7210 Service Access System

Release 26.9.R1

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

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1 Getting started

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

1.1 About this guide

This guide describes the OAM diagnostics and other tools supported on the following 7210 SAS platforms, operating in one of the modes described in Table 1: Supported modes of operation and configuration methods. If multiple modes of operation apply, they are explicitly noted in the topic.

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

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

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

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

- access-uplink mode of operation

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

- network mode of operation

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

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

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1.1.1 Document structure and content

This guide uses the following structure to describe features and configuration 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.
- 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.

  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**

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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.

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.

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

- **standalone**

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

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

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

- **standalone-VC**

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

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

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

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

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

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

Table 1: Supported modes of operation and configuration methods

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

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

1.3 7210 SAS port modes

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

- **access port mode**

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

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

- **access-uplink port mode**

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

2 See section7210 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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Access-uplink ports provide native Ethernet connectivity in service provider transport or in an infrastructure network. With this option, the encap-type can be configured to only QinQ. Access-uplink SAPs, which are QinQ SAPs, can only be configured on an access-uplink port to allow the operator to differentiate multiple services being carried over a single uplink port.

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

- **network port mode**

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

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

- **hybrid port mode**

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

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

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

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

Table 2: Supported port modes by mode of operation

Mode of operation	Supported port mode			
	Access	Network	Hybrid	Access-uplink
Access-Uplink	✓			✓
Network	✓	✓	✓	
Satellite[5]				
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 detailed 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 OAM configuration process

The following table lists the tasks necessary to configure mirroring and to perform OAM and other diagnostics 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:
   - This is one option.

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- 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 on the 7210 SAS.

2.1 Service mirroring

When troubleshooting complex operational problems, customer packets can be analyzed as they traverse the network. The Nokia service mirroring feature provides the capability to mirror customer packets to allow for troubleshooting and offline analysis. This capability 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 complex and costly to carry out on data networks. Service mirroring simplifies these tasks and reduces costs by centralizing analysis tools and using skilled technicians.

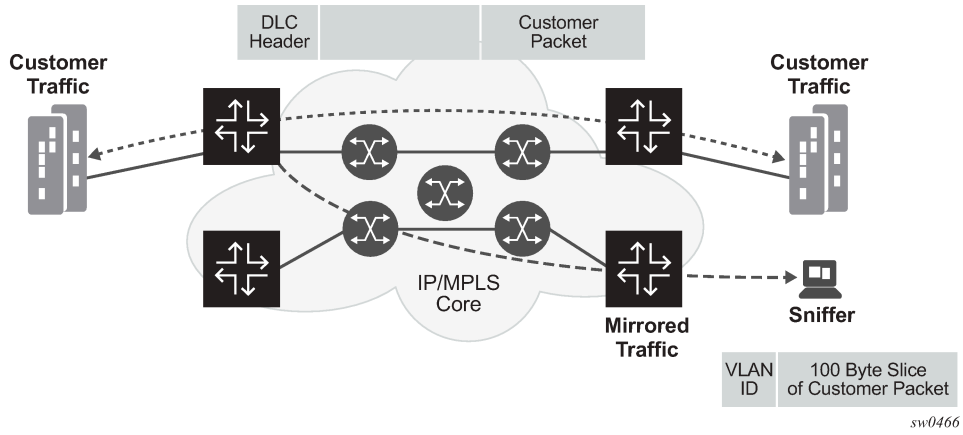
Original packets are forwarded while copies are sent out of the mirror source port to the mirror destination port. Service mirroring allows an operator to see the actual traffic on a customer service using a network analyzer (sniffer) in a central location. In many cases, this reduces the need for a separate, costly overlay sniffer network.

Mirroring is supported on the following 7210 SAS platforms:

- 7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-K 2F1C2T support local mirroring only
- 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C support both local and remote mirroring

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 for ingress or egress on specific service entities (for example: SAPs, ports, filter entries), which are referred to as mirror sources. A mirror copy of the packet is sent out of the mirror destination, which can be either a local mirror destination or remote mirror destination. For platform-specific support information about mirror sources and mirror destinations, see Mirror sources and destinations.

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

- When mirroring at ingress, ingress packets are mirrored as they appear on the wire. A copy of the ingress packet is encapsulated and sent to the mirror destination. Except for adding the required encapsulations, the content of the original packet is unchanged. The system performs normal packet handling and forwards the original packet to its destination. This behavior is important for troubleshooting encapsulation and protocol issues.

