00:00:00:00:00:30
Source Assoc'n    : 4
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
DMM Test Configuration and Status
-------------------------------------------------------------------------------
Test ID           : 10004              Admin State        : Up
Oper State        : Up                 Data TLV Size      : 1000 octets
On-Demand Duration: Not Applicable     On-Demand Remaining: Not Applicable
Interval          : 1000 ms
-------------------------------------------------------------------------------
```


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```
-------------------------------------------------------------------------------
SLM Test Configuration and Status
-------------------------------------------------------------------------------
Test ID           : 10004               Admin State        : Up
Oper State        : Up                  Data TLV Size      : 1000 octets
On-Demand Duration: Not Applicable      On-Demand Remaining: Not Applicable
Interval          : 100 ms
CHLI Threshold    : 4 HLIs              Frames Per Delta-T : 10 SLM frames
Consec Delta-Ts   : 10                  FLR Threshold      : 50%
-------------------------------------------------------------------------------

show oam-pm session "eth-pm-service-4" bin-group
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                   Admin Bin     FD(us)    FDR(us)   IFDV(us)
-------------------------------------------------------------------------------
2                                   Up   0          0          0          0
                                         1       1000       5000        100
                                         2       2000          -        200
                                         3       3000          -        300
                                         4       4000          -        400
                                         5       5000          -        500
                                         6       6000          -        600
                                         7       7000          -        700
                                         8       8000          -        800
                                         9      10000          -       1000
-------------------------------------------------------------------------------


show oam-pm session "eth-pm-service-4" meas-interval
-------------------------------------------------------------------------------
15-mins Measurement Interval Configuration
-------------------------------------------------------------------------------
Duration          : 15-mins             Intervals Stored   : 32
Boundary Type     : clock-aligned       Clock Offset       : 0 seconds
Accounting Policy : none
-------------------------------------------------------------------------------
```

sessions

Syntax

sessions [**test-family** {**ethernet** | **ip**}] [**event-mon**]

Context

show>oam-pm

Platforms

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

Description

This command displays a summary of the OAM-PM sessions.

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Parameters

ethernet

Specifies Ethernet sessions only.

ip

Specifies IP sessions only.

event-mon

Specifies a summary of all event monitoring information, and the current state for each session.

Output

The following output is an example of summary OAM-PM session information.

Sample output

```
show oam-pm sessions
===============================================================================
OAM Performance Monitoring Session Summary for the Ethernet Test Family
===============================================================================
Session                         State   Bin Group   Sess Type   Test Types
-------------------------------------------------------------------------------
eth-vpls-00005                  Inact           2   proactive      DMM SLM
eth-epipe-00002                 Inact          10   proactive      DMM SLM
eth-epipe-000001                Inact           3   proactive      DMM
eth-pm-service-4                  Act           2   proactive      DMM SLM
===============================================================================


show oam-pm sessions test-family ethernet
===============================================================================
OAM Performance Monitoring Session Summary for the Ethernet Test Family
===============================================================================
Session                         State   Bin Group   Sess Type   Test Types
-------------------------------------------------------------------------------
eth-vpls-00005                  Inact           2   proactive      DMM SLM
eth-epipe-00002                 Inact          10   proactive      DMM SLM
eth-epipe-000001                Inact           3   proactive      DMM
eth-pm-service-4                  Act           2   proactive      DMM SLM
===============================================================================
```

statistics

Syntax

statistics

Context

show>oam-pm

Platforms

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

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Description

Commands in this context display OAM-PM delay or synthetic loss statistics.

session

Syntax

session *session-name*

Context

show>oam-pm>statistics

Platforms

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

Description

This command displays OAM-PM session statistics.

Parameters

session-name

Specifies the session name. 32 characters maximum.

dmm

Syntax

dmm

Context

show>oam-pm>statistics>session

Platforms

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

Description

Commands in this context display DMM test statistics.

meas-interval

Syntax

meas-interval raw [{**all** | **bins** | **summary**}]

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meas-interval {**5-mins** | **15-mins** | **1-hour** | **1-day**} **interval-number** *interval-number* [{**all** | **bins** | **summary**}]

Context

show>oam-pm>statistics>session>dmm

Platforms

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

Description

This command displays measured interval statistics for DMM tests in the specified session.

Parameters

raw

Specifies raw information.

5-mins

Specifies information for 5-min intervals.

15-mins

Specifies information for 15-min intervals.

1-hour

Specifies information for 1-hour intervals.

1-day

Specifies information for 1-day intervals.

interval-number

Specifies the interval number.

Values 1 to 97

all

Specifies all information for the interval.

bins

Specifies bin information for the interval.

summary

Specifies summarized information for the interval.

Output

The following output is an example of DMM measured interval statistics information.

Sample output

```
show oam-pm statistics session "eth-pm-service-4" dmm meas-interval 15-
mins all interval-number 2
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 10:15:00          Status          : completed
Elapsed (seconds) : 900                          Suspect         : no
```


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```
Frames Sent       : 900                         Frames Received : 900
-------------------------------------------------------------------------------

-------------------------------------------------------------------------
Bin Type     Direction     Minimum (us)   Maximum (us)   Average (us)
-------------------------------------------------------------------------
FD           Forward                0          11670            779
FD           Backward               0           7076           1746
FD           Round Trip          1109          13222           2293
FDR          Forward                0          11670            779
FDR          Backward               0           7076           1738
FDR          Round Trip             0          12104           1178
IFDV         Forward                0          10027            489
IFDV         Backward               0           5444            742
IFDV         Round Trip             0          11853           1088
-------------------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay (FD) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           625           244             0
1           1000 us           194           356           465
2           2000 us            50           153           244
3           3000 us            11           121           119
4           4000 us            10            17            40
5           5000 us             5             6            20
6           6000 us             4             2             5
7           7000 us             0             1             3
8           8000 us             0             0             3
9          10000 us             1             0             1
-----------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           890           891           889
1           5000 us            10             9            11
-----------------------------------------------------------------

-----------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           398           255           102
1            100 us            82            88            89
2            200 us            79            57            59
3            300 us            60            63            61
4            400 us            39            37            54
5            500 us            31            24            42
6            600 us            26            30            43
7            700 us            29            20            34
8            800 us            54            47            67
9           1000 us           102           279           349
-----------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" dmm meas-interval 15-
mins bins interval-number 2
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 10:30:00          Status          : completed
```


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```
Elapsed (seconds) : 900                          Suspect         : no
Frames Sent       : 900                          Frames Received : 900
-------------------------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay (FD) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           699           167             0
1           1000 us           169           312           456
2           2000 us            24           228           274
3           3000 us             3           136           111
4           4000 us             3            48            41
5           5000 us             1             7            10
6           6000 us             1             1             3
7           7000 us             0             1             2
8           8000 us             0             0             3
9          10000 us             0             0             0
-----------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           898           891           892
1           5000 us             2             9             8
-----------------------------------------------------------------

-----------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us           462           217           107
1            100 us            63            99            80
2            200 us            64            85            71
3            300 us            63            74            53
4            400 us            34            53            45
5            500 us            37            24            50
6            600 us            34            17            41
7            700 us            35            23            57
8            800 us            46            32            60
9           1000 us            62           276           336
-----------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" dmm meas-interval 15-
mins summary interval-number 2
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 10:30:00          Status          : completed
Elapsed (seconds) : 900                          Suspect         : no
Frames Sent       : 900                          Frames Received : 900
-------------------------------------------------------------------------------

-------------------------------------------------------------------
Bin Type     Direction     Minimum (us)   Maximum (us)   Average (us)
-------------------------------------------------------------------
FD           Forward                0           6379            518
FD           Backward               0           7856           2049
FD           Round Trip          1118           9879           2241
FDR          Forward                0           6379            518
FDR          Backward               0           7856           2049
FDR          Round Trip             9           8770           1132
```


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```
IFDV         Forward                  0           6021            328
IFDV         Backward                 0           5800            732
IFDV         Round Trip               2           7758            984
-------------------------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" dmm meas-interval raw
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 09:43:58          Status          : in-progress
Elapsed (seconds) : 3812                         Suspect         : yes
Frames Sent       : 3812                         Frames Received : 3812
-------------------------------------------------------------------------------

-------------------------------------------------------------------
Bin Type     Direction     Minimum (us)   Maximum (us)   Average (us)
-------------------------------------------------------------------
FD           Forward                 0          11670            629
FD           Backward                0          11710           2156
FD           Round Trip           1109          14902           2497
FDR          Forward                 0          11670            617
FDR          Backward                0          11710           2156
FDR          Round Trip              0          13784           1360
IFDV         Forward                 0          10027            404
IFDV         Backward                0          10436            768
IFDV         Round Trip              0          13542           1056
-------------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay (FD) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us          2815           661             0
1           1000 us           803          1287          1591
2           2000 us           127           971          1227
3           3000 us            21           639           623
4           4000 us            25           181           232
5           5000 us            12            42            72
6           6000 us             7            14            28
7           7000 us             0             4            13
8           8000 us             1            12            19
9          10000 us             1             1             7
-----------------------------------------------------------------

-----------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us          3792          3740          3751
1           5000 us            21            73            62
-----------------------------------------------------------------

-----------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-----------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-----------------------------------------------------------------
0              0 us          1815           884           410
1            100 us           338           439           354
2            200 us           280           313           282
3            300 us           241           313           268
4            400 us           162           193           231
5            500 us           134           141           202
6            600 us           126           102           178
```


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```
7             700 us           127            97           153
8             800 us           208           165           276
9            1000 us           381          1165          1458
-------------------------------------------------------------------
```

slm

Syntax

slm

Context

show>oam-pm>statistics>session

Platforms

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

Description

Commands in this context display SLM test statistics.

meas-interval

Syntax

meas-interval raw

meas-interval {**5-mins** | **15-mins** | **1-hour** | **1-day**} **interval-number** *interval-number*

Context

show>oam-pm>statistics>session>slm

Platforms

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

Description

This command displays measured interval statistics for SLM tests in the specified session

Parameters

raw

Specifies raw information.

5-mins

Specifies information for 5-min intervals.

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15-mins

Specifies information for 15-min intervals.

1-hour

Specifies information for 1-hour intervals.

1-day

Specifies information for 1-day intervals.

interval-number

Specifies the interval number.

Values 1 to 97

Output

The following output is an example of SLM measured interval statistics information.

Sample output

```
show oam-pm statistics session "eth-pm-service-4" slm meas-interval 15-
mins interval-number 2
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 10:30:00         Status          : completed
Elapsed (seconds) : 900                         Suspect         : no
Frames Sent       : 9000                        Frames Received : 9000
-------------------------------------------------------------------------------

-----------------------------------------------------
                    Frames Sent       Frames Received
-----------------------------------------------------
Forward                    9000                  9000
Backward                   9000                  9000
-----------------------------------------------------

-------------------------------------------
Frame Loss Ratios
-------------------------------------------
             Minimum    Maximum    Average
-------------------------------------------
Forward       0.000%     0.000%     0.000%
Backward      0.000%     0.000%     0.000%
-------------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
           Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward          900           0           0           0          0          0
Backward         900           0           0           0          0          0
-------------------------------------------------------------------------------

show oam-pm statistics session "eth-pm-service-4" slm meas-interval raw
-------------------------------------------------------------------------------
Start (UTC)       : 2014/02/01 09:44:03         Status          : in-progress
Elapsed (seconds) : 4152                        Suspect         : yes
Frames Sent       : 41523                       Frames Received : 41523
-------------------------------------------------------------------------------

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


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```
                    Frames Sent       Frames Received
-------------------------------------------------------
Forward                   41369                 41369
Backward                  41369                 41369
-------------------------------------------------------

-----------------------------------------
Frame Loss Ratios
-----------------------------------------
             Minimum    Maximum    Average
-----------------------------------------
Forward       0.000%     0.000%     0.000%
Backward      0.000%     0.000%     0.000%
-----------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
           Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward         4137           0           0           0          0          0
Backward        4137           0           0           0          0          0
-------------------------------------------------------------------------------
Ib
```

twamp-light

Syntax

twamp-light

Context

show>oam-pm>statistics>session

Platforms

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

Description

Commands in this context display TWAMP Light test statistics.

meas-interval

Syntax

meas-interval raw delay [{**all** | **bins** | **summary**}]

meas-interval raw [**loss**]

meas-interval {**5-mins** | **15-mins** | **1-hour** | **1-day**} **interval-number** *interval-number* **delay** [{**all** | **bins** | **summary**}]

meas-interval {**5-mins** | **15-mins** | **1-hour** | **1-day**} **interval-number** *interval-number* [**loss**]

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Context

show>oam-pm>statistics>session>twamp-light

Platforms

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

Description

This command displays measured interval statistics for TWAMP-Light tests in the specified session.

Parameters

raw

Specifies raw information.

5-mins

Specifies information for 5-min intervals.

15-mins

Specifies information for 15-min intervals.

1-hour

Specifies information for 1-hour intervals.

1-day

Specifies information for 1-day intervals.

interval-number

Specifies the interval number.

Values 1 to 97

delay

Specifies TWAMP Light delay statistics only.

loss

Specifies TWAMP Light loss statistics only.

all

Specifies all information for the interval.

bins

Specifies bin information for the interval.

summary

Specifies summarized information for the interval.

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3.8.2.15 Monitor commands

session

Syntax

session *session-name* [{**dmm** | **slm** | **twamp-light**}]

Context

monitor>oam-pm

Platforms

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

Description

This command monitors the raw measurement interval for the specified session.

Parameters

session-name

Specifies the session name, up to 32 characters.

dmm

Specifies monitoring information for DMM tests only.

slm

Specifies monitoring information for SLM tests only.

twamp-light

Specifies monitoring information for TWAMP-Light tests only.

Output

Sample output

```
monitor oam-pm session "eth-pm-service-4" dmm
------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
------------------------------------------------------------------------------

-------------------------------------------------------------
Frame Delay (FD) Bin Counts
-------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------
0              0 us          3928          1125             0
1           1000 us          1197          1855          2611
2           2000 us           183          1361          1565
3           3000 us            36           762           778
4           4000 us            30           214           280
5           5000 us            14            45            81
6           6000 us             8            17            35
7           7000 us             1             5            16
```


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```
8            8000 us             5             15             26
9           10000 us             1              4             11
-------------------------------------------------------------------

-------------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-------------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------------
0               0 us          5374          5317          5321
1            5000 us            29            86            82
-------------------------------------------------------------------

-------------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-------------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------------
0               0 us          2475          1268           625
1             100 us           516           676           554
2             200 us           395           479           417
3             300 us           338           451           398
4             400 us           224           291           340
5             500 us           185           212           280
6             600 us           187           137           234
7             700 us           185           134           208
8             800 us           315           223           392
9            1000 us           582          1531          1954
-------------------------------------------------------------------

-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Delta)
-------------------------------------------------------------------------------

-------------------------------------------------------------------
Frame Delay (FD) Bin Counts
-------------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------------
0               0 us             0             7             0
1            1000 us            10             2             6
2            2000 us             0             1             3
3            3000 us             0             0             1
4            4000 us             0             0             0
5            5000 us             0             0             0
6            6000 us             0             0             0
7            7000 us             0             0             0
8            8000 us             0             0             0
9           10000 us             0             0             0
-------------------------------------------------------------------

-------------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-------------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------------
0               0 us            10            10            10
1            5000 us             0             0             0
-------------------------------------------------------------------

-------------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-------------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
```


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```
-------------------------------------------------------------
0               0 us             5             4             2
1             100 us             2             2             2
2             200 us             2             1             1
3             300 us             1             0             0
4             400 us             0             0             1
5             500 us             0             0             0
6             600 us             0             0             0
7             700 us             0             0             1
8             800 us             0             0             0
9            1000 us             0             3             3
-------------------------------------------------------------

-------------------------------------------------------------------------------
At time t = 20 sec (Mode: Delta)
-------------------------------------------------------------------------------

-------------------------------------------------------------
Frame Delay (FD) Bin Counts
-------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------
0               0 us             9             0             0
1            1000 us             0             7             6
2            2000 us             0             3             3
3            3000 us             1             0             0
4            4000 us             0             0             0
5            5000 us             0             0             1
6            6000 us             0             0             0
7            7000 us             0             0             0
8            8000 us             0             0             0
9           10000 us             0             0             0
-------------------------------------------------------------

-------------------------------------------------------------
Frame Delay Range (FDR) Bin Counts
-------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------
0               0 us            10            10            10
1            5000 us             0             0             0
-------------------------------------------------------------

-------------------------------------------------------------
Inter-Frame Delay Variation (IFDV) Bin Counts
-------------------------------------------------------------
Bin      Lower Bound       Forward      Backward    Round Trip
-------------------------------------------------------------
0               0 us             5             3             2
1             100 us             0             2             2
2             200 us             0             1             0
3             300 us             0             3             1
4             400 us             2             0             0
5             500 us             1             0             0
6             600 us             0             1             2
7             700 us             0             0             0
8             800 us             0             0             0
9            1000 us             2             0             3
-------------------------------------------------------------


monitor oam-pm session "eth-pm-service-4" slm
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
```


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

-------------------------------------------------------
                   Frames Sent       Frames Received
-------------------------------------------------------
Forward                  54749                 54749
Backward                 54749                 54749
-------------------------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
          Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward        5475           0           0           0          0          0
Backward       5475           0           0           0          0          0
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
At time t = 10 sec (Mode: Delta)
-------------------------------------------------------------------------------

-------------------------------------------------------
                   Frames Sent       Frames Received
-------------------------------------------------------
Forward                    100                   100
Backward                   100                   100
-------------------------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
          Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward           10           0           0           0          0          0
Backward          10           0           0           0          0          0
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
At time t = 20 sec (Mode: Delta)
-------------------------------------------------------------------------------

-------------------------------------------------------
                   Frames Sent       Frames Received
-------------------------------------------------------
Forward                    100                   100
Backward                   100                   100
-------------------------------------------------------

-------------------------------------------------------------------------------
Availability Counters (Und = Undetermined)
-------------------------------------------------------------------------------
          Available   Und-Avail Unavailable Und-Unavail        HLI       CHLI
-------------------------------------------------------------------------------
Forward           10           0           0           0          0          0
Backward          10           0           0           0          0          0
-------------------------------------------------------------------------------
```


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3.8.2.16 Clear commands

saa

Syntax

saa-test [*test-name* [**owner** *test-owner*]]

Context

clear

Platforms

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

Description

This command clears the SAA results for the latest and the history for this test. If the test name is omitted, all the results for all tests are cleared.

Parameters

test-name

Specifies the name of the SAA test. The test name must already be configured in the **config**>**saa**>**test** context.

owner *test-owner*

Specifies the owner of an SAA operation up to 32 characters.

Default If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

session

Syntax

session *session-name* {**dmm** | **slm** | **twamp-light**}

Context

clear>oam-pm

Platforms

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

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Description

This command clears the raw measurement interval for the specified session and test.

Parameters

session-name

Specifies the name of the session, 32 characters maximum.

dmm

Clears the raw measurement interval for DMM tests.

slm

Clears the raw measurement interval for SLM tests.

twamp-light

Clears the raw measurement interval for TWAMP Light tests.

mep

Syntax

mep *mep-id* **domain** *md-index* **association** *ma-index* **statistics**

Context

clear>eth-cfm

Platforms

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

Description

This command clears the specified MEP.

Parameters

mep-id

Specifies the MEP ID.

Values 1 to 8191

md-index

Specifies the domain context for the MEP.

Values 1 to 4294967295

ma-index

Specifies the association context for the MEP.

Values 1 to 4294967295

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statistics

Clears MEP statistics for the specified MEP.

statistics

Syntax

statistics

Context

clear>eth-cfm

Platforms

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

Description

This command clears the ETH-CFM statistics counters.

test-oam

Syntax

test-oam

Context

clear

Platforms

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

Description

This command clears the Operations, Administration, and Maintenance test parameters.

twamp

Syntax

twamp

Context

clear>test-oam

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Platforms

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

Description

Commands in this context clear TWAMP server statistics.

server

Syntax

server

Context

clear>test-oam>twamp

Platforms

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

Description

This command clears TWAMP server statistics.

testhead

Syntax

testhead

Context

clear

Platforms

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

Description

Commands in this context clear teasthead statistics.

result

Syntax

result [*test-name*] [**owner** *test-owner*]

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result testhead-profile *profile-id*

Context

clear>testhead

Platforms

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

Description

This command clears testhead results from the latest history for the test.

Parameters

test-name

Specifies the name of the test.

Values ASCII string up to 32 characters.

test-owner

Specifies the owner of a testhead operation.

Values ASCII string up to 32 characters.

profile-id

Clears the testhead profile ID to use with this run/session of testhead invocation.

Values 1 to 10

3.9 Tools command reference

3.9.1 Command hierarchies

- Tools dump commands
- Tools perform commands

3.9.1.1 Configuration commands

3.9.1.1.1 Tools dump commands

```
tools
    - dump
        - accounting-policy acct-policy-id flash-write-count [clear]
        - top-active-meps [rx-sort | tx-sort] [clear]
        - eth-ring ring-index [clear]
```


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```
        - lag lag-id lag-id
        - ldp-treetrace {prefix ip-prefix/mask | manual-prefix ip-prefix/mask} [path-
destination ip-address] [trace-tree]
        - redundancy
            - multi-chassis
                - mc-endpoint peer ip-address
                - sync-database [peer ip-address] [port port-id | lag-id] [sync-tag sync-tag]
 [application application] [detail] [type type]
        - router router-instance
            - dintf [ip-address]
            - filter-info [verbose]
            - l3info
            - l3-stats [clear]
            - service-name service-name
            - ldp
                - fec prefix ip-prefix/mask
                - fec p2mp-id id root ip-address [detail]
                - fec vc-type {vc-type} agi agi
                - fec vc-type {ethernet | vlan} vc-id vc-id
                - interface [ip-int-name | ip-address]
                - memory-usage
                - peer ip-address
                - session [ip-addr[:label-space] [connection | peer | adjacency]
                - sockets
                - timers
            - mpls
                - cspf to ip-addr [from ip-addr] [strict-srlg] [srlg-group grp-id...(up to 8
 max)] [bandwidth bandwidth] [include-bitmap bitmap] [exclude-bitmap bitmap] [hop-limit limit]
 [exclude-address excl-addr [excl-addr...(upto
8 max)]] [use-te-metric] [exclude-node excl-node-id [excl-node-id...(upto 8 max)]] [skip-
interface interface-name]
                - force-switch-path lsp lsp-name path path-name
                - no force-switch-path lsp lsp-name
                - ftn [endpoint endpoint | sender sender | nexthop nexthop | lsp-id lsp-id |
 tunnel-id tunnel-id | label start-label end-label]
                - ilm [endpoint endpoint | sender sender | nexthop nexthop | lsp-id lsp-id |
 tunnel-id tunnel-id | label start-label end-label]
                - lspinfo [lsp-name] [detail]
                - memory-usage
                - te-lspinfo [endpoint ip-address] [sender ip-address] [lspid lsp-id] [detail]
                - te-lspinfo [endpoint ip-address] [sender ip-address] [lspid lsp-id] [detail]
                - switch-path lsp lsp-name path path-name
                - tp-tunnel
                    - clear {lsp-name | id tunnel-id}
                    - force {lsp-name | id tunnel-id}
                    - manual {lsp-name | id tunnel-id}
                    - lockout {lsp-name | id tunnel-id}
                - trap-suppress number-of-traps time-interval
            - ospf ospf-instance
                - abr [detail]
                - asbr [detail]
                - bad-packet interface-name
                - leaked-routes [summary | detail]
                - memory-usage [detail]
                - request-list [neighbor ip-address] [detail]
                - request-list virtual-neighbor ip-address area-id area-id [detail]
                - retransmission-list [neighbor ip-address] [detail]
                - retransmission-list virtual-neighbor ip-address area-id area-id [detail]
                - route-summary
                - route-table ip-prefix/mask [type] [detail]
            - ospf3
            - rsvp
                - psb [endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
 [lspid lsp-id]
```


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```
                - rsb [endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
 [lspid lsp-id]
                - tcsb[endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
 [lspid lsp-id]
                - neighbor [ip-address] [detail]
            - service
                - base-stats [clear]
                - dpipe service-id
                - dtls service-id
                - iom-stats [clear]
                - l2pt-diags
                - l2pt-diags clear
                - l2pt-diags detail
                - vpls-fdb-stats [clear]
                - vpls-mfib-stats [clear]
            - system
                - cpu-pkt-stats
            - system-resources slot-number [sap-ingress-qos] [associations]
            - system-resources slot-number mcast-groups
            - system-resources slot-number g8032-control-sap-tags
            - system-resources slot-number l4-port-range
            - system-resources sap [port port-id] [lag lag-id]
            - vc-stack card slot-number [detail]
            - vc-stack card slot-number [detail] fabric-ports [pools]
```

3.9.1.1.2 Tools perform commands

```
tools
    - perform
        - eth-ring
            - clear ring-index
            - force ring-index path {a | b}
            - manual ring-index path {a | b}
        - lag
            - clear-force all-mc
            - clear-force lag-id lag-id [sub-group sub-group-id]
            - clear-force peer-mc ip-address
            - force all-mc {active | standby}
            - force lag-id lag-id [sub-group sub-group-id] {active | standby}
            - force peer-mc peer-ip-address {active | standby}
        - log
            - test-event
        - redundancy
            - issu-post-process
        - router [router-instance]
            - isis
            - mpls
                - cspf to ip-addr [from ip-addr] [bandwidth bandwidth] [include-bitmap bitmap]
 [exclude-bitmap bitmap] [hop-limit limit] [exclude-address excl-addr [excl-addr...(up to 8
 max)]] [use-te-metric] [skip-interface interface-name]
                - resignal lsp lsp-name path path-name delay minutes
                - resignal {p2mp-lsp p2mp-lsp-name p2mp-instance p2mp-instancename | p2mp-
delay p2mp-minutes}
                - trap-suppress number-of-traps time-interval
            - ospf [ospf-instance]
                - ldp-sync-exit
                - refresh-lsas
                - run-manual-spf
            - ospf3
                - ldp-sync-exit
                - refresh-lsas
```


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```
            - run-manual-spf
        - service
            - eval-pw-template  policy-id [allow-service-impact]
            - id service-id
                - endpoint endpoint-name
                    - force-switchover sdp-id:vc-id
                    - no force-switchover
                - eval-pw-template  policy-id [allow-service-impact]
            - pw-routing
                - eval-expired-fec  spoke-sdp-fec-id
                - eval-expired-fec  all
            - spoke-sdp-fec-release global-id[:prefix[:ac-id]]
        - system
            - cron
                - tod
                    - re-evaluate
                        - customer customer-id [site customer-site-name]
                        - filter ip-filter [filter-id]
                        - filter ipv6-filter [filter-id]
                        - filter mac-filter [filter-id]
                        - service id service-id [sap sap-id]
                        - tod-suite tod-suite-name
            - script-control
                - script-policy
                    - stop [script-policy-name] [owner script-policy-owner] [all]
```

3.9.2 Command descriptions

- Tools commands
- Performance commands

3.9.2.1 Tools commands

- Generic commands
- Dump commands
- Dump router commands
- Dump service commands

3.9.2.1.1 Generic commands

```
tools
```

Syntax

tools

Context

root

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure debugging tools.

Parameters

dump

Enables dump tools for the various protocols.

perform

Enables tools to perform specific tasks.

3.9.2.1.2 Dump commands

dump

Syntax

dump *router-name*

Context

tools

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display information for debugging.

Parameters

router-name

Specifies a router name, up to 32 characters.

Default Base

accounting-policy

Syntax

accounting-policy *acct-policy-id* **flash-write-count** [**clear**]

Context

tools>dump

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Platforms

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

Description

This command dumps the total count of flash writes for the accounting policy specified by the user. The **clear** option allows the user to clear the count maintained per accounting policy and starts the counter afresh.

Parameters

flash-write-count

Dumps the total number of flash writes up to the present for the accounting policy specified by accounting-policy 'id'.

acct-policy-id

Specifies the Accounting policy.

Values 1 to 99

clear

Clears statistics.

top-active-meps

Syntax

top-active-meps [**rx-sort** | **tx-sort**] [**clear**]

Context

tools>dump>eth-cfm

Platforms

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

Description

This command displays, and optionally clears, the most active MEPs on the system.

Default

sorts total in both directions

Parameters

rx-sort

Sorts in the receive (Rx) direction.

tx-sort

Sorts in the transmit (Tx) direction.

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clear

Clears the current counters.

eth-ring

Syntax

eth-ring *ring-index* [**clear**]

Context

tools>dump

Platforms

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

Description

This command displays Ethernet ring information.

Parameters

ring-index

Specifies the ring index.

Values 1 to 128

clear

Clears statistics.

lag

Syntax

lag lag-id *lag-id*

Context

tools>dump

Platforms

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

Description

This command displays LAG information.

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Parameters

lag-id

Specifies an existing LAG ID.

Values 1 to 12

Output

```
*A:kiran3>tools>dump# lag lag-id 1
Port state      : Up
Selected subgrp : 1
NumActivePorts  : 2
ThresholdRising : 2
ThresholdFalling: 0
IOM bitmask     : 2
Config MTU      : 1522
Oper. MTU       : 1522
Bandwidth       : 200000

multi-chassis   : NO

-------------------------------------------------------------------------------
Indx   PortId   RX pkts   TX pkts   State Active Port  Cfg Oper Speed       BW AP CS
                                               Pri   Mtu Mtu
-------------------------------------------------------------------------------
   0    1/1/
1         1         1      Up    yes 32768 1522 1522  1000   100000  0  2
   1    1/1/
2         0         0      Up    yes 32768 1522 1522  1000   100000  0  2
```

ldp-treetrace

Syntax

ldp-treetrace {**prefix** *ip-prefix/mask* | **manual-prefix** *ip-prefix/mask*} [**path-destination** *ip-address*] [**trace-tree**]

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays LDP treetrace information.

Note:
The **tools dump ldp-treetrace prefix** command displays entries only if **ldp-treetrace** is enabled, that is, **configure test-oam ldp-treetrace no shutdown** is configured.

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Parameters

prefix ip-prefix/mask

Specifies the IP prefix and host bits.

Values host bits: must be 0 mask: 0 to 32

Output

The following output is an example of automated LDP treetrace information.

Sample output — automated LDP treetrace

```
*A:Dut-B# tools dump ldp-treetrace prefix 10.20.1.6/32
    Discovered Paths:
    ==================
    Id   PathDst           EgrNextHop        ReplyRtrAddr      DiscoveryTime
           DiscoveryTtl      ProbeState        ProbeTmOutCnt     RtnCode
    ===  ================  ================  ================  ==================
    001       127.1.0.255        10.10.41.2         10.10.9.6  11/09/2010 16:15:54
                     002                OK                00             EgressRtr
    002       127.2.0.255        10.10.42.2         10.10.9.6  11/09/2010 16:15:54
                     002                OK                00             EgressRtr
    003       127.3.0.255        10.10.43.2         10.10.9.6  11/09/2010 16:15:54
                     002                OK                00             EgressRtr
    004       127.4.0.255        10.10.44.2         10.10.9.6  11/09/2010 16:15:54
                     002                OK                00             EgressRtr
    005       127.5.0.255        10.10.45.2         10.10.9.6  11/09/2010 16:15:54
                     002                OK                00             EgressRtr

    ldp-treetrace discovery state: Done
    ldp-treetrace discovery status: ' OK '
    Total number of discovered paths: 5
    Total number of probe-failed paths: 0
    Total number of failed traces: 0
*A:Dut-B#
```

eth-ring

Syntax

eth-ring *ring-index* [**clear**]

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays eth-ring information.

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Parameters

ring-index

Specifies the ring index.

Values 1 to 128

clear

Clears the eth-ring statistics.

redundancy

Syntax

redundancy

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context dump tools for redundancy.

multi-chassis

Syntax

multi-chassis

Context

tools>dump>redundancy>multi-chassis

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context dump tools for multi-chassis redundancy.

mc-endpoint

Syntax

multi-chassis

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Context

tools>dump>redundancy>multi-chassis

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps multi-chassis endpoint information.

Parameters

peer ip-address

Specifies the peer IP address.

sync-database

Syntax

sync-database [**peer** *ip-address*] [**port** *port-id* | *lag-id*] [**sync-tag** *sync-tag*] [**application** *application*] [**detail**] [**type** *type*]

Context

tools>dump>redundancy>multi-chassis

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps MCS database information.

Parameters

peer *ip-address*

Specifies the peer IP address.

port *port-id* | *lag-id*

Indicates the port or LAG ID to be synchronized with the multi-chassis peer.

Values *slot*/*mda*/*port* or lag-*lag-id*

sync-tag *sync-tag*

Specifies a synchronization tag to be used while synchronizing this port with the multi-chassis peer.

application *application*

Specifies a particular multi-chassis peer synchronization protocol application.

Values

igmp-snooping: igmp-snooping

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mc-ring:	multi-chassis ring
sub-host-trk:	subscriber host tracking

type *type*

Indicates the locally deleted or alarmed deleted entries in the MCS database per multi-chassis peer.

Values alarm-deleted, local-deleted

detail

Displays detailed information.

system

Syntax

system

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps tools for system information.

cpu-pkt-stats

Syntax

cpu-pkt-stats

Context

tools>dump>system

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps statistics for CPU traffic.

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system-resources

Syntax

system-resources *slot-number* [**sap-ingress-qos**] [**associations**]

system-resources mcast-groups

system-resources *slot-number* **g8032-control-sap-tags**

system-resources [*slot-number*] **l4-port-range**

system-resources sap [**port** *port-id*] [**lag** *lag-id*]

Context

tools>dump

Platforms

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

Description

This command displays system resource information.

Parameters

slot-number

Specifies the slot for which system resources information is displayed.

Values 1

sap-ingress-qos

Displays details on usage of resources allocated for QoS classification and different match criteria under QoS classification.

associations

Displays all SAPs with the allocated resource type and chunk ID.

mcast-groups

Displays details on usage of resources allocated for multicast group resource consumption.

g8032-control-sap-tags

Displays details on usage of VLANs used for a G8032 control session. This keyword is supported only on the 7210 SAS-T.

l4-port-range

Displays details on the range qualifier resources in use. This keyword is supported only on the 7210 SAS-Mxp.

sap

Displays the total number of SAPs configured on the system. This keyword is supported only on the 7210 SAS-Mxp.

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port-id

Specifies the port ID for which to display a total SAP count. This parameter is supported only on the 7210 SAS-Mxp.

Values slot/mda/port

lag-id

Specifies the LAG ID for which to displays a total SAP count. This parameter is supported only on the 7210 SAS-Mxp.