  There are some exceptions to this behavior; for example, on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C all packets received by the ingress processing pipeline are mirrored, whereas packets dropped by the pre-classifier modules are not mirrored. For more information about exceptions, see the *7210 SAS Software Release Notes 26.x.Rx*.
- When mirroring at egress on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, the mirrored packet is an exact copy of the forwarded packet. A mirror copy of the packet is created after the packet is processed by egress QoS, but before it is sent out to the wire.
- When mirroring at egress on the 7210 SAS-D and 7210 SAS-Dxp, the mirror packet is not an exact copy of the forwarded packet. The mirror packet contains an internal VLAN tag and does not contain the SAP tags contained in the forwarded copy of the packet. Because the mirror copy of the packet is created at egress before it is processed by egress QoS, the packet may be dropped by egress QoS mechanisms (such as RED mechanisms and so on) and may not be forwarded. However, the dropped packet is still mirrored.
- On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C, mirroring supports remote destinations as follows:
  - 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 sources and destinations

Mirror sources and destinations have the following characteristics for 7210 SAS devices:

- The source and destination can be on the same router (local) or on two different routers (remote). Mirrored packets are transported as follows:
  - **local mirroring**

    The 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C use VLANs (using a null, dot1q, or Q1.* SAP) for transport. For more information about mirror destination support of 7210 SAS platforms, see the final bullet point in this list.
  - **remote mirroring**

    The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C use MPLS SDP bindings for transport

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- Mirror destinations can terminate on egress virtual ports, which allow multiple mirror destinations to send to the same packet decoding device, delimited by IEEE 802.1Q (referred to as dot1q) tags. This is helpful when troubleshooting a multi-port issue within the network.
- Packets ingressing a port can have a mirror destination separate from packets egressing the same or a different port (the ports can be on separate nodes).
- Multiple mirror destinations are supported (local or remote) on some platforms.
- The number of mirror sources and destinations is different on different platforms. For the number of mirror destinations and sources supported on a platform, contact a Nokia representative.
- The operational state of a mirror destination depends on the state of all the outputs of the mirror. The mirror destination will go operationally down if all the outputs are down (for example, all **mirror-dest**>**sap** and **mirror-dest**>**spoke-sdp** entities are down). The state of a mirror destination does not depend on inputs, such as SDPs that are configured under **mirror-dest**>**remote-source** or **debug**>**mirror-source** entries.
- The mirror destination support available on the 7210 SAS platforms is as follows:
  - On the 7210 SAS-D and 7210 SAS-Dxp, you can use a null SAP or a dot1q SAP or a Q1.* SAP as the mirror destination for local mirroring. Use of the dot1q SAP or a Q1.* SAP as the mirror destination allows the mirror traffic to share the same uplink as the service traffic when the uplinks are L2 based. When using a dot1q SAP or a Q1.* SAP as the mirror destination, you must dedicate the resources of a port for use with the mirror application For more information, see Configuration guidelines.
  - On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, you can use a null SAP or a dot1q SAP or a Q1.* SAP as the mirror destination for local mirroring. Use of a dot1q SAP or a Q1.* SAP as the mirror destination allows the mirror traffic to share the same uplink as the service traffic when the uplinks are L2 based.
  - On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C, remote destination is supported.

2.2.1.1 Local and remote mirroring

Note:
The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C do not support the use of segment routing tunnels for remote mirroring.

Mirrored frames can be copied and sent to a specific local destination or service on the router (local mirroring) or copies can be encapsulated and sent to a different router (remote mirroring). This functionality allows network operators to centralize not only sniffer resources, but also the technical staff who operate them.

The router 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 Configuration guidelines.

Remote mirroring uses an SDP that acts as a logical way of directing traffic from one router to another through a uni-directional (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. You must create SDPs before you can configure services.

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2.2.2 Mirroring performance

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

The following table lists the mirroring support for mirror sources.

Table 5: Mirroring support

Mirroring	7210 SAS-D and 7210 SAS-Dxp	7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
Port (ingress and egress)	✓	✓
SAP (ingress only)	✓	✓
MAC filter (ingress only)	✓	✓
IP filter (ingress only)	✓	✓
SAP egress		✓

2.2.3 Mirroring configuration

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

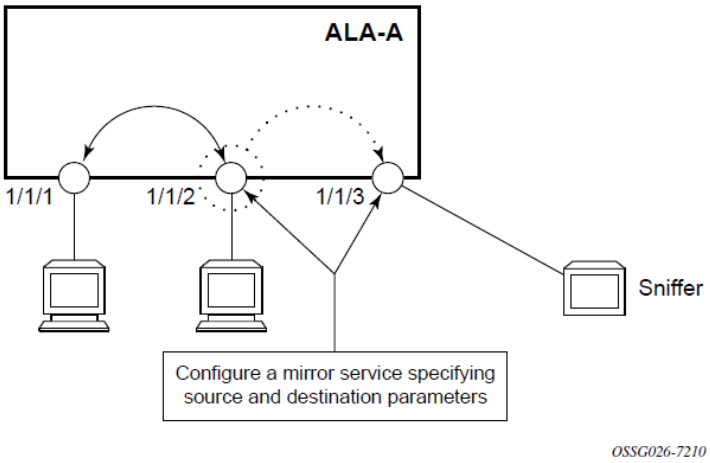
- mirror source - the traffic on specific points to mirror
- mirror destination - the location to send the mirrored traffic where the sniffer will be located

Figure 2: Local mirroring example 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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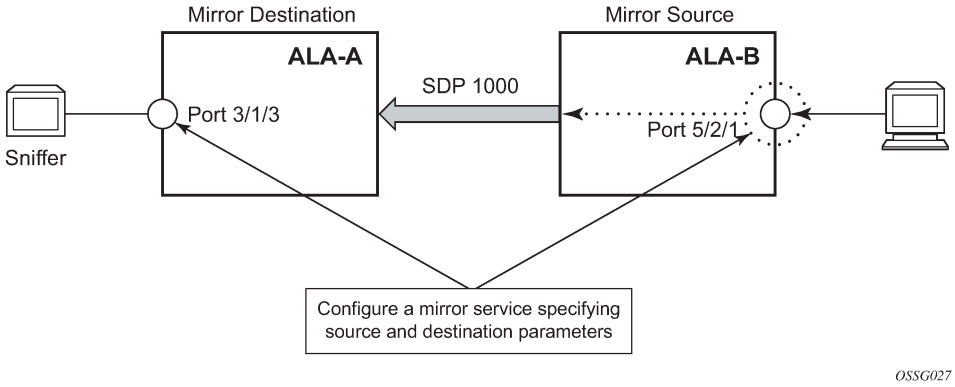
Figure 2: Local mirroring example



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.

Figure 3: Remote mirroring example



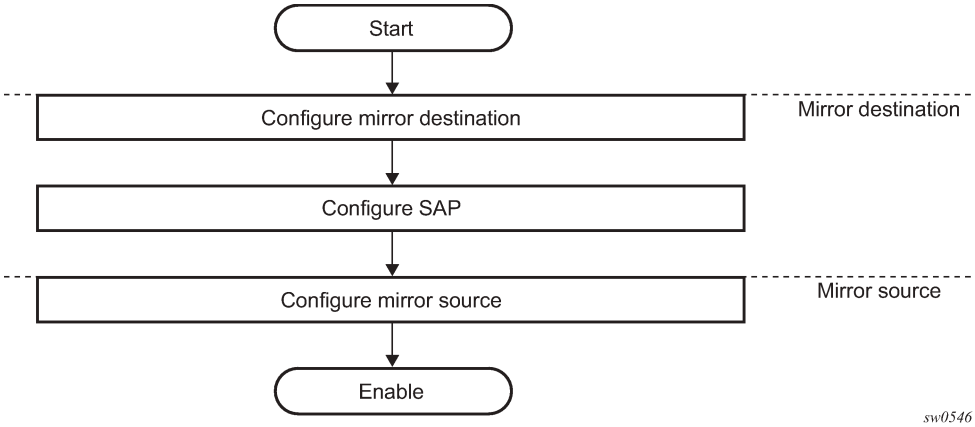
- Destination parameters are defined to specify where the mirrored traffic is sent. In this case, mirrored traffic sent to a SAP configured as part of the mirror service on port 3/1/3 on ALA-A (the mirror destination).
- ALA-A decodes the service ID and sends the traffic out of port 3/1/3.
- The sniffer is physically connected to this port (3/1/3). SAP, encapsulation requirements, packet slicing, and mirror classification parameters are configured in the destination parameters.