Values 1 to 200

Output

The following outputs are examples of port information, and the associated tables describe the output fields:

- Sample output: SAP ingress QoS, Table 44: Output fields: dump system-resource SAP ingress QoS
- Sample output: SAP ingress policy using DSCP classification (for 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12) , Table 45: Output fields: SAP ingress policy using DSCP classification and various hardware resouce pools
- Sample output: SAP egress aggregate meter (7210 SAS-T), Table 45: Output fields: SAP ingress policy using DSCP classification and various hardware resouce pools
- Sample output: Resource utilization for SAP egress aggregate meter (7210 SAS-Mxp), Table 45: Output fields: SAP ingress policy using DSCP classification and various hardware resouce pools
- Sample output: SAP ingress QoS policy associations, Table 46: Output fields: SAP ingress QoS policy associations
- Sample output: multicast groups, Table 47: Output fields: multicast groups
- Sample output: g8032 control SAP tags (for 7210 SAS-T), Table 47: Output fields: multicast groups
- Sample output: system resources SAP (for 7210 SAS-Mxp), Table 48: Output fields: g8032 control SAP tags
- Sample output: Port range support in an IPv4 filter (for 7210 SAS-Mxp)Table 50: Output fields: Port range support in an IPv4 filter (for 7210 SAS-Mxp)

Sample output: SAP ingress QoS

```
*A:7210-SAS>tools>dump# system-resources sap-ingress-qos
Sap Resource Manager info at 001 d 10/11/12 04:42:00.043:
Sap Ingress Resource Usage for Slot #1, Cmplx #0:

Total Chunks Configured : 6
Total Chunks Available  : 6
Number of Chunks in Use : 1
Number of Free Chunks   : 5
Number of Chunks in use for IP match   :0
Number of Chunks in use for IPv6 match :0
Number of Chunks in use for MAC match  :1
                 |  Classification Entries   |           Meters
    Chunk | Type | Total  |Allocated|  Free  | Total  |Allocated|  Free
  --------+------+--------+---------+--------+--------+---------+---------
         0|   Mac|     512|        2|     510|     256|        1|     255

Number of Chunks available for use with IP match*   : 5
```


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```
Number of Chunks available for use with IPv6 match* : 0
Number of Chunks available for use with MAC match*  : 5

* - Assumes all remaining chunks are used
*A:Dut-A>tools>dump#
```

For the 7210 SAS-Mxp:

```
*A:dut-a# tools dump system-resources sap-ingress-qos
Sap Resource Manager info at 014 h 10/30/18 09:50:01.718:
Sap Ingress Resource Usage for Slot #1, Cmplx #0:

Total Chunks Configured : 5
Total Chunks Available  : 5
Number of Chunks in Use : 2
Number of Free Chunks   : 3
Number of Chunks in use for IP match       : 0
Number of Chunks in use for IPv6 match     : 0
Number of Chunks in use for IP + Mac match : 0
Number of Chunks in use for MAC match      : 1
Number of Chunks in use for DSCP           : 1
                |  Classification Entries   |           Meters
    Chunk | Type | Total  |Allocated|  Free  | Total  |Allocated|  Free
  --------+------+--------+---------+--------+--------+---------+---------
         0|   Mac|     256|      120|     136|     128|       60|      68
         1|  Dscp|     256|       32|     224|     128|       16|     112
Number of Chunks available for use with IP match*        : 4
Number of Chunks available for use with IPv6 match*      : 0
Number of Chunks available for use with Ip + Mac match*  : 4
Number of Chunks available for use with MAC match*       : 4
Number of Chunks available for use with DSCP match*      : 4
* - Assumes all remaining chunks are used
*A:dut-a#
```

Table 44: Output fields: dump system-resource SAP ingress QoS

Labels	Descriptions
Total Chunks Configured	Displays the total number of chunks configured for use by SAP ingress QoS classification across all the match criteria.
Total Chunks Available	Displays the total number of chunks alloted by software for use by SAP ingress QoS classification across all the match criteria.
Number of Chunks in Use	Displays the total number of chunks in use by SAP for SAP ingress QoS classification.
Number of Free Chunks	Displays the total number of chunks available for use by SAP for SAP ingress QoS classification.
Number of Chunks in use for IP match	Displays the total number of chunks in use by SAP that uses IP classification match criteria in the SAP ingress QoS policy.
Number of Chunks in use for IPv6 match	Displays the total number of chunks in use by SAP that uses IPv6 classification match criteria in the SAP ingress QoS policy.
Number of Chunks in use for MAC match	Displays the total number of chunks in use by SAP that uses MAC classification match criteria in the SAP ingress QoS policy.

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Labels	Descriptions
Number of Chunks in use for DSCP	Displays the total number of chunks in use by SAP that uses DSCP table-based classification policy match criteria in the SAP ingress QoS policy.
Classification Entries	The total number of classification entries that are available/allocated/free per chunk. Information is displayed only for chunks that are in use.
Meters	The total number of meters that are available/allocated/free per chunk. Information is displayed only for chunks that are in use.
Number of Chunks available for use with IP match criteria	Displays the total number of chunks available for use by SAP that uses IP classification match criteria in the SAP ingress QoS policy. This assumes all of the free chunks are alloted to IP classification match criteria.
Number of Chunks available for use with IPv6 match criteria	Displays the total number of chunks available for use by SAP that uses IPv6 classification match criteria in the SAP ingress QoS policy. This assumes all of the free chunks are alloted to IPv6 classification match criteria.
Number of Chunks available for use with MAC match criteria	Displays the total number of chunks available for use by SAP that uses MAC classification match criteria in the SAP ingress QoS policy. This assumes all of the free chunks are alloted to MAC classification match criteria.
Number of Chunks available for use with DSCP match criteria	Displays the total number of chunks available for use by SAP that uses DSCP table-based classification policy match criteria in the SAP ingress QoS policy. This assumes all of the free chunks are alloted to DSCP table-based classification policy match criteria.

Sample output: SAP ingress policy using DSCP classification (for 7210 SAS-Mxp, 7210 SAS-R6, and 7210 SAS-R12)

```
7210SAS>tools>dump# system-resources

Hardware Resource Usage for Slot #1, CardType iom-sas, Cmplx #0:
                               |   Total   | Allocated |    Free
  -----------------------------+-----------+-----------+------------
        SAP Ingress QoS Policies |       1791|          1|       1790
        Access Egr. QoS Policies |        255|          1|        254
         SAP Egress QoS Policies |       2047|          1|       2046
     SAP Ingress Aggregate-Meter |        384|          0|        384
       Shared Qos Ingress Meters |        640|          0|        640
  Shared Qos Ingress CAM Entries |       1280|          0|       1280
          Mac Qos Ingress Meters |          0|          0|          0
     Mac Qos Ingress CAM Entries |          0|          0|          0
        IPv4  Qos Ingress Meters |          0|          0|          0
    IPv4 Qos Ingress CAM Entries |          0|          0|          0
        IPv6  Qos Ingress Meters |          0|          0|          0
    IPv6 Qos Ingress CAM Entries |          0|          0|          0
    IP + Mac  Qos Ingress Meters |          0|          0|          0
IP + Mac Qos Ingress CAM Entries |          0|          0|          0
        DSCP  Qos Ingress Meters |          0|          0|          0
                DSCP CAM Entries |          0|          0|          0
                    DSCP Profile |         62|          1|         61
         Network Ing Port Meters |        128|         28|        100
    Network Ing Port CAM Entries |        256|         28|        228
```


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```
       Network Ing IpIntf Meters |        128|          0|        128
  Network Ing IpIntf CAM Entries |        256|          0|        256
  Network MPLS Exp Profile Table |         31|          0|         31
         Port Scheduler Policies |          0|          0|          0
       Queue Management Policies |        500|          1|        499
                 Remark Policies |        256|          2|        254
      Shared Egr QOS MAP Entries |         14|          0|         14
          Egress QOS CAM Entries |        400|          0|        400
    Dscp Classification policies |         51|          1|         50
      Ingress Shared ACL Entries |        768|          0|        768
         Ingress Mac ACL Entries |          0|          0|          0
        Ingress IPv4 ACL Entries |          0|          0|          0
    Ing IPv6 128 bit ACL Entries |          0|          0|          0
     Ing IPv6 64 bit ACL Entries |          0|          0|          0
       Egress Shared ACL Entries |        256|          0|        256
     Egress Mac only ACL Entries |          0|          0|          0
     Egress Mac+IPv4 ACL Entries |          0|          0|          0
    Egr IPv6 128 bit ACL Entries |          0|          0|          0
 Egr Mac+IPv6 64 bit ACL Entries |          0|          0|          0
      Ingress SAP Lookup Entries |        703|          0|        703
               TWAMP/LT  Entries |         32|          0|         32
         MEP Lookup CAM Entries  |        256|          0|        256
                  DN MEP Entries |       1024|         42|        982
Num VLAN-ID/Range in Con Profile |       4096|          0|       4096
        Egress TLS Mcast Entries |     147455|          0|     147455
```

Sample output: SAP egress aggregate meter (7210 SAS-T)

```
*7210SAS>config>service# /tools dump system-resources
Resource Manager info at 022 h 07/27/01 22:50:44.676:

Hardware Resource Usage per Node:

                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
         Max System Ecmp Routes |           |          1|


Hardware Resource Usage for Slot #1, CardType iom-sas, Cmplx #0:
                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
       SAP Ingress QoS Policies |       1791|          1|       1790
       Access Egr. QoS Policies |        255|          1|        254
    SAP Ingress Aggregate-Meter |        256|          0|        256
      Shared Qos Ingress Meters |       1280|        256|       1024
  Shared Qos Ingress CAM Entries |       2560|        512|       2048
         Mac Qos Ingress Meters |        256|          2|        254
    Mac Qos Ingress CAM Entries |        512|          4|        508
       IPv4  Qos Ingress Meters |          0|          0|          0
   IPv4 Qos Ingress CAM Entries |          0|          0|          0
       IPv6  Qos Ingress Meters |          0|          0|          0
   IPv6 Qos Ingress CAM Entries |          0|          0|          0
   IP + Mac  Qos Ingress Meters |          0|          0|          0
IP + Mac Qos Ingress CAM Entries |          0|          0|          0
SAP Egress Aggregate-Meter Entries|        512|          2|        510
          Network Ingress Meters |        256|          0|        256
         Network Ing CAM Entries |        512|          0|        512
         Port Scheduler Policies |       1023|          1|       1022
      Ingress Shared ACL Entries |       2560|          0|       2560
         Ingress Mac ACL Entries |          0|          0|          0
        Ingress IPv4 ACL Entries |          0|          0|          0
    Ing IPv6 128 bit ACL Entries |          0|          0|          0
```


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```
     Ing IPv6 64 bit ACL Entries |          0|          0|          0
       Egress Shared ACL Entries |          0|          0|          0
     Egress Mac only ACL Entries |          0|          0|          0
     Egress Mac+IPv4 ACL Entries |          0|          0|          0
    Egr IPv6 128 bit ACL Entries |          0|          0|          0
 Egr Mac+IPv6 64 bit ACL Entries |          0|          0|          0
      Ingress SAP Lookup Entries |       1496|          4|       1492
Num VLAN-ID/Range in Con Profile |       4096|          0|       4096
===============================================================================
```

The following sample displays the resource utilization for various hardware resource pools on the 7210 SAS-R6:

```
A:7210SAS-053>tools>dump# system-resources
Resource Manager info at 001 h 02/29/16 10:03:45.035:

Hardware Resource Usage per Node:

                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
         Max System Ecmp Routes |           |          1|
         Ldp Ecmp percent value |           |          0|
    Eth-Ring Fast Flood Entries |       1280|          1|       1279

Hardware Resource Usage for Slot #1, CardType imm-sas-b-10sfp-1sfp+, Cmplx #0:
                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
       SAP Ingress QoS Policies |       1791|          2|       1789
       Access Egr. QoS Policies |        255|          2|        253
        SAP Egress QoS Policies |       2047|          2|       2045
    SAP Ingress Aggregate-Meter |        384|          0|        384
      Shared Qos Ingress Meters |        640|        128|        512
  Shared Qos Ingress CAM Entries |       1280|        256|       1024
        Mac Qos Ingress Meters |        128|          6|        122
    Mac Qos Ingress CAM Entries |        256|         12|        244
       IPv4  Qos Ingress Meters |          0|          0|          0
   IPv4 Qos Ingress CAM Entries |          0|          0|          0
       IPv6  Qos Ingress Meters |          0|          0|          0
   IPv6 Qos Ingress CAM Entries |          0|          0|          0
   IP + Mac  Qos Ingress Meters |          0|          0|          0
IP + Mac Qos Ingress CAM Entries |          0|          0|          0
    SAP Egress Agg-Meter Entries |          0|          0|          0
        Network Ing Port Meters |        128|         10|        118
    Network Ing Port CAM Entries |        256|         10|        246
       Network Ing IpIntf Meters |        128|          4|        124
  Network Ing IpIntf CAM Entries |        256|          4|        252
  Network MPLS Exp Profile Table |         31|          0|         31
        Port Scheduler Policies |          0|          0|          0
       Queue Management Policies |        500|          1|        499
                 Remark Policies |        256|          5|        251
     Shared Egr QOS MAP Entries |         14|          1|         13
         Egress QOS CAM Entries |        400|          6|        394
     Ingress Shared ACL Entries |        768|          0|        768
        Ingress Mac ACL Entries |          0|          0|          0
       Ingress IPv4 ACL Entries |          0|          0|          0
    Ing IPv6 128 bit ACL Entries |          0|          0|          0
     Ing IPv6 64 bit ACL Entries |          0|          0|          0
       Egress Shared ACL Entries |        128|          0|        128
     Egress Mac only ACL Entries |          0|          0|          0
     Egress Mac+IPv4 ACL Entries |          0|          0|          0
```


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```
    Egr IPv6 128 bit ACL Entries |          0|          0|          0
 Egr Mac+IPv6 64 bit ACL Entries |          0|          0|          0
      Ingress SAP Lookup Entries |        706|          8|        698
      Egress Sap Counter Entries |        127|          0|        127
         MEP Lookup CAM Entries  |        256|          0|        256
                  DN MEP Entries |        256|         38|        218
              Port Scheduler Mode |          0|          0|          0
Num VLAN-ID/Range in Con Profile |       4096|          0|       4096
```

The following sample displays the resource utilization for various hardware resource pools on the 7210 SAS-Sx 10/100GE:

```
7210SAS>tools>dump# system-resources
Resource Manager info at 008 d 01/09/00 06:24:56.148:

Hardware Resource Usage per Node:

                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
          Max System Ecmp Routes |           |          1|


Hardware Resource Usage for Slot #1, CardType iom-sas, Cmplx #0:
                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
        SAP Ingress QoS Policies |       1791|          1|       1790
        Access Egr. QoS Policies |        255|          1|        254
            Network QoS Policies |        255|          2|        253
      Network Queue QoS Policies |        255|          1|        254
       Shared Qos Ingress Meters |       3072|          0|       3072
  Shared Qos Ingress CAM Entries |       6144|          0|       6144
         Mac Qos Ingress Meters |          0|          0|          0
     Mac Qos Ingress CAM Entries |          0|          0|          0
        IPv4  Qos Ingress Meters |          0|          0|          0
    IPv4 Qos Ingress CAM Entries |          0|          0|          0
        IPv6  Qos Ingress Meters |          0|          0|          0
    IPv6 Qos Ingress CAM Entries |          0|          0|          0
    IP + Mac  Qos Ingress Meters |          0|          0|          0
IP + Mac Qos Ingress CAM Entries |          0|          0|          0
    SAP Egress Agg-Meter Entries |          0|          0|          0
             Network Ing Meters |        512|         68|        444
         Network Ing CAM Entries |       1024|         68|        956
  Network MPLS Exp Profile Table |         31|          0|         31
         Port Scheduler Policies |       1023|          1|       1022
                 Remark Policies |        256|          2|        254
      Shared Egr QOS MAP Entries |         13|          0|         13
      Ingress Shared ACL Entries |       2048|          0|       2048
         Ingress Mac ACL Entries |          0|          0|          0
        Ingress IPv4 ACL Entries |          0|          0|          0
    Ing IPv6 128 bit ACL Entries |          0|          0|          0
     Ing IPv6 64 bit ACL Entries |          0|          0|          0
       Egress Shared ACL Entries |        256|          0|        256
     Egress Mac only ACL Entries |          0|          0|          0
     Egress Mac+IPv4 ACL Entries |          0|          0|          0
    Egr IPv6 128 bit ACL Entries |          0|          0|          0
 Egr Mac+IPv6 64 bit ACL Entries |          0|          0|          0
      Ingress SAP Lookup Entries |        703|          0|        703
               TWAMP/LT  Entries |         32|          0|         32
         MEP Lookup CAM Entries  |        256|          0|        256
                  DN MEP Entries |       1024|         42|        982
Num VLAN-ID/Range in Con Profile |       4096|          0|       4096
        Egress TLS Mcast Entries |     147455|          0|     147455
```


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Sample output: Resource utilization for various hardware resource pools on the 7210 SAS-Mxp

```
tools dump system-resources
Resource Manager info at 004 h 03/06/23 08:41:24.963:

Hardware Resource Usage per Node:

                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
          Max System Ecmp Routes |           |         1|


Hardware Resource Usage for Slot #1, CardType iom-sas, Cmplx #0:
                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
        SAP Ingress QoS Policies |       1791|          2|       1789
        Access Ing. QoS Policies |        255|          6|        249
        Access Egr. QoS Policies |        255|          1|        254
            Network QoS Policies |        255|          2|        253
         SAP Egress QoS Policies |       2047|          1|       2046
     SAP Ingress Aggregate-Meter |        384|          0|        384
       Shared Qos Ingress Meters |        256|          0|        256
  Shared Qos Ingress CAM Entries |        512|          0|        512
          Mac Qos Ingress Meters |          0|          0|          0
     Mac Qos Ingress CAM Entries |          0|          0|          0
        IPv4  Qos Ingress Meters |          0|          0|          0
    IPv4 Qos Ingress CAM Entries |          0|          0|          0
        IPv6  Qos Ingress Meters |          0|          0|          0
    IPv6 Qos Ingress CAM Entries |          0|          0|          0
    IP + Mac  Qos Ingress Meters |          0|          0|          0
IP + Mac Qos Ingress CAM Entries |          0|          0|          0
        DSCP  Qos Ingress Meters |          0|          0|          0
                DSCP CAM Entries |          0|          0|          0
          Ingress Service Meters |       5120|          0|       5120
     Ingress Service Meter Stats |      10240|          0|      10240
                    DSCP Profile |         61|          3|         58
                  DOT1P Profile  |         61|          3|         58
         Network Ing Port Meters |        128|         19|        109
    Network Ing Port CAM Entries |        256|         19|        237
       Network Ing IpIntf Meters |        128|          0|        128
  Network Ing IpIntf CAM Entries |        256|          0|        256
  Network MPLS Exp Profile Table |         31|          0|         31
          Access Ing Port Meters |          0|          0|          0
     Access Ing Port CAM Entries |          0|          0|          0
           Shared Acc Ing Meters |        512|        512|          0
      Shared Acc Ing CAM Entries |       1024|       1024|          0
          Acc Ing Shrd IP Meters |        128|         83|         45
     Acc Ing Shrd IP CAM Entries |        256|        166|         90
 Acc Ing Shrd IpPortRange Meters |        128|         16|        112
Acc Ing Shrd IpPortRange CAM Ent |        256|         32|        224
        Acc Ing Shrd DSCP Meters |        128|         66|         62
   Acc Ing Shrd DSCP CAM Entries |        256|        132|        124
         Port Scheduler Policies |          0|          0|          0
       Queue Management Policies |        500|          1|        499
                 Remark Policies |        256|          2|        254
      Shared Egr QOS MAP Entries |         13|          0|         13
          Egress QOS CAM Entries |        400|          0|        400
   Dot1p Classification policies |         51|          2|         49
    Dscp Classification policies |         51|          2|         49
      Ingress Shared ACL Entries |          0|          0|          0
         Ingress Mac ACL Entries |          0|          0|          0
        Ingress IPv4 ACL Entries |          0|          0|          0
    Ing IPv6 128 bit ACL Entries |          0|          0|          0
     Ing IPv6 64 bit ACL Entries |          0|          0|          0
```


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```
 Ing IPv4 Port Range ACL Entries |          0|          0|          0
       Egress Shared ACL Entries |        128|          0|        128
     Egress Mac only ACL Entries |          0|          0|          0
     Egress Mac+IPv4 ACL Entries |          0|          0|          0
    Egr IPv6 128 bit ACL Entries |          0|          0|          0
 Egr Mac+IPv6 64 bit ACL Entries |          0|          0|          0
      Ingress SAP Lookup Entries |        706|          0|        706
               TWAMP/LT  Entries |         32|          0|         32
         MEP Lookup CAM Entries  |        256|          0|        256
                  DN MEP Entries |        256|         44|        212
Num VLAN-ID/Range in Con Profile |       4096|          0|       4096
        Egress TLS Mcast Entries |     147455|        800|     146655
        L3 Protocol Tcam Entries |        128|         83|         45
            DHCP6 SDP Entries    |          0|          0|          0
              Port Range Entries |         15|         15|          0
```

Table 45: Output fields: SAP ingress policy using DSCP classification and various hardware resouce pools

Labels	Descriptions
SAP Ingress QoS Policies	Displays the number of SAP ingress policies that are allowed to be configured (software-limit)
Access Egr. QoS Policies	Displays the number of Access egress policies that are allowed to be configured (software-limit)
SAP Egress QoS Policies	Displays the number of SAP egress policies that are allowed to be configured (software-limit)
SAP Ingress Aggregate-Meter	Displays the number of SAP ingress aggregate meter (that is, per SAP aggregate meter) allowed (hardware limit)
Shared Qos Ingress Meters	Displays the number of SAP ingress meter (that is, per FC meter) across all type of match-criteria (that is, MAC, IPv4, IPv6) (hardware limit)
Shared Qos Ingress CAM Entries	Displays the number of SAP ingress classification CAM entries across all match-criteria (hardware limit)
Mac Qos Ingress Meters	Displays the number of SAP ingress meter (that is, per FC meter) for MAC match-criteria (hardware limit)
Mac Qos Ingress CAM Entries	Displays the number of SAP ingress classification CAM entries for MAC match-criteria (hardware limit)
IPv4 Qos Ingress Meters	Displays the number of SAP ingress meter (that is, per FC meter) for IPv4 match-criteria (hardware limit)
IPv4 Qos Ingress CAM Entries	Displays the number of SAP ingress classification CAM entries for IPv4 match-criteria (hardware limit)
IPv6 Qos Ingress Meters	Displays the number of SAP ingress meter (that is, per FC meter) for IPv6 match-criteria (hardware limit)

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Labels	Descriptions
IPv6 Qos Ingress CAM Entries	Displays the number of SAP ingress classification CAM entries for IPv6 match-criteria (hardware limit)
IP + Mac Qos Ingress Meters	Displays the number of SAP ingress meter (that is, per FC meter) for IP+MAC match-criteria (hardware limit)
IP + Mac Qos Ingress CAM Entries	Displays the number of SAP ingress classification CAM entries for IP+MAC match-criteria (that is, IP and MAC criteria in the same policy) (hardware limit)
DSCP Qos Ingress Meters	Displays the number of SAP ingress meter (that is, per FC meter) when using IP DSCP table-based classification (hardware limit)
DSCP CAM Entries	Displays the number of CAM entries for IP DSCP table-based classification. (hardware limit)
DSCP Profile	Displays the number of IP DSCP table-based classification resources (hardware limit)
Network Ing Port Meters	Displays the number of Network Port Ingress Meters (hardware limit)
Network Ing Port CAM Entries	Displays the number of Network port ingress classification CAM entries used for FC classification. (hardware limit)
Network Ing IpIntf Meters	Displays the number of Network IP interface meters (hardware limit)
Network Ing IpIntf CAM Entries	Displays the number of Network IP interface ingress classification CAM entries used for FC classification. (hardware limit)
Network MPLS Exp Profile Table	Displays the number of MPLS EXP to FC mapping table resources (hardware limit)
Access Ing Port Meters	Displays the number of access ingress port meters
Access Ing Port CAM Entries	Displays the number of access ingress port CAM entries
Shared Acc Ing Meters	Displays the number of shared access ingress meters
Shared Acc Ing CAM Entries	Displays the number of shared access ingress CAM entries
Acc Ing Shrd IP Meters	Displays the number of shared access ingress IP meters
Acc Ing Shrd IP CAM Entries	Displays the number of shared access ingress IP CAM entries

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Labels	Descriptions
Acc Ing Shrd IpPortRange Meters	Displays the number of shared access ingress IP port range meters
Acc Ing Shrd IpPortRange CAM Ent	Displays the number of shared access ingress IP port range CAM entries
Acc Ing Shrd DSCP Meters	Displays the number of shared access ingress DSCP meters
Acc Ing Shrd DSCP CAM Entries	Displays the number of shared access ingress DSCP CAM entries
Port Scheduler Policies	Displays the number of Port Scheduler policies that can be configured (software limit).
Queue Management Policies	Displays the number of Queue Management policies that can be configured (software limit).
Remark Policies	Displays the number of Remark policies that can be configured (software limit).
Shared Egr QOS MAP Entries	Displays the number of entries in the remark table used for access SAP egress marking, network IP interface egress MPLS EXP marking, and access egress marking (hardware limit).
Egress QOS CAM Entries	Displays the number of resources used for access SAP egress queuing (hardware limit). These resources are taken from the ingress-internal-tcam pool.
Dscp Classification policies	Displays the number of IP DSCP table-based classification policy templates (software limit).
Ingress Shared ACL Entries	Displays the number of CAM entries for ingress ACLs across all match-criteria (some of these are shared with SAP aggregate meter) (hardware limit). Read the system resource profile command description for more information.
Ingress Mac ACL Entries	Displays the Ingress ACL CAM entries for MAC match criteria (hardware limit).
Ingress IPv4 ACL Entries	Displays the Ingress ACL CAM entries for IPv4 match criteria (hardware limit).
Ing IPv6 128 bit ACL Entries	Displays the Ingress ACL CAM entries for IPv6 with 128-bit addresses match criteria (hardware limit).
Ing IPv6 64 bit ACL Entries	Displays the Ingress ACL CAM entries for IPv6 with 64-bit addresses match criteria (hardware limit).

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Labels	Descriptions
Egress Shared ACL Entries	Displays the number of CAM entries for egress ACLs across all match-criteria (hardware limit).
Egress Mac only ACL Entries	Displays the Egress ACL CAM entries for MAC match criteria (hardware limit).
Egress Mac+IPv4 ACL Entries	Displays the Egress ACL CAM entries for MAC and IPv4 match criteria (hardware limit).
Egr IPv6 128 bit ACL Entries	Displays the Egress ACL CAM entries for IPv6 128-bit match criteria (hardware limit).
Egr Mac+IPv6 64 bit ACL Entries	Displays the Egress ACL CAM entries for MAC + IPv6 64-bit match criteria (hardware limit).
Ingress SAP Lookup Entries	Displays the number of entries used to identify the SAP on port ingress (hardware limit).
Egress Aggregate Meter	Displays the resources used for egress aggregate meter configured for access SAP (hardware limit).
TWAMP/LT Entries	Displays the number of CAM entries used for TWAMP/ TWAMP light (hardware limit).
MEP Lookup CAM Entries	Displays the number of CAM entries (pre-ingress resource pool) used for CFM/Y.1731 Down MEP processing (hardware limit).
DN MEP Entries	Displays the number of CAM entries in the ingress-internal-tcam pool for CFM/Y.1731 Down MEP processing (hardware limit).
Num VLAN-ID/Range in Con Profile	Displays the number of VLAN IDs that can be listed explicitly in the connection profile, instead of specifying the range value (hardware limit).
Egress TLS Mcast Entries	Displays the number of egress multicast entries (software limit).
Port Range Entries	Displays the number of port range entries

Sample output: SAP ingress QoS policy associations

```
*A:dut-a# tools dump system-resources sap-ingress-qos associations
Sap Resource Manager info at 008 h 10/28/18 05:34:18.747:
===============================================================================
Service Access Points TCAM Ingress Resource Usage Slot #1, Cmplx #0:
===============================================================================
  Sap Id                    SvcId     Ing. Qos    Chunk    Num       Type
                                         Pol.          Classifiers
===============================================================================
  1/1/1:100                   505       1           0        2        Mac
  lag-6:300                   505       1           0        2        Mac
```


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```
  1/1/1:200                     506       1           0        2        Mac
  lag-6:400                     506       1           0        2        Mac
  1/1/1:201                     507       1           0        2        Mac
  lag-6:401                     507       1           0        2        Mac
  1/1/1:202                     508       1           0        2        Mac
  lag-6:402                     508       1           0        2        Mac
  1/1/1:300                     605       1           0        2        Mac
  lag-6:100                     605       21          0        32       Mac
  1/1/1:400                     606       1           0        2        Mac
  lag-6:200                     606       22          1        32       Dscp
  1/1/1:401                     607       1           0        2        Mac
  lag-6:201                     607       23          0        32       Mac
  1/1/1:402                     608       1           0        2        Mac
  lag-6:202                     608       24          1        32       Dscp
-------------------------------------------------------------------------------
Number of SAPs : 16
-------------------------------------------------------------------------------
===============================================================================
```

Table 46: Output fields: SAP ingress QoS policy associations

Labels	Descriptions
Sap Id	Displays the SAP ID
SvcId	Displays service ID
Ing. Qos Pol.	Displays the ingress QoS policy ID
Chunk	Displays the total number of chunks available for use by the SAP
Num Classifiers	Displays the number of classifiers
Type	Displays the SAP type
Number of SAPs	Displays the total number of SAPs

Sample output: multicast groups

```
*A:Dut-B# tools dump system-resources mcast-groups
 ===========================================================
 Multicast Group Usage
 ===========================================================
              Owner    No. of Mcast Groups
 -----------------------------------------------------------
             SVCMGR    2
               MFIB    11
 -----------------------------------------------------------
    Total Available    4080
    Total Allocated    13
 ===========================================================
*A:Dut-B#
```


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Table 47: Output fields: multicast groups

Labels	Descriptions
Owner	Displays the multicast resource modules that are using the resources
No. of Mcast Groups	Displays the number of multicast group resources used by the module identified in the Owner field
Total Available	Displays the total number of available resources for multicast groups per node
Total Allocated	Displays the total number of resources allocated to multicast groups per node

Sample output: g8032 control SAP tags (for 7210 SAS-T)

```
*A:dut-a# tools dump system-resources 1 g8032-control-sap-tags
Control Sap Tag on SlotNum 1
------Port-----|------Vlan Tags-------------------------|
-----------------------------------------------------------|
    1/1/16       601   605   610   630
    1/1/18       601   605   610   630
*A:dut-a# show version
```

Table 48: Output fields: g8032 control SAP tags

Labels	Descriptions
Port	Displays the port number
VLAN Tags	Displays the control SAP VLAN tags associated with the port

Sample output: system resources SAP (for 7210 SAS-Mxp)

```
*A:Dut-A# /tools dump system-resources sap
Maximum Total SAP per node                                          3072
Count of SAPs with port ingress QoS policy per node                 2
Count of SAPs with SAP ingress QoS policy (svc-meter) per node      2
Count of SAPs with SAP ingress QoS policy (tcam-meter) per node     0

*A:Dut-A# /tools dump system-resources sap port 1/1/2
Total count of SAP on port 1/1/2                                    2
Count of SAPs with port ingress QoS policy port ID 1/1/2            2

*A:Dut-A# /tools dump system-resources sap port 1/1/1
Total count of SAP on port 1/1/1                                    1
Count of SAPs with SAP ingress QoS policy (svc-meter) port ID 1/1/1 1
Count of SAPs with SAP ingress QoS policy (tcam-meter) port ID 1/1/1 0

*A:Dut-B# tools dump system-resources sap lag 1
Total count of SAP on lag 1                                         64
Count of SAPs with SAP ingress QoS policy (svc-meter) lag ID 1      0
```


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```
Count of SAPs with SAP ingress QoS policy (tcam-meter) lag ID 1           64
```

Table 49: Output fields: system resources SAP

Labels	Descriptions
Maximum Total SAP per node	Displays the maximum number of SAPs that can be configured per node
Count of SAPs with port ingress QoS policy per node	Displays the total number of SAPs using a port ingress QoS policy per node
Count of SAPs with SAP ingress QoS policy (svc-meter) per node	Displays the number of SAPs using a SAP ingress QoS policy that is using service meter resources
Count of SAPs with SAP ingress QoS policy (tcam-meter) per node	Displays the number of SAPs using a SAP ingress QoS policy that is using tcam meter resources

Sample output: Port range support in an IPv4 filter (for 7210 SAS-Mxp)

```
*A:Dut-A/tools dump system-resources l4-port-range 1
===============================================================================
IPv4 Port Range Information
===============================================================================
-------------------------------------------------------------------------------
                              |   Total   | Allocated |    Free   |
------------------------------+-----------+-----------+-----------+
       IPv4 Port Range Entries |         15|         15|          0|
------------------------------+-----------+-----------+-----------+

-------------------------------------------------------------------------------
             Match Criteria    |   Start   |    End    |   Count   |
------------------------------+-----------+-----------+-----------+
                   Source Port |          1|       1024|          3|
                   Source Port |       1000|       2000|          1|
                   Source Port |       1024|      65535|          3|
                   Source Port |       1762|       1764|          1|
                   Source Port |       6000|       6063|          1|
                   Source Port |       8000|      12000|          3|
                   Source Port |      33434|      33625|          1|
------------------------------+-----------+-----------+-----------+
                   Dest Port   |         60|        520|          3|
                   Dest Port   |        120|        200|          1|
                   Dest Port   |       1000|       2000|          1|
                   Dest Port   |       1024|      65535|          4|
                   Dest Port   |       1761|       1764|          1|
                   Dest Port   |       6000|       6063|          1|
                   Dest Port   |       8000|      12000|          3|
                   Dest Port   |       8160|       8161|          1|
-------------------------------------------------------------------------------
===============================================================================
```


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Table 50: Output fields: Port range support in an IPv4 filter (for 7210 SAS-Mxp)

Labels	Descriptions
IPv4 Port Range Entries	Displays the number of total, allocated, and free TCP/UDP port range entries
Match Criteria	Displays whether the source port match uses range values or the destination port match uses range values
Source Port	Displays the start, end, and count of source port match range values
Dest Port	Displays the start, end, and count of destination port match range values

vc-stack

Syntax

vc-stack card *slot-number* [**detail**]

vc-stack card *slot-number* [**detail**] **fabric-ports** [**pools**]

Context

tools>dump

Platforms

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

Description

This command displays card information and statistics for the specified node in a VC.

Parameters

slot-number

Specifies the slot number for the node.

Values 1 to 8

detail

Displays detailed information about the card.

fabric-ports

Displays statistics for each queue on the card stacking ports.

pools

Displays the stacking port queue buffer information.

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Output

The following output is an example of VC-stack card information and statistics.

Detailed VC-stack information example

```
A:Dut-A# tools dump vc-stack card 1 detail
[membership information]
=========================
vc-stack-name               :    VC-3
Active Card Number          :    9
Vc-Stack-Node-Type          :    cpm-imm
Base Mac Address            :    d0:99:d5:91:1c:41
CPM Card Number             :    10
Neighbour1                  :    Card 2
Neighbour1 State            :    Two-Way
Neighbour1 Cost             :    1
Neighbour2                  :    Card 3
Neighbour2 State            :    Two-Way
Neighbour2 Cost             :    1
number of nodes in the vc: 3
[Topology Information]
=========================
-----------------------------------------
Card        Neighbour1        Neighbour2
-----------------------------------------
   1:            2              3
   2:            3              1
   3:            1              2
[Virtual Fabric Layer Software Module Statistics]
================================================
Number of Discovery packets transmitted: 345469
Number of Discovery packets received from Cards:
Card #  # of Packets received
------  ---------------------
  2      339202
  3      340335
Number of Hello packets transmitted on Fabric Port #1: 183381
Number of Hello packets transmitted on Fabric Port #2: 183268
Number of Hello packets received from Neighbours:
Card #  # of Packets received
------  ---------------------
  2      183092
  3      182699
For Tree rooted at the present Card (used by unicast packets):
List of cards on Fabric Port #1: [  2  ]
List of cards on Fabric Port #2: [  3  ]
For tree rooted at the Active Card (used by multicast packets):
List of cards on Fabric Port #1: [  2  ]
List of cards on Fabric Port #2: [  3  ]

A:Dut-A# tools dump vc-stack card 1 fabric-ports detail
===============================================================================
HG0 Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
                                    Packets
-------------------------------------------------------------------------------
Egress Queue  0
Fwd Stats           :                0
Drop Stats          :                0
Fwd Stats  (uc)     :                0
Drop Stats (uc)     :                0
```


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```
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  1
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  2
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  3
Fwd Stats            :               1323
Drop Stats           :                  0
Fwd Stats  (uc)      :                286
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :               1037
Drop Stats (mc)      :                  0
Egress Queue  4
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  5
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  6
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  7
Fwd Stats            :                374
Drop Stats           :                  0
Fwd Stats  (uc)      :                 61
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                313
Drop Stats (mc)      :                  0
===============================================================================
HG1 Queue Statistics
===============================================================================

-------------------------------------------------------------------------------
                                    Packets
-------------------------------------------------------------------------------
Egress Queue  0
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
```


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```
Drop Stats (mc)      :                  0
Egress Queue  1
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  2
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  3
Fwd Stats            :               1945
Drop Stats           :                  0
Fwd Stats  (uc)      :                895
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :               1050
Drop Stats (mc)      :                  0
Egress Queue  4
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  5
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  6
Fwd Stats            :                  0
Drop Stats           :                  0
Fwd Stats  (uc)      :                  0
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                  0
Drop Stats (mc)      :                  0
Egress Queue  7
Fwd Stats            :               3336
Drop Stats           :                  0
Fwd Stats  (uc)      :               3023
Drop Stats (uc)      :                  0
Fwd Stats  (mc)      :                313
Drop Stats (mc)      :                  0
===============================================================================
A:Dut-A#
```


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3.9.2.1.3 Dump router commands

router

Syntax

router *router-instance*

Context

tools>dump

tools>perform

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables tools for the router instance.

Parameters

router *router-instance*

Specifies the router name or service ID.

Values *router-name*: Base, management

Default Base

dintf

Syntax

dintf [*ip-address*]

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays the internal IP interface details.

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Parameters

ip-address

Specifies the IP interface details to display.

filter-info

Syntax

filter-info [**verbose**]

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps the hardware-specific filter information.

Parameters

verbose

Displays the verbose hardware information of the filter.

l3info

Syntax

lag

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps the hardware-specific Layer 3 information.

l3-stats

Syntax

l3-stats [**clear**]

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Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps the hardware-specific Layer 3 statistics.

Parameters

clear

Clears the hardware information of the filter.

eth-ring

Syntax

eth-ring

Context

tools>perform

Platforms

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

Description

Commands in this context configure tools to control Ethernet rings.

clear

Syntax

clear *ring-index*

Context

tools>perform>eth-ring

Platforms

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

Description

This command removes all switching operational commands. It is used for the following operations.

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- Clears an active local administrative command (for example, the force switch or manual switch commands).
- Triggers reversion before the WTR or WTB timer expires in case of revertive operation.
- Triggers reversion in case of non-revertive operation.

Parameters

ring-index

Specifies the ring index of the Ethernet ring.

Values 1 to 128

force

Syntax

force *ring-index* **path** {**a** | **b**}

Context

tools>perform>eth-ring

Platforms

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

Description

This command forces the specified path into a blocked state.

Parameters

ring-index

Specifies the ring index of the Ethernet ring.

Values 1 to 128

path {a | b}

Specifies the path of the Ethernet ring.

manual

Syntax

manual *ring-index* **path** {**a** | **b**}

Context

tools>perform>eth-ring

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Platforms

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

Description

This command sets the specified Ethernet ring path into a blocked state.

Parameters

ring-index

Specifies the ring index of the Ethernet ring.

Values 1 to 128

path {a | b}

Specifies the path of the Ethernet ring.

lag

Syntax

lag

Context

tools>perform

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures tools to control LAG.

clear-force

Syntax

clear-force lag-id *lag-id* [**sub-group** *sub-group-id*]

clear-force all-mc

clear-force peer-mc *ip-address*

Context

tools>perform>lag

Platforms

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

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Description

This command clears a forced status.

Parameters

lag-id *lag-id*

Specifies an existing LAG ID.

Values 1 to 200

all-mc

Clears all multi-chassis LAG information.

force

Syntax

force lag-id *lag-id* [**sub-group** *sub-group-id*] {**active** | **standby**}

force all-mc {**active** | **standby**}

force peer-mc *peer-ip-address* {**active** | **standby**}

Context

tools>perform>lag

Platforms

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

Description

This command forces an active or standby status.

Parameters

active

Forces all drives on the active CPM.

all-mc

Clears all multi-chassis LAG information.

peer-mc

Clears multi-chassis LAG peer information.

standby

Forces all drives on the standby CPM.

lag-id *lag-id*

Specifies an existing LAG ID.

Values 1 to 6

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log

Syntax

log

Context

tools>perform

Platforms

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

Description

This command is logs events.

test-event

Syntax

test-event

Context

tools>perform>log

Platforms

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

Description

This command causes a test event to be generated. The test event is LOGGER event #2011 and maps to the tmnxEventSNMP trap in the TIMETRA-LOG-MIB.

redundancy

Syntax

redundancy

Context

tools>perform

Platforms

7210 SAS-R6 and 7210 SAS-R12

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Description

Commands in this context configure redundancy parameters.

issu-post-process

Syntax

issu-post-process

Context

tools>perform>redundancy

Platforms

7210 SAS-R6 and 7210 SAS-R12

Description

This command forces the MPLS module to exit maintenance mode, and therefore resume signaling new LSP paths, before major or minor ISSU is completed.

When the system starts major or minor ISSU procedures, MPLS is automatically put into maintenance mode such that existing LSP paths continue to operate while the node does not issue new LSP paths or a Make-Before-Break (MBB) path for existing LSPs. It also rejects requests for new LSP paths or MBB paths of existing LSPs coming from RSVP neighbors.

The MPLS module automatically exits maintenance mode when the major or minor ISSU is completed. As such this command must only be used if the user encounters MPLS issues during the ISSU process.

interface

Syntax

interface [*ip-int-name* | *ip-address*]

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information for an LDP interface.

Parameters

ip-int-name

Specifies the interface name.

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ip-address

Specifies the IP address.

ldp

Syntax

ldp

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables dump tools for LDP.

peer

Syntax

peer *ip-address*

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information for an LDP peer.

Parameters

ip-address

Specifies the IP address.

fec

Syntax

fec p2mp-id *id* **root** *ip-address* [**detail**]

fec prefix [*ip-prefix/mask*]

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fec vc-type {**ethernet** | **vlan**} **vc-id** *vc-id*

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information for an LDP FEC.

Parameters

p2mp-id id

Specifies the LDP active P2MP identifier bindings to dump. This parameter is supported only on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-T.

Values 0 to 4294967295

root ip-address

Specifies the root IP address to dump.

detail

Dumps detailed LDP active P2MP identifier bindings information or detailed root IP address information.

ip-prefix/mask

Specifies the IP prefix and host bits.

Values host bits: must be 0

mask: 0 to 32

vc-type

Specifies the VC type signaled for the spoke or mesh binding to the far end of an SDP. The VC type is a 15 bit-quantity containing a value which represents the type of VC. The actual signaling of the VC type depends on the signaling parameter defined for the SDP. If signaling is disabled, the **vc-type** command can still be used to define the Dot1q value expected by the far-end provider equipment. A change of the binding's VC type causes the binding to signal the new VC type to the far end when signaling is enabled.

VC types are derived according to IETF *draft-martini-l2circuit-trans-mpls*.

- Ethernet — The VC type value for Ethernet is 0x0005.
- VLAN — The VC type value for an Ethernet VLAN is 0x0004.

vc-id

Specifies the virtual circuit identifier.

Values 1 to 4294967295

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memory-usage

Syntax

memory-usage

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays memory usage information for LDP.

session

Syntax

session [*ip-address* |*:label space*] [**connection** | **peer** | **adjacency**]

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information for an LDP session.

Parameters

ip-address

Specifies the IP address of the LDP peer.

label-space

Specifies the label space identifier that the router is advertising on the interface.

connection

Displays connection information.

peer

Displays peer information.

adjacency

Displays hello adjacency information.

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sockets

Syntax

sockets

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information for all sockets being used by the LDP protocol.

timers

Syntax

timers

Context

tools>dump>router>ldp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays timer information for LDP.

mpls

Syntax

mpls

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

Commands in this context display MPLS information.

ftn

Syntax

ftn

Context

tools>dump>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays FEC-to-NHLFE (FTN) dump information for MPLS. (NHLFE is the acronym for Next Hop Label Forwarding Entry.)

ilm

Syntax

ilm

Context

tools>dump>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays incoming label map (ILM) information for MPLS.

lspinfo

Syntax

lspinfo [*lsp-name*] [**detail**]

Context

tools>dump>router>mpls

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays label switched path (LSP) information for MPLS.

Parameters

lsp-name

Specifies the name that identifies the LSP. The LSP name can be up to 32 characters and must be unique.

detail

Displays detailed information about the LSP.

cspf

Syntax

cspf to *ip-addr* [**from** *ip-addr*] [**strict-srlg**] [**srlg-group** *grp-id*...(**up to 8 max**)] [**bandwidth** *bandwidth*] [**include-bitmap** *bitmap*] [**exclude-bitmap** *bitmap*] [**hop-limit** *limit*] [**exclude-address** *excl-addr* [*excl-addr*...(**upto 8 max**)]] [**use-te-metric**] [**exclude-node** *excl-node-id* [*excl-node-id*...(**upto 8 max**)]] [**skip-interface** *interface-name*]

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command computes a CSPF path with specified user constraints.

Parameters

to *ip-addr*

Specifies the destination IP address.

from *ip-addr*

Specifies the originating IP address.

srlg-group *grp-id*

Specifies the group ID.

bandwidth *bandwidth*

Specifies the amount of bandwidth in mega-bits per second (Mbps) to be reserved.

include-bitmap *bitmap*

Specifies to include a bit-map that lists admin groups that should be included during setup.

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exclude-bitmap *bitmap*

Specifies to exclude a bit-map that lists admin groups that should be included during setup.

hop-limit *limit*

Specifies the total number of hops a detour LSP can take before merging back onto the main LSP path.

exclude-address *ip-addr*

Specifies an IP address to exclude from the operation.

use-te-metric

Specifies whether the TE metric is used for the purpose of the LSP path computation by CSPF.

skip-interface *interface-name*

Specifies a local interface name, instead of the interface address, to be excluded from the CSPF computation.

force-switch-path

Syntax

force-switch-path lsp *lsp-name* **path** *path-name*

no force-switch-path lsp *lsp-name*

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures a forced path switch.

switch-path

Syntax

switch-path lsp *lsp-name* **path** *path-name*

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

This command moves from a standby (or an active secondary) to another standby of the same priority. If a new standby path with a higher priority or a primary path comes up after the tools perform command is executed, the path re-evaluation command runs and the path is moved to the path specified by the outcome of the re-evaluation.

Parameters

lsp-name

Specifies an existing LSP name to move.

path-name

Specifies the path name to which to move the specified LSP.

trap-suppress

Syntax

trap-suppress [*number-of-traps*] [*time-interval*]

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command modifies thresholds for trap suppression.

Parameters

number-of-traps

Specify the number of traps in multiples of 100. An error messages is generated if an invalid value is entered.

Values 100 to 1000

time-interval

Specifies the timer interval in seconds.

Values 1 to 300

tp-tunnel

Syntax

tp-tunnel

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Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context perform linear protection operations on an MPLS-TP LSP.

clear

Syntax

clear {*lsp-name* | **id** *tunnel-id*}

Context

tools>perform>router>mpls>tp-tunnel

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command clears all the MPLS-TP linear protection operational commands for the specified LSP that are currently active.

Parameters

lsp-name

Specifies the name of the MPLS-TP LSP.

Values up to 32 characters in text

id tunnel-id

Specifies the tunnel number of the MPLS-TP LSP

Values 1 to 61440

force

Syntax

force {*lsp-name* | **id** *tunnel-id*}

Context

tools>perform>router>mpls>tp-tunnel

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs a force switchover of the MPLS-TP LSP from the active path to the protect path.

Parameters

lsp-name

Specifies the name of the MPLS-TP LSP.

Values up to 32 characters in text

id tunnel-id

Specifies the tunnel number of the MPLS-TP LSP

Values 1 to 61440

manual

Syntax

manual {*lsp-name* | **id** *tunnel-id*}

Context

tools>perform>router>mpls>tp-tunnel

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs a manual switchover of the MPLS-TP LSP from the active path to the protect path.

Parameters

lsp-name

Specifies the name of the MPLS-TP LSP.

Values up to 32 characters in text

id tunnel-id

Specifies the tunnel number of the MPLS-TP LSP

Values 1 to 61440

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lockout

Syntax

lockout {*lsp-name* | **id** *tunnel-id*}

Context

tools>perform>router>mpls>tp-tunnel

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs a lockout of protection for an MPLS-TP LSP. This prevents a switchover to the protect path.

Parameters

lsp-name

Specifies the name of the MPLS-TP LSP.

Values up to 32 characters in text

id tunnel-id

Specifies the tunnel number of the MPLS-TP LSP

Values 1 to 61440

memory-usage

Syntax

memory-usage

Context

tools>dump>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays memory usage information for MPLS.

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te-lspinfo

Syntax

te-lspinfo [**endpoint** *ip-address*] [**sender** *ip-address*] [**lspid** *lsp-id*] [**detail**]

te-lspinfo [**endpoint** *ip-address*] [**sender** *ip-address*] [**lspid** *lsp-id*] [**detail**]

Context

tools>dump>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays TE LSP information for MPLS.

ospf

Syntax

ospf [*ospf-instance*]

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display tools information for OSPF.

Note:
The number of OSPF instances supported on different 7210 platforms varies. Consult a Nokia representative for information about supported scaling limits.

Parameters

ospf-instance

Specifies the OSPF instance.

Values 0 to 31

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abr

Syntax

abr [**detail**]

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays area border router (ABR) information for OSPF.

Parameters

detail

Displays detailed information about the ABR.

asbr

Syntax

asbr [**detail**]

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays autonomous system border router (ASBR) information for OSPF.

Parameters

detail

Displays detailed information about the ASBR.

bad-packet

Syntax

bad-packet [*interface-name*]

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Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information about bad packets for OSPF.

Parameters

interface-name

Displays only the bad packets identified by this interface name.

leaked-routes

Syntax

leaked-routes [**summary** | **detail**}

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information about leaked routes for OSPF.

Default

summary

Parameters

summary

Displays a summary of information about leaked routes for OSPF.

detail

Displays detailed information about leaked routes for OSPF.

memory-usage

Syntax

memory-usage [**detail**]

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Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays memory usage information for OSPF.

Parameters

detail

Displays detailed information about memory usage for OSPF.

request-list

Syntax

request-list [**neighbor** *ip-address*] [**detail**]

request-list virtual-neighbor *ip-address* **area-id** *area-id* [**detail**]

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays request list information for OSPF.

Parameters

neighbor *ip-address*

Specifies the IP address for the neighbor.

detail

Displays detailed information about the neighbor.

virtual-neighbor *ip-address*

Specifies the IP address of the virtual neighbor.

area-id *area-id*

Specifies the OSPF area ID expressed in dotted decimal notation or as a 32-bit decimal integer.

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retransmission-list

Syntax

retransmission-list [**neighbor** *ip-address*] [**detail**]

retransmission-list virtual-neighbor *ip-address* **area-id** *area-id* [**detail**]

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays dump retransmission list information for OSPF.

Parameters

neighbor *ip-address*

Specifies the IP address for the neighbor.

detail

Displays detailed information about the neighbor.

virtual-neighbor *ip-address*

Specifies the IP address of the virtual neighbor.

area-id *area-id*

Specifies the OSPF area ID expressed in dotted-decimal notation or as a 32-bit decimal integer.

route-summary

Syntax

route-summary

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays dump route summary information for OSPF.

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route-table

Syntax

route-table ip-prefix/mask [**type**] [**detail**]

Context

tools>dump>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays dump information about routes learned through OSPF.

Parameters

type

Specifies the type of route table information to display.

Values intra-area, inter-area, external-1, external-2, nssa-1, nssa-2

detail

Displays detailed information about learned routes.

ospf3

Syntax

ospf3

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display tools information for OSPF3.

refresh-lsas

Syntax

refresh-lsas [**lsa-type**] [*area-id*]

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Context

tools>perform>router>ospf

tools>perform>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command refreshes LSAs for OSPF.

Parameters

lsa-type

Specifies the LSA type using allow keywords.

Values router, network, summary, asbr, extern, nssa, opaque

area-id

Specifies the OSPF area ID expressed in dotted-decimal notation or as a 32-bit decimal integer.

Values 0 to 4294967295

run-manual-spf

Syntax

run-manual-spf externals-only

Context

tools>perform>router>ospf

tools>perform>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command runs the Shortest Path First (SPF) algorithm.

Parameters

externals-only

Specifies the route preference for OSPF external routes.

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rsvp

Syntax

rsvp

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display RSVP information.

psb

Syntax

psb [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** *tunnel-id*] [**lspid** *lsp-id*]

Context

tools>dump>router>rsvp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays path state block (PSB) information for RSVP.

When a PATH message arrives at an LSR, the LSR stores the label request in the local PSB for the LSP. If a label range is specified, the label allocation process must assign a label from that range.

The PSB contains the IP address of the previous hop, the session, the sender, and the TSPEC. This information is used to route the corresponding RESV message back to LSR 1.

Parameters

endpoint *endpoint-address*

Specifies the IP address of the last hop.

sender *sender-address*

Specifies the IP address of the sender.

tunnelid *tunnel-id*

Specifies the SDP ID.

Values 0 to 4294967295

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lspid *lsp-id*

Specifies the label switched path that is signaled for this entry.

Values 1 to 65535

Output

Sample output

```
A:Dut-A# config>router>mpls# tools dump router rsvp psb detail

------------------------------------------------------------------------
PSB:
 P2P: Session (To: 10.20.1.4 - 61441 - 10.20.1.1), Sender (10.20.1.1 -
2) PHop 255.255.255.255

PSB CurrState: BACKUPS_CONNECTED  PrevState: BACKUPS_INIT  Flags: 0x0
LocalLabel 0 OutLabel 131070
Incoming IfIndex: Interface: Local API(-1)
Refresh interval 0, Send Path refresh in 3 secs,  Path Refresh timeout
0 secs
PrevHop: Ctype 1  Addr 255.255.255.255, LIH 0
DnStream Nbr: Addr-> 10.20.1.3  IfIndex ip-10.10.2.1(3)
UpStream Neighbor is NULLP
Session Attribute:
   Session Name: bypass-node10.20.1.2
   HoldPri: 0 SetupPri: 7 Flags: 0x2
   Ctype: 7, IncludeGroup: 0x0 IncludeAllGroup: 0x0 ExcludeGroup: 0x0
ClassType: Absent
TSpec: Flags 0x8000 QOSC 0, PDR (infinity), PBS 0.000 bps, CDR (0.000
bps) MTU: 0
CSPF Hop List: ->
  (1) UnnumIfId 3 RtrId 10.20.1.1 EgrAdmGrp 0x0 (Strict)
  (2) UnnumIfId 2 RtrId 10.20.1.3 EgrAdmGrp 0x0 (Strict)
  (3) UnnumIfId 5 RtrId 10.20.1.4 EgrAdmGrp 0x0 (Strict)
PSB RRO : ->
  (1) * Flags : 0x0 :      U
  (1) * UnInf : 10.20.1.1, 3
PSB SENT RRO : ->
  (1) * Flags : 0x0 :      U
  (1) * UnInf : 10.20.1.1, 3
PSB FILTERSPEC RRO : ->
  (1) * Flags : 0x0 :      U
  (1) * UnInf : 10.20.1.3, 2
  (2) * Flags : 0x1 :     Global
  (2) * Label : 131070
  (3) * Flags : 0x0 :      U
  (3) * UnInf : 10.20.1.4, 5
  (4) * Flags : 0x1 :     Global
  (4) * Label : 131070
PSB ERO : ->
  (1) Unnumbered RouterId 10.20.1.1, LinkId 3, Strict
  (2) Unnumbered RouterId 10.20.1.3, LinkId 2, Strict
  (3) Unnumbered RouterId 10.20.1.4, LinkId 5, Strict
PSB SENT ERO : ->
  (1) Unnumbered RouterId 10.20.1.3, LinkId 2, Strict
  (2) Unnumbered RouterId 10.20.1.4, LinkId 5, Strict
SendTempl: Sender:10.20.1.1_2
AdSpec Present - Flags: 0x0
  AdSpec General
  - Service Break bit           : 0x0
  - IS Hop Count                : 0x0
```


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```
  - Path Bandwidth Estimate     : 0x0
  - Minimum Path latency        : 0x0
  - Composed path MTU           : 0

Num Paths Received   :0
Num Paths Transmitted:5
Num Resvs Received   :8
Num Resvs Transmitted:0

Num Summmary Paths Received   :0
Num Summmary Paths Transmitted:0
Num Summmary Resvs Received   :0
Num Summmary Resvs Transmitted:0
Created at 91359 (26 secs back)
-------------------------------------------------------------------------
-------------------------------------------------------------------------
PSB:
 P2P: Session (To: 10.20.1.6 - 1 - 10.20.1.1), Sender (10.20.1.1 -
30208) PHop 0.0.0.0

PSB CurrState: PRIMARYS_CONNECTED  PrevState: PRIMARYS_INIT  Flags: 0x8
LocalLabel 0 OutLabel 131071
Incoming IfIndex: Interface: Local API(-1)
Refresh interval 5, Send Path refresh in 4 secs,  Path Refresh timeout
0 secs
PrevHop: Ctype 1  Addr 0.0.0.0, LIH 0
DnStream Nbr: Addr-> 10.20.1.2  IfIndex ip-10.10.1.1(2)
UpStream Neighbor is NULLP
Session Attribute:
   Session Name: 1::1
   HoldPri: 0 SetupPri: 7 Flags: 0x17
   Ctype: 7, IncludeGroup: 0x0 IncludeAllGroup: 0x0 ExcludeGroup: 0x0
ClassType: Absent
TSpec: Flags 0x8000 QOSC 1, PDR (infinity), PBS 0.000 bps, CDR (0.000
bps) MTU: 0
CSPF Hop List: ->
  (1) UnnumIfId 2 RtrId 10.20.1.1 EgrAdmGrp 0x0 (Strict)
  (2) UnnumIfId 2 RtrId 10.20.1.2 EgrAdmGrp 0x0 (Strict)
  (3) UnnumIfId 2 RtrId 10.20.1.4 EgrAdmGrp 0x0 (Strict)
  (4) UnnumIfId 2 RtrId 10.20.1.6 EgrAdmGrp 0x0 (Strict)
PSB RRO : ->
  (1) * Flags : 0x9 :      U LP_AVAIL NODE
  (1) * UnInf : 10.20.1.1, 2
PSB SENT RRO : ->
  (1) * Flags : 0x0 :      U
  (1) * UnInf : 10.20.1.1, 2
PSB FILTERSPEC RRO : ->
  (1) * Flags : 0x9 :      U LP_AVAIL NODE
  (1) * UnInf : 10.20.1.2, 2
  (2) * Flags : 0x1 :     Global
  (2) * Label : 131071
  (3) * Flags : 0x1 :      U LP_AVAIL
  (3) * UnInf : 10.20.1.4, 2
  (4) * Flags : 0x1 :     Global
  (4) * Label : 131071
  (5) * Flags : 0x0 :      U
  (5) * UnInf : 10.20.1.6, 2
  (6) * Flags : 0x1 :     Global
  (6) * Label : 131071
PSB ERO : ->
  (1) Unnumbered RouterId 10.20.1.2, LinkId 2, Strict
  (2) Unnumbered RouterId 10.20.1.4, LinkId 2, Strict
  (3) Unnumbered RouterId 10.20.1.6, LinkId 2, Strict
PSB SENT ERO : ->
```


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```
  (1) Unnumbered RouterId 10.20.1.2, LinkId 2, Strict
  (2) Unnumbered RouterId 10.20.1.4, LinkId 2, Strict
  (3) Unnumbered RouterId 10.20.1.6, LinkId 2, Strict
SendTempl: Sender:10.20.1.1_30208
AdSpec not present
FRR: Flags 0x2 HopLimit 16 SetupPri 7 HoldPri 0 IncludeAny 0x0
ExcludeAny 0x0 IncludeAll 0x0
PLR: Flag (0x166) State PLRS_BYPASS_UP AvoidNodeId 10.20.1.2 inIntf -1
inLabel 0
PLR: FRRRequestCount: 1  CSPFFailures: 0  ProtectionType: NodeProtect

Num Paths Received   :0
Num Paths Transmitted:5
Num Resvs Received   :5
 Num Resvs Transmitted:0

Num Summmary Paths Received   :0
Num Summmary Paths Transmitted:0
Num Summmary Resvs Received   :0
Num Summmary Resvs Transmitted:0
Created at 91359 (28 secs back)
-------------------------------------------------------------------------
  Total PSB Count   : 2

A:Dut-A# config>router>mpls#
```

rsb

Syntax

rsb [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** *tunnel-id*] [**lspid** *lsp-id*]

Context

tools>dump>router>rsvp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays RSVP Reservation State Block (RSB) information.

Parameters

endpoint *endpoint-address*

Specifies the IP address of the last hop.

sender *sender-address*

Specifies the IP address of the sender.

tunnelid *tunnel-id*

Specifies the SDP ID.

Values 0 to 4294967295

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lspid *lsp-id*

Specifies the label switched path that is signaled for this entry.

Values 1 to 65535

Output

Sample output

```
A:Dut-A# config>router>mpls# tools dump router rsvp rsb detail

------------------------------------------------------------------------
RSB:
 EndPt 10.20.1.4  Tid 61441  XTid 10.20.1.1  Sndr 10.20.1.1  LspId 2
ifIndex 3 NHop 20.20.1.3
Style FF, refresh in 0 secs
RSVP NextHop 20.20.1.3, LIH 3 (TLV: RtrId 10.20.1.3 IntfId 2)
CT Shared Reservation Info:
No Reservation:
FlowSpec :Flags 0x8000 QOSC 1, PDR (infinity), PBS 0.000 bps, CDR
(0.000 bps)
           CBS 0, EBS 0, RSpecR 0, RSpecS 0 MTU 1500 MPU 20
FwdFlowspec :Flags 0x0 QOSC 0, PDR (0.000 bps), PBS 0.000 bps, CDR
(0.000 bps)
              CBS 0, EBS 0, RSpecR 0, RSpecS 0 MPU 0
FilterSpec:
Timeout in : 26 secs, LocLabel: 0  Sender: 10.20.1.1 lspId: 2 OutIfId:
0
RRO :
  (1) * Flags : 0x0 :      U
  (1) * UnInf : 10.20.1.3, 2
  (2) * Flags : 0x1 :     Global
  (2) * Label : 131070
  (3) * Flags : 0x0 :      U
  (3) * UnInf : 10.20.1.4, 5
  (4) * Flags : 0x1 :     Global
  (4) * Label : 131070
------------------------------------------------------------------------
------------------------------------------------------------------------
RSB:
 EndPt 10.20.1.6  Tid 1  XTid 10.20.1.1  Sndr 0.0.0.0  LspId 0  ifIndex
2 NHop 20.20.1.2
Style SE, refresh in 0 secs
RSVP NextHop 20.20.1.2, LIH 2 (TLV: RtrId 10.20.1.2 IntfId 2)
CT Shared Reservation Info:
No Reservation:
FlowSpec :Flags 0x8000 QOSC 1, PDR (infinity), PBS 0.000 bps, CDR
(0.000 bps)
           CBS 0, EBS 0, RSpecR 0, RSpecS 0 MTU 1496 MPU 20
FwdFlowspec :Flags 0x0 QOSC 0, PDR (0.000 bps), PBS 0.000 bps, CDR
(0.000 bps)
              CBS 0, EBS 0, RSpecR 0, RSpecS 0 MPU 0
FilterSpec:
Timeout in : 21 secs, LocLabel: 0  Sender: 10.20.1.1 lspId: 30208
OutIfId: 0
RRO :
  (1) * Flags : 0x9 :      U LP_AVAIL NODE
  (1) * UnInf : 10.20.1.2, 2
  (2) * Flags : 0x1 :     Global
  (2) * Label : 131071
  (3) * Flags : 0x1 :      U LP_AVAIL
  (3) * UnInf : 10.20.1.4, 2
```


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```
  (4) * Flags : 0x1 :     Global
  (4) * Label : 131071
  (5) * Flags : 0x0 :      U
  (5) * UnInf : 10.20.1.6, 2
  (6) * Flags : 0x1 :     Global
  (6) * Label : 131071
-------------------------------------------------------------------------
  Total RSB Count   : 2

A:Dut-A# config>router>mpls#
```

tcsb

Syntax

tcsb [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** *tunnel-id*] [**lspid** *lsp-id*]

Context

tools>dump>router>rsvp

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays RSVP traffic control state block (TCSB) information.

Parameters

endpoint *endpoint-address*

Specifies the IP address of the egress node for the tunnel supporting this session.

sender *sender-address*

Specifies the IP address of the sender node for the tunnel supporting this session. It is derived from the source address of the associated MPLS LSP definition.

tunnelid *tunnel-id*

Specifies the IP address of the ingress node of the tunnel supporting this RSVP session.

Values 0 to 4294967295

lspid *lsp-id*

Specifies the label switched path that is signaled for this entry.

Values 1 to 65535

static-route

Syntax

static-route ldp-sync-status

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Context
tools>dump>router

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

Description
This command displays the synchronization status of LDP interfaces that static route keeps track of.

3.9.2.1.4 Dump service commands

service

Syntax
service

Context
tools>dump

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

Description
This command configures tools to display service dump information.

base-stats

Syntax
base-stats [**clear**]

Context
tools>dump>service

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

Description
This command displays internal service statistics.

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Parameters

clear

Clears stats after reading.

dpipe

Syntax

dpipe *service-id*

Context

tools>dump>service

Platforms

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

Description

This command displays debug information for a specified service.

Parameters

service-id

Specifies the service ID.

Values 1 to 2147483647

dtls

Syntax

dtls *service-id*

Context

tools>dump>service

Platforms

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

Description

This command displays TLS service statistics.

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Parameters

service-id

Specifies the service ID.

iom-stats

Syntax

iom-stats [**clear**]

Context

tools>dump>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays IOM message statistics.

Parameters

clear

Clears the statistics after reading.

l2pt-diags

Syntax

l2pt-diags

l2pt-diags clear

l2pt-diags detail

Context

tools>dump>service

Platforms

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

Description

This command displays L2pt diagnostics.

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Parameters

clear

Clears the diagnostics after reading.

detail

Displays detailed information.

Output

Sample output

```
A:ALA-48>tools>dump>service# l2pt-diags
[ l2pt/bpdu error diagnostics ]
 Error Name       | Occurence   | Event log
 -----------------+-------------+-----------------------------
[ l2pt/bpdu forwarding diagnostics ]

 Rx Frames   | Tx Frames   | Frame Type
 ------------+-------------+---------------------------------
A:ALA-48>tools>dump>service#

A:ALA-48>tools>dump>service# l2pt-diags detail
[ l2pt/bpdu error diagnostics ]
 Error Name       | Occurence   | Event log
 -----------------+-------------+-----------------------------
[ l2pt/bpdu forwarding diagnostics ]

 Rx Frames   | Tx Frames   | Frame Type
 ------------+-------------+---------------------------------
[ l2pt/bpdu config diagnostics ]
 WARNING - service 700 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 800 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 9000 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 32806 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 90001 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
A:ALA-48>tools>dump>service#
```

vpls-fdb-stats

Syntax

vpls-fdb-stats [**clear**]

Context

tools>dump>service

Platforms

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

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Description

This command displays VPLS FDB statistics.

Parameters

clear

Clears the statistics after reading.

vpls-mfib-stats

Syntax

vpls-mfib-stats [**clear**]

Context

tools>dump>service

Platforms

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

Description

This command displays VPLS MFIB statistics.

Parameters

clear

Clears statistics after reading.

3.9.2.2 Performance commands

perform

Syntax

perform

Context

tools

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context enable tools to perform specific tasks.

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cron

Syntax

cron

Context

tools>perform>system

Platforms

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

Description

Commands in this context perform CRON (scheduling) control operations.

tod

Syntax

tod

Context

tools>perform>system>cron

Platforms

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

Description

This command enables the context for tools for controlling time-of-day actions.

re-evaluate

Syntax

re-evaluate

Context

tools>perform>system>cron>tod

Platforms

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

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Description

Commands in this context re-evaluate the time-of-day state.

customer

Syntax

customer *customer-id* [**site** *customer-site-name*]

Context

tools>perform>system>cron>tod>re-eval

Platforms

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

Description

This command reevaluates the time-of-day state of a multi-service site.

Parameters

customer-id

Specifies an existing customer ID.

Values 1 to 2147483647

site *customer-site-name*

Specifies an existing customer site name.

filter

Syntax

filter ip-filter [*filter-id*]

filter ipv6-filter [*filter-id*]

filter mac-filter [*filter-id*]

Context

tools>perform>system>cron>tod>re-eval

Platforms

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

Description

This command reevaluates the time-of-day state of a filter entry.

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Parameters

filter-type

Specifies the filter type.

Values ip-filter, mac-filter

filter-id

Specifies an existing filter ID.

Values 1 to 65535

service

Syntax

service id *service-id* [**sap** *sap-id*]

Context

tools>perform>system>cron>tod>re-eval

Platforms

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

Description

This command reevaluates the time-of-day state of a SAP.

Parameters

service-id

Specifies the an existing service ID.

Values 1 to 2147483647

sap *sap-id*

Specifies the physical port identifier portion of the SAP definition. See Common CLI command descriptions for CLI command syntax.

tod-suite

Syntax

tod-suite *tod-suite-name*

Context

tools>perform>system>cron>tod>re-eval

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Platforms

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

Description

This command reevaluates the time-of-day state for the objects referring to a ToD suite.

Parameters

tod-suite-name

Specifies an existing ToD name.

system

Syntax

system

Context

tools>perform

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command is a tool for controlling the system.

script-control

Syntax

script-control

Context

tools>perform>system

Platforms

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

Description

This command performs script-control operations.

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script-policy

Syntax

script-policy

Context

tools>perform>system>script-control

Platforms

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

Description

This command performs script-policy operations.

stop

Syntax

stop [*script-policy-name*] [**owner** *script-policy-owner*] [**all**]

Context

tools>perform>system>script-control>script-policy

Platforms

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

Description

This command stops the execution of scripts.

Parameters

script-policy-name

Specifies to only stop scripts with the specified.

owner *script-policy-owner*

Specifies to only stop scripts that are associated with script-policies with the specified owner.

Default TiMOS CLI

all

Specifies to stop all running scripts.

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ldp-sync-exit

Syntax

[**no**] **ldp-sync-exit**

Context

tools>perform>router>isis

tools>perform>router>ospf

tools>perform>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command restores the actual cost of an interface at any time. When this command is executed, IGP immediately advertises the actual value of the link cost for all interfaces which have the IGP-LDP synchronization enabled if the currently advertised cost is different.

run-manual-spf

Syntax

run-manual-spf

Context

tools>perform>router>isis

tools>perform>router>ospf

tools>perform>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command runs the Shortest Path First (SPF) algorithm or OSPF or IS-IS.

isis

Syntax

isis

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Context

tools>perform>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure tools to perform specific IS-IS tasks.

mpls

Syntax

mpls

Context

tools>perform>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context perform specific MPLS tasks.

cspf

Syntax

cspf to *ip-addr* [**from** *ip-addr*] [**bandwidth** *bandwidth*] [**include-bitmap** *bitmap*] [**exclude-bitmap** *bitmap*] [**hop-limit** *limit*] [**exclude-address** *excl-addr* [*excl-addr*...(**up to 8 max**)]] [**use-te-metric**] [**skip-interface** *interface-name*] [**ds-class-type** *class-type*] [**cspf-reqtype** *req-type*]

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command computes a CSPF path with specified user constraints.

Parameters

to *ip-addr*

Specifies the destination IP address.

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from *ip-addr*

Specifies the originating IP address.

bandwidth *bandwidth*

Specifies the amount of bandwidth in mega-bits per second (Mbps) to be reserved.

Values 1 to 100000 in Mbps

include-bitmap *bitmap*

Specifies to include a bit-map that lists admin groups that should be included during setup.

Values 0 to 4294967295, accepted in decimal, hex(0x) or binary(0b)

exclude-bitmap *bitmap*

Specifies to exclude a bit-map that lists admin groups that should be included during setup.

Values 0 to 4294967295, accepted in decimal, hex(0x) or binary(0b)

hop-limit *limit*

Specifies the total number of hops a detour LSP can take before merging back onto the main LSP path.

Values 1 to 255

exclude-address *ip-addr*

Specifies an IP address to exclude from the operation.

use-te-metric

Specifies whether the TE metric would be used for the purpose of the LSP path computation by CSPF.

skip-interface *interface-name*

Specifies a local interface name, instead of the interface address, to be excluded from the CSPF computation.

resignal

Syntax

resignal lsp *lsp-name* **path** *path-name* **delay** *minutes*

resignal {**p2mp-lsp** *p2mp-lsp-name* **p2mp-instance** *p2mp-instance-name* | **p2mp-delay** *p2mp-minutes*}

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command resignals a specific LSP path.

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Parameters

lsp *lsp-name*

Specifies a unique name, up to 64 characters, that identifies the LSP.

path *path-name*

Specifies the name for the LSP path up, to 32 characters.

delay *minutes*

Specifies the resignal delay in minutes.

Values 0 to 30

p2mp-lsp *p2mp-lsp-name*

Specifies an existing point-to-multipoint LSP name, up to 64 characters. This parameter is supported only on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-T.

p2mp-instance *p2mp-instance-name*

Specifies a name, up to 32 characters, that identifies the P2MP LSP instance. This parameter is supported only on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-T.

p2mp-delay *p2mp-minutes*

Specifies the delay time, in minutes. This parameter is supported only on the 7210 SAS-Mxp, 7210 SAS-R6, 7210 SAS-R12, 7210 SAS-Sx/S 1/10GE (standalone and standalone-VC), and 7210 SAS-T.

Values 0 to 60

trap-suppress

Syntax

trap-suppress [*number-of-traps*] [*time-interval*]

Context

tools>perform>router>mpls

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command modifies thresholds for trap suppression.

Parameters

number-of-traps

Specifies the number of traps in multiples of 100. An error messages is generated if an invalid value is entered.

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Values 100 to 1000

time-interval

Specifies the timer interval, in seconds.

Values 1 to 300

ospf

Syntax

ospf

Context

tools>perform>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context perform specific OSPF tasks.

ldp-sync-exit

Syntax

[**no**] **ldp-sync-exit**

Context

tools>perform>router>isis

tools>perform>router>ospf

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command restores the actual cost of an interface at any time. When this command is executed, IGP immediately advertises the actual value of the link cost for all interfaces which have the IGP-LDP synchronization enabled if the currently advertised cost is different.

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service

Syntax

services

Context

tools>perform

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure tools for services.

id

Syntax

id *service-id*

Context

tools>perform>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure tools for a specific service.

Parameters

service-id

Specifies an existing service ID.

Values 1 to 2147483647

endpoint

Syntax

endpoint *endpoint-name*

Context

tools>perform>service>id

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure tools for a specific VLL service endpoint.

Parameters

endpoint-name

Specifies an existing VLL service endpoint name.

force-switchover

Syntax

force-switchover *sdp-id:vc-id*

no force-switchover

Context

tools>perform>service>id

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command forces a switch of the active spoke SDP for the specified service.

Parameters

sdp-id:vc-id

Specifies an existing spoke SDP for the service.

Output

Sample output

```
A:Dut-B# tools perform service id 1 endpoint mcep-t1 force-switchover 221:1
*A:Dut-B# show service  id  1 endpoint
===============================================================================
Service 1 endpoints
===============================================================================
Endpoint name               : mcep-t1
Description                 : (Not Specified)
Revert time                 : 0
Act Hold Delay              : 0
Ignore Standby Signaling    : false
Suppress Standby Signaling  : false
Block On Mesh Fail          : true
Multi-Chassis Endpoint      : 1
MC Endpoint Peer Addr       : 10.1.1.3
Psv Mode Active             : No
Tx Active                   : 221:1(forced)
```


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```
Tx Active Up Time            : 0d 00:00:17
Revert Time Count Down       : N/A
Tx Active Change Count       : 6
Last Tx Active Change        : 02/14/2009 00:17:32
-------------------------------------------------------------------------------
Members
-------------------------------------------------------------------------------
Spoke-sdp: 221:1 Prec:1                          Oper Status: Up
Spoke-sdp: 231:1 Prec:2                          Oper Status: Up
===============================================================================
*A:Dut-B#
```

eval-pw-template

Syntax

eval-pw-template

Context

tools>perform>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command reevaluates the pseudowire template policy.

Parameters

policy-id

Specifies the pseudowire template policy.

eval-expired-fec

Syntax

eval-expired-fec *spoke-sdp-fec-id*

eval-expired-fec all

Context

tools>perform>service>pw-routing

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command resets the retry counter and retry timer for the specified spoke SDP and attempts to reestablish the spoke SDP.

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spoke-sdp-fec-release

Syntax

spoke-sdp-fec-release *global-id*[**:***prefix*[**:***ac-id*]]

Context

tools>perform>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command clears the MS-PW bindings associated with a particular SAII or TAII on an S-PE.

Parameters

global-id

Specifies the global ID of either the SAII or TAII of the MS-PW to be released.

Values 1 to 4294967295

prefix

Specifies the prefix of either the SAII or TAII of the MS-PW to be released.

Values ipv4-formatted address: a.b.c.d | 1 to 4294967295

ac-id

Specifies the AC-ID of either the SAII or TAII of the MS-PW to be released.

Values 1 to 4294967295

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4 Common CLI command descriptions

This chapter provides CLI syntax and command descriptions for SAP and port commands.

4.1 Command descriptions

4.1.1 SAP syntax

sap

Syntax

[**no**] **sap** *sap-id*

Context

(multiple)

Description

This command specifies the physical port identifier portion of the SAP definition.

Parameters

sap-id

Specifies the physical port identifier portion of the SAP definition.

The *sap-id* can be configured in one of the following formats:

Table 51: SAP-ID formats

Type	Syntax	Example
port-id	*slot*/*mda*/*port*[.*channel*]	1/1/5
null	[*port-id* | *lag-id*]	*port-id*: 1/1/3 *lag-id*: lag-3
dot1q	[*port-id* | *lag-id*]:qtag1	*port-id*:qtag1: 1/1/3:100 *lag-id*:qtag1:lag-3:102
qinq	[*port-id* | *lag-id*]:*qtag1*.*qtag2*	*port-id*:qtag1.qtag2: 1/1/3:100.10 *lag-id*:qtag1.qtag2: lag-10:

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4.1.2 Port syntax

port

Syntax

port *port-id*

Context

(multiple)

Description

This command specifies a port identifier.

Parameters

port-id

The *port-id* can be configured in one of the following formats.

Values

port-id	slot/mda/port[.channel]	
lag-id	lag-id	
	lag	keyword
	id	1 to 200

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5 Standards and protocol support

Note:
The information provided in this chapter is subject to change without notice and may not apply to all platforms.

Nokia assumes no responsibility for inaccuracies.

The following conventions are used in this section:

- T(A,N) indicates 7210 SAS-T in both Access-uplink mode and Network mode. Similarly, T(N) indicates 7210 SAS-T in network mode only.
- K5 indicates 7210 SAS-K 2F2T1C.
- K12 indicates 7210 SAS-K 2F4T6C.
- K30 indicates 7210 SAS-K 3SFP+ 8C.
- Sx/S-1/10GE indicates all variants of 7210 SAS-Sx 1/10GE and 7210 SAS-S 1/10GE platforms.
- Sx-10/100GE indicates only the variants of 7210 SAS-Sx 10/100GE. Sx-10/100GE QSFP28 indicates the 7210 SAS-Sx 10/100GE 64 SFP+ 4QSFP28 variant.
- Sx/S-1/10GE-VC indicates 7210 SAS-Sx 1/10GE and 7210 SAS-S 1/10GE platforms in standalone VC mode.
- R6 indicates 7210 SAS-R6.
- R12 indicates 7210 SAS-R12.
- D indicates 7210 SAS-D and 7210 SAS-D ETR. If a line item applies only to 7210 SAS-D ETR, then it is indicated as D-ETR.
- Dxp indicates 7210 SAS-Dxp-12p (2SFP+ 4F6T) 7210 SAS-Dxp-12p ETR (2SFP+ 4F6T), 7210 SAS-Dxp 16p (2SFP+ 4F10T), and 7210 SAS-Dxp-24p (2SFP+ 6F16T). If a line item applies only to a particular variant, the variant name will be called out explicitly against that item.
- This standards list is not applicable to platforms in the satellite mode of operation, as most of the features are supported on 7x50 SR platforms. For this reason, the host platforms standards compliance must be consulted for the satellite mode of operation.

5.1 BGP

draft-ietf-idr-add-paths-04, Advertisement of Multiple Paths in BGP is supported on T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-ietf-sidr-origin-validation-signaling-04, BGP Prefix Origin Validation State Extended Community is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1772, Application of the Border Gateway Protocol in the Internet is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1997, BGP Communities Attribute is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 2385, Protection of BGP Sessions via the TCP MD5 Signature Option is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2439, BGP Route Flap Damping is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2545, Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2858, Multiprotocol Extensions for BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2918, Route Refresh Capability for BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3107, Carrying Label Information in BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3392, Capabilities Advertisement with BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4271, A Border Gateway Protocol 4 (BGP-4) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4360, BGP Extended Communities Attribute is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4364, BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4456, BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only R6 and R12 supports RR server functionality. Rest of the platforms support only client function.

RFC 4659, BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4684, Constrained Route Distribution for Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4760, Multiprotocol Extensions for BGP-4 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4798, Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4893, BGP Support for Four-octet AS Number Space is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5004, Avoid BGP Best Path Transitions from One External to Another is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5291, Outbound Route Filtering Capability for BGP-4 is supported on K12, K30, T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5668, 4-Octet AS Specific BGP Extended Community is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 6811, Prefix Origin Validation is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.2 Certificate Management

RFC 5280, Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7468, Textual Encodings of PKIX, PKCS, and CMS Structures is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only PKIX and PKCS is supported.

5.3 Ethernet

IEEE 802.1AB, Station and Media Access Control Connectivity Discovery is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

TIA-1057, LLDP for Media endpoint devices is supported on Dxp, Sx/S-1/10GE, and Sx/S-1/10GE-VC

IEEE 802.1ad, Provider Bridges is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1ag, Connectivity Fault Management is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1ah, Provider Backbone Bridges is supported on T(N)

IEEE 802.1ax, Link Aggregation is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1D, MAC Bridges is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1p, Traffic Class Expediting is supported on D, E, Dxp, K5, K12, K30, T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1Q, Virtual LANs is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1s, Multiple Spanning Trees is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1w, Rapid Reconfiguration of Spanning Tree is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.1X, Port Based Network Access Control is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ab, 1000BASE-T is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ac, VLAN Tag is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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IEEE 802.3ad, Link Aggregation is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ae, 10 Gb/s Ethernet is supported on Dxp, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ah, Ethernet in the First Mile is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3ba, 40 Gb/s and 100 Gb/s Ethernet is supported on R6, R12, and Sx-10/100GE

IEEE 802.3i, Ethernet is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3u, Fast Ethernet is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3z, Gigabit Ethernet is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE 802.3af, Power Over Ethernet (PoE) is supported on Dxp, T-ETR, Mxp-ETR, Sx/S-1/10GE, and Sx/S-1/10GE-VC

Note:
Sx/S-1/10GE only on PoE variant and Sx-1/10GE fiber variant with two fixed copper ports. Only on Dxp-16p and Dxp-24p.

IEEE 802.3at, Power Over Ethernet (PoE+) is supported on Dxp, T-ETR, Mxp-ETR, Sx/S-1/10GE, and Sx/S-1/10GE-VC

Note:
Sx/S-1/10GE only on PoE variant and Sx-1/10GE fiber variant with two fixed copper ports. Only on Dxp-16p and Dxp-24p.

IEEE 802.3bt, Power Over Ethernet (PoE++/HPoE) is supported on Dxp

Note:
Only on Dxp-16p and Dxp-24p.

ITU-T G.8032, Ethernet Ring Protection Switching is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ITU-T Y.1731, OAM functions and mechanisms for Ethernet based networks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.4 EVPN

draft-snr-bess-evpn-proxy-arp-nd-00, Proxy-ARP/ND function in EVPN networks is supported on K12, K30, Mxp, Sx/S-1/10GE, R6, and R12

Note:
Sx/S-/10GE standalone mode only.

RFC 7432, BGP MPLS-Based Ethernet VPN is supported on K12, K30, Mxp, Sx/S-1/10GE, R6, and R12

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Note:
Sx/S-/10GE standalone mode only.

draft-ietf-bess-evpn-vpws-14, Virtual Private Wire Service support in Ethernet VPN is supported on Mxp

5.5 Fast Reroute

draft-ietf-rtgwg-lfa-manageability-08, Operational management of Loop Free Alternates is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
With Segment Routing.

RFC 5286, Basic Specification for IP Fast Reroute: Loop-Free Alternates is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
With Segment Routing.

RFC 7490, Remote Loop-Free Alternate (LFA) Fast Reroute (FRR) is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
With Segment Routing.

5.6 Internet Protocol (IP) — General

draft-grant-tacacs-02, The TACACS+ Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-vrrp-unified-spec-02, Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6 is supported on Mxp

RFC 768, User Datagram Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 793, Transmission Control Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 854, TELNET Protocol Specifications is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 951, Bootstrap Protocol (BOOTP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1034, Domain Names - Concepts and Facilities is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1035, Domain Names - Implementation and Specification is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1350, The TFTP Protocol (revision 2) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 1534, Interoperation between DHCP and BOOTP is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1542, Clarifications and Extensions for the Bootstrap Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2131, Dynamic Host Configuration Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2132, DHCP Options and BOOTP Vendor Extensions is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2347, TFTP Option Extension is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2348, TFTP Blocksize Option is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2349, TFTP Timeout Interval and Transfer Size Options is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2428, FTP Extensions for IPv6 and NATs is supported on D, Dxp, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2865, Remote Authentication Dial In User Service (RADIUS) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2866, RADIUS Accounting is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3046, DHCP Relay Agent Information Option (Option 82) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3596, DNS Extensions to Support IP version 6 is supported on D, Dxp, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3768, Virtual Router Redundancy Protocol (VRRP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4250, The Secure Shell (SSH) Protocol Assigned Numbers is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4251, The Secure Shell (SSH) Protocol Architecture is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4252, The Secure Shell (SSH) Authentication Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
All 7210 platforms support password and public key based user authentication. 7210 SAS-D support only password based authentication.

RFC 4253, The Secure Shell (SSH) Transport Layer Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4254, The Secure Shell (SSH) Connection Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5246, The Transport Layer Security (TLS) Protocol Version 1.2 – TLS client, RSA public key is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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Note:
Only TLS client.

RFC 5425, Transport Layer Security (TLS) Transport Mapping for Syslog – RFC 3164 with TLS is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only TLS client.

RFC 5656, Elliptic Curve Algorithm Integration in the Secure Shell Transport Layer – ECDSA is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7301, Transport Layer Security (TLS) Application Layer Protocol Negotiation Extension is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only TLS client.

RFC 8446, The Transport Layer Security (TLS) Protocol Version 1.3 is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only TLS client.

RFC 4632, Classless Inter-domain Routing (CIDR): The Internet Address Assignment and Aggregation Plan is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5880, Bidirectional Forwarding Detection (BFD) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IPv4 only on all platforms listed. IPv4 and IPv6 only on Mxp.

RFC 5881, Bidirectional Forwarding Detection (BFD) IPv4 and IPv6 (Single Hop) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IPv4 only on all platforms listed. IPv4 and IPv6 only on Mxp.

RFC 5883, Bidirectional Forwarding Detection (BFD) for Multihop Paths is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IPv4 only on all platforms listed. IPv4 and IPv6 only on Mxp.

RFC 6528, Defending against Sequence Number Attacks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7130, Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces is supported on T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

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5.7 IP — Multicast

RFC 1112, Host Extensions for IP Multicasting is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
IGMP v1, v2, v3 is supported.

RFC 2236, Internet Group Management Protocol, Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3306, Unicast-Prefix-based IPv6 Multicast Addresses is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3376, Internet Group Management Protocol, Version 3 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3446, Anycast Rendevous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
MSDP supported only on Sx/S-1/10GE standalone.

RFC 3618, Multicast Source Discovery Protocol (MSDP) is supported on Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 4601, Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4604, Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
MLD is not supported.

RFC 4607, Source-Specific Multicast for IP is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4608, Source-Specific Protocol Independent Multicast in 232/8 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4610, Anycast-RP Using Protocol Independent Multicast (PIM) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5059, Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5384, The Protocol Independent Multicast (PIM) Join Attribute Format is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6513, Multicast in MPLS/BGP IP VPNs is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

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Note:
Only IPv4.

RFC 6514, BGP Encodings and Procedures for Multicast in MPLS/IP VPNs is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6515, IPv4 and IPv6 Infrastructure Addresses in BGP Updates for Multicast VPNs is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6625, Wildcards in Multicast VPN Auto-Discover Routes is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 6826, Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Path is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 7246, Multipoint Label Distribution Protocol In-Band Signaling in a Virtual Routing and Forwarding (VRF) Table Context is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

RFC 7385, IANA Registry for P-Multicast Service Interface (PMSI) Tunnel Type Code Points is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only IPv4.

5.8 IP — Version 4

RFC 791, Internet Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 792, Internet Control Message Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 826, An Ethernet Address Resolution Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1519, Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 1812, Requirements for IPv4 Routers is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1981, Path MTU Discovery for IP version 6 is supported on K12, K30, T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2401, Security Architecture for Internet Protocol is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Supported only for OSPFv3 authentication. Not supported for services.

RFC 2460, Internet Protocol, Version 6 (IPv6) Specification is supported on D, Dxp, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, and T(A) for Management only.

5.9 IP — Version 6

RFC 2464, Transmission of IPv6 Packets over Ethernet Networks is supported on D, Dxp, K5 K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 3021, Using 31-Bit Prefixes on IPv4 Point-to-Point Links is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3122, Extensions to IPv6 Neighbor Discovery for Inverse Discovery Specification is supported on K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3587, IPv6 Global Unicast Address Format is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 4007, IPv6 Scoped Address Architecture is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 4193, Unique Local IPv6 Unicast Addresses is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 4291, Internet Protocol Version 6 (IPv6) Addressing Architecture is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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Note:
D, Dxp, K5, and T(A) for Management only.

RFC 4443, Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 4861, Neighbor Discovery for IP version 6 (IPv6) is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 4862, IPv6 Stateless Address Autoconfiguration (Router Only) is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 5095, Deprecation of Type 0 Routing Headers in IPv6 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5952, A Recommendation for IPv6 Address Text Representation is supported on D, Dxp, K5, K12, K30, T(A, N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
D, Dxp, K5, and T(A) for Management only.

RFC 6106, IPv6 Router Advertisement Options for DNS Configuration is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6164, Using 127-Bit IPv6 Prefixes on Inter-Router Links is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.10 IPsec

RFC 2401, Security Architecture for the Internet Protocol is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only for use with OSPFv3 authentication. Not supported for services.

RFC 2406, IP Encapsulating Security Payload (ESP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
Only for use with OSPFv3 authentication. Not supported for services.

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5.11 IS-IS

draft-ietf-isis-mi-02, IS-IS Multi-Instance is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-isis-segment-routing-extensions-04, IS-IS Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

draft-kaplan-isis-ext-eth-02, Extended Ethernet Frame Size Support is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ISO/IEC 10589:2002, Second Edition, Nov. 2002, Intermediate system to Intermediate system intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1195, Use of OSI IS-IS for Routing in TCP/IP and Dual Environments is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3359, Reserved Type, Length and Value (TLV) Codepoints in Intermediate System to Intermediate System is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3719, Recommendations for Interoperable Networks using Intermediate System to Intermediate System (IS-IS) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3787, Recommendations for Interoperable IP Networks using Intermediate System to Intermediate System (IS-IS) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4971, Intermediate System to Intermediate System (IS-IS) Extensions for Advertising Router Information is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5120, M-ISIS: Multi Topology (MT) Routing in IS-IS is supported on K12, T(N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5130, A Policy Control Mechanism in IS-IS Using Administrative Tags is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5301, Dynamic Hostname Exchange Mechanism for IS-IS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5302, Domain-wide Prefix Distribution with Two-Level IS-IS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5303, Three-Way Handshake for IS-IS Point-to-Point Adjacencies is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5304, IS-IS Cryptographic Authentication is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5305, IS-IS Extensions for Traffic Engineering TE is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5306, Restart Signaling for IS-IS (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5308, Routing IPv6 with IS-IS is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

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RFC 5309, Point-to-Point Operation over LAN in Link State Routing Protocols is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5310, IS-IS Generic Cryptographic Authentication is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6232, Purge Originator Identification TLV for IS-IS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6233, IS-IS Registry Extension for Purges is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-isis-mi-02, IS-IS Multi-Instance is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

Note:
K12, K30 support only a single instance and can operate in multi-instance deployment as it supports the processing of TLVs for multi-instance support.

draft-ietf-isis-segment-routing-extensions-04, IS-IS Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

5.12 Management

draft-ieft-snmpv3-update-mib-05, Management Information Base (MIB) for the Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-idr-bgp4-mib-05, Definitions of Managed Objects for the Fourth Version of Border Gateway Protocol (BGP-4) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-isis-wg-mib-06, Management Information Base for Intermediate System to Intermediate System (IS-IS) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-mboned-msdp-mib-01, Multicast Source Discovery protocol MIB is supported on Sx/S-1/10GE

Note:
Only in standalone mode.

draft-ietf-mpls-ldp-mib-07, Definitions of Managed Objects for the Multiprotocol Label Switching, Label Distribution Protocol (LDP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-mpls-lsr-mib-06, Multiprotocol Label Switching (MPLS) Label Switching Router (LSR) Management Information Base Using SMIv2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-mpls-te-mib-04, Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-ospf-mib-update-08, OSPF Version 2 Management Information Base is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ianaaddressfamilynumbers-mib, IANA-ADDRESS-FAMILY-NUMBERS-MIB is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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ianaiftype-mib, IANAifType-MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

ianaiprouteprotocol-mib, IANA-RTPROTO-MIB is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE8021-CFM-MIB, IEEE P802.1ag(TM) CFM MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE8021-PAE-MIB, IEEE 802.1X MIB is supported on D, Dxp, K5, K12, K30, T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

IEEE8023-LAG-MIB, IEEE 802.3ad MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

LLDP-MIB, IEEE P802.1AB(TM) LLDP MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1157, A Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1215, A Convention for Defining Traps for use with the SNMP is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 1724, RIP Version 2 MIB Extension is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 2021, Remote Network Monitoring Management Information Base Version 2 using SMIv2 is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2138, Remote Authentication Dial In User Service (RADIUS) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2206, RSVP Management Information Base using SMIv2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2213, Integrated Services Management Information Base using SMIv2 is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2571, An Architecture for Describing SNMP Management Frameworks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2572, Message Processing and Dispatching for the Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2573, SNMP Applications is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2575, View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP) is supported on D, E, Dxp, K5, K12, K30, T(A,N), X, Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2578, Structure of Management Information Version 2 (SMIv2) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2579, Textual Conventions for SMIv2 is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 2787, Definitions of Managed Objects for the Virtual Router Redundancy Protocol is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2819, Remote Network Monitoring Management Information Base is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2856, Textual Conventions for Additional High Capacity Data Types is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2863, The Interfaces Group MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2864, The Inverted Stack Table Extension to the Interfaces Group MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2933, Internet Group Management Protocol MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3014, Notification Log MIB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3164, The BSD syslog Protocol is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3165, Definitions of Managed Objects for the Delegation of Management Scripts is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3231, Definitions of Managed Objects for Scheduling Management Operations is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3273, Remote Network Monitoring Management Information Base for High Capacity Networks is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3414, User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3416. Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3417, Transport Mappings for the Simple Network Management Protocol (SNMP) (SNMP over UDP over IPv4) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3419, Textual Conventions for Transport Addresses is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3584, Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3593, Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals is supported on Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3635, Definitions of Managed Objects for the Ethernet-like Interface Types is supported on D, E, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 3826, The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3877, Alarm Management Information Base (MIB) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4001, Textual Conventions for Internet Network Addresses is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4022, Management Information Base for the Transmission Control Protocol (TCP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4113, Management Information Base for the User Datagram Protocol (UDP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4220, Traffic Engineering Link Management Information Base is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4292, IP Forwarding Table MIB is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4293, Management Information Base for the Internet Protocol (IP) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5101, Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information is supported on Mxp, Sx/S-1/10GE, and R6

RFC 6241, Network Configuration Protocol (NETCONF) is supported on K5, K12, T(N), Mxp, Sx/S-1/10GE, R6, and R12

RFC 6242, Using the NETCONF Protocol over Secure Shell (SSH) is supported on K5, K12, T(N), Mxp, Sx/S-1/10GE, R6, and R12

5.13 MPLS — General

RFC 3031, Multiprotocol Label Switching Architecture is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3032, MPLS Label Stack Encoding is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3443, Time To Live (TTL) Processing in Multi-Protocol Label Switching (MPLS) Networks is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4182, Removing a Restriction on the use of MPLS Explicit NULL is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5332, MPLS Multicast Encapsulations is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

5.14 MPLS — GMPLS

draft-ietf-ccamp-rsvp-te-srlg-collect-04, RSVP-TE Extensions for Collecting SRLG Information is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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5.15 MPLS — LDP

draft-ietf-mpls-ldp-ipv6-15, Updates to LDP for IPv6 is supported on Mxp

draft-pdutta-mpls-ldp-adj-capability-00, LDP Adjacency Capabilities is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-pdutta-mpls-ldp-v2-00, LDP Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-pdutta-mpls-tldp-hello-reduce-04, Targeted LDP Hello Reduction is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3037, LDP Applicability is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3478, Graceful Restart Mechanism for Label Distribution Protocol (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5036, LDP Specification is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5283, LDP Extension for Inter-Area Label Switched Paths (LSPs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5443, LDP IGP Synchronization is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5561, LDP Capabilities is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6388, Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

Note:
P2MP LSPs only.

5.16 MPLS — MPLS-TP

RFC 5586, MPLS Generic Associated Channel is supported on T(N), R6, and R12

RFC 5921, A Framework for MPLS in Transport Networks is supported on T(N), R6, and R12

RFC 5960, MPLS Transport Profile Data Plane Architecture is supported on T(N), R6, and R12

RFC 6370, MPLS Transport Profile (MPLS-TP) Identifiers is supported on T(N), R6, and R12

RFC 6378, MPLS Transport Profile (MPLS-TP) Linear Protection is supported on T(N), R6, and R12

RFC 6426, MPLS On-Demand Connectivity and Route Tracing is supported on T(N), R6, and R12

RFC 6428, Proactive Connectivity Verification, Continuity Check and Remote Defect indication for MPLS Transport Profile is supported on T(N), R6, and R12

RFC 6478, Pseudowire Status for Static Pseudowires is supported on T(N), R6, and R12

RFC 7213, MPLS Transport Profile (MPLS-TP) Next-Hop Ethernet Addressing is supported on T(N), R6, and R12

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5.17 MPLS — OAM

RFC 6424, Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6425, Detecting Data Plane Failures in Point-to-Multipoint Multiprotocol Label Switching (MPLS) - Extensions to LSP Ping is supported on T(N), Mxp, R6, and R12

5.18 MPLS — RSVP-TE

RFC 2702, Requirements for Traffic Engineering over MPLS is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2747, RSVP Cryptographic Authentication is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2961, RSVP Refresh Overhead Reduction Extensions is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3097, RSVP Cryptographic Authentication -- Updated Message Type Value is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3209, RSVP-TE: Extensions to RSVP for LSP Tunnels is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3477, Signalling Unnumbered Links in Resource ReSerVation Protocol - Traffic Engineering (RSVP-TE) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4090, Fast Reroute Extensions to RSVP-TE for LSP Tunnels is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4561, Definition of a Record Route Object (RRO) Node-Id Sub-Object is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4875, Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs) is supported on T(N), Mxp, Sx/S-1/10GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4950, ICMP Extensions for Multiprotocol Label Switching is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5817, Graceful Shutdown in MPLS and Generalized MPLS Traffic Engineering Networks is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.19 OSPF

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-ospf-segment-routing-extensions-04, OSPF Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 1765, OSPF Database Overflow is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 2328, OSPF Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3101, The OSPF Not-So-Stubby Area (NSSA) Option is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3509, Alternative Implementations of OSPF Area Border Routers is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3623, Graceful OSPF Restart Graceful OSPF Restart (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3630, Traffic Engineering (TE) Extensions to OSPF Version 2 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4222, Prioritized Treatment of Specific OSPF Version 2 Packets and Congestion Avoidance is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4552, Authentication/Confidentiality for OSPFv3 is supported on K12, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4576, Using a Link State Advertisement (LSA) Options Bit to Prevent Looping in BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4577, OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 4970, Extensions to OSPF for Advertising Optional Router Capabilities is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5185, OSPF Multi-Area Adjacency is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5187, OSPFv3 Graceful Restart (Helper Mode) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

RFC 5243, OSPF Database Exchange Summary List Optimization is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5250, The OSPF Opaque LSA Option is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5309, Point-to-Point Operation over LAN in Link State Routing Protocols is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5340, OSPF for IPv6 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5838, Support of Address Families in OSPFv3 is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6987, OSPF Stub Router Advertisement is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

draft-ietf-ospf-prefix-link-attr-06, OSPFv2 Prefix/Link Attribute Advertisement is supported on K12, K30, Mxp, Sx/S-1/10GE, R6, and R12

draft-ietf-ospf-segment-routing-extensions-04, OSPF Extensions for Segment Routing is supported on K12, K30, Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

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5.20 Pseudowire

draft-ietf-l2vpn-vpws-iw-oam-04, OAM Procedures for VPWS Interworking is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3916, Requirements for Pseudo- Wire Emulation Edge-to-Edge (PWE3) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3985, Pseudo Wire Emulation Edge-to-Edge (PWE3) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4385, Pseudo Wire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4446, IANA Allocations for Pseudowire Edge to Edge Emulation (PWE3) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4447, Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 4448, Encapsulation Methods for Transport of Ethernet over MPLS Networks is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5659, An Architecture for Multi-Segment Pseudowire Emulation Edge-to-Edge is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6073, Segmented Pseudowire is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6310, Pseudowire (PW) Operations, Administration, and Maintenance (OAM) Message Mapping is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6391, Flow-Aware Transport of Pseudowires over an MPLS Packet Switched Network is supported on K12, K30, Mxp, R6, and R12

RFC 6718, Pseudowire Redundancy is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6870, Pseudowire Preferential Forwarding Status bit is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7023, MPLS and Ethernet Operations, Administration, and Maintenance (OAM) Interworking is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 7267, Dynamic Placement of Multi-Segment Pseudowires is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.21 Quality of Service

RFC 2430, A Provider Architecture for Differentiated Services and Traffic Engineering (PASTE) is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 2474, Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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RFC 2598, An Expedited Forwarding PHB is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3140, Per Hop Behavior Identification Codes is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 3260, New Terminology and Clarifications for Diffserv is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.22 RIP

RFC 1058, Routing Information Protocol is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 2082, RIP-2 MD5 Authentication is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

RFC 2453, RIP Version 2 is supported on Mxp and Sx/S-1/10GE

Note:
Only in standalone mode.

5.23 Timing

GR-1244-CORE, Clocks for the Synchronized Network: Common Generic Criteria, Issue 3, May 2005 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

GR-253-CORE, SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

IEEE 1588-2008, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, IEEE default profile is supported only includes the Dxp-12p ETR, Dxp-16p, Dxp-24p. Sx-10/100GE does not support IEEE default profile.

ITU-T G.781, Synchronization layer functions, issued 09/2008 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

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Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.813, Timing characteristics of SDH equipment slave clocks (SEC), issued 03/2003 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8261, Timing and synchronization aspects in packet networks, issued 04/2008 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8262, Timing characteristics of synchronous Ethernet equipment slave clock (EEC), issued 08/2007 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8264, Distribution of timing information through packet networks, issued 10/2008 is supported on D-ETR, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, R6, and R12

Note:
For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, and Dxp-24p.

ITU-T G.8265.1, Precision time protocol telecom profile for frequency synchronization, issued 10/2010 is supported on D-ETR, K5, K12, K30, T(A,N), Mxp, Sx-1/10GE, R6, and R12

ITU-T G.8275.1, Precision time protocol telecom profile for phase/time synchronization with full timing support from the network, issued 07/2014 is supported on Dxp, K12, K30, T(A,N), Mxp, Sx-1/10GE, Sx-10/100GE, R6, and R12

Note:
For 7210 SAS-Sx 10/100GE, the support only includes the Sx 10/100GE QSFP28 variant. For Dxp, the support only includes the Dxp-12p ETR, Dxp-16p, Dxp-24p.

IEC/IEEE 61850-9-3-2016, Communication networks and systems for power utility automation - Part 9-3: Precision time protocol profile for power utility automation is supported on Dxp-16p and Dxp-24p

IEEE C37.238-2017 - IEEE Standard Profile for Use of IEEE 1588 Precision Time Protocol in Power System Applications is supported on Dxp-16p and Dxp-24p

RFC 5905, Network Time Protocol Version 4: Protocol and Algorithms Specification is supported on D, Dxp, K5, K12, K30, T(A,N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

5.24 VPLS

RFC 4761, Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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Note:
On 7210 platforms, only BGP-AD is supported with TLDP signalling for PW. No BGP signalling is supported for PW establishment.

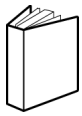
RFC 4762, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 5501, Requirements for Multicast Support in Virtual Private LAN Services is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

RFC 6074, Provisioning, Auto-Discovery, and Signaling in Layer 2 Virtual Private Networks (L2VPNs) is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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