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2.3 Configuration process overview

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

Figure 4: Mirror configuration and implementation flow



2.4 Configuration guidelines

This section describes the following mirroring configuration caveats:

- 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-Dxp, 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 **config**>**system**>**loopback-no-svc-port mirror** CLI command. The user has the option to use either one of the available virtual internal port resources or a front panel port. The available virtual internal port resources can be determined using the **show**>**system**>**internal-loopback-ports detail** CLI command. No services can be configured on this port. See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide* for more information about both commands.
- On the 7210 SAS-D and 7210 SAS-Dxp, in case of port egress mirroring, one egress mirror source can be configured to only one mirror destination. In other words, with port egress mirroring multiple ports configured as mirror sources cannot use the same mirror destination.
- On the 7210 SAS-D, the software uses the resources associated with an internal port for mirror application. The user does not need to explicitly configure it.
- On the 7210 SAS-Dxp, the user can choose one of the three available loopback ports based on requirements. The three internal loopback ports (displayed using the **show**>**system**>**internal-loopback-ports** command) have different capacities; one port is 1GE capacity and two ports are 10GE capacity. When the user needs to mirror traffic to a dot1q SAP which exceeds 1GE but does not exceed 10GE, they must use a 10GE internal loopback port.
- The destination mirroring service IDs and service parameters are persistent between router reboots and are included in the configuration saves.

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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 or jabbers are not mirrored. Typically, only complete packets are mirrored.
- 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 shut down, 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 to delete a service ID or SAP association from the system.

  Mirror sources:

  – The default state for a mirror source for a specific 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 shut down to remove them from the system. When a mirror source is shut down, 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 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 the ingress of a service entity or egress of a service entity. The list of mirror sources supported on a specific platform is listed in Table 6: Mirror source port requirements .
- A SAP is defined in local mirror services as the mirror destination to where the mirrored packets are sent.
- The 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C support remote mirroring. An SDP is used to define the mirror destination on the source router to point to a remote destination (another router).

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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 the Nokia 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)
- 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 each platforms is different. For more information about the lists of packet fields available on each platforms, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C 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

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Example: Configuration output of a local mirrored service (ALA-A)

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









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

Example: Mirror source configuration output

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


     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 following entities: Port, SAP, MAC filter, and IP filter.

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 access uplink mode. Port mirroring is supported in the combinations listed in the following table.

Table 6: Mirror source port requirements

Port type	Port mode	Port encap type	Platforms
Ethernet	access	null, dot1q and QinQ	7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

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Port type	Port mode	Port encap type	Platforms
Ethernet	access uplink	qinq	7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C
Ethernet	network mode	null, dot1q	7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C

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

Example

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

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
```

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

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

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 …]
```

Example

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


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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:
IP and MAC filters cannot be applied to a mirror destination SAP.

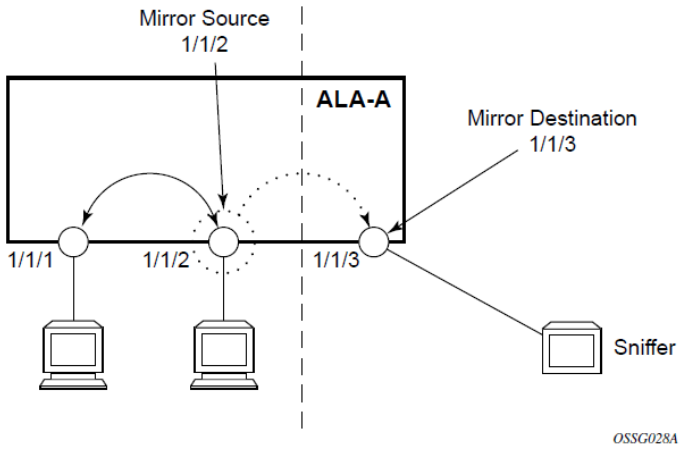
2.7 Common configuration tasks

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.

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



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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.

```
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. 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
```

Example: Configuration output using a NULL SAP

The following output displays an example of a local mirrored service using a NULL SAP. 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

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

            sap 1/1/24 create




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

Example: Configuration output using a dot1q SAP

The following output displays an example of local mirrored service using a dot1q SAP. 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.

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Note:

- On the 7210 SAS-D, the **loopback-no-svc-port** command is not needed. The software uses the resources associated with an internal port for the mirroring application.
- On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, the **loopback-no-svc-port** configuration is not needed.

```
*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: 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
```

2.7.2 Configuring a remote mirror service

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

Note:
Remote mirroring using MPLS SDPs is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C platforms. It is not supported on platforms 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*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 …]
```


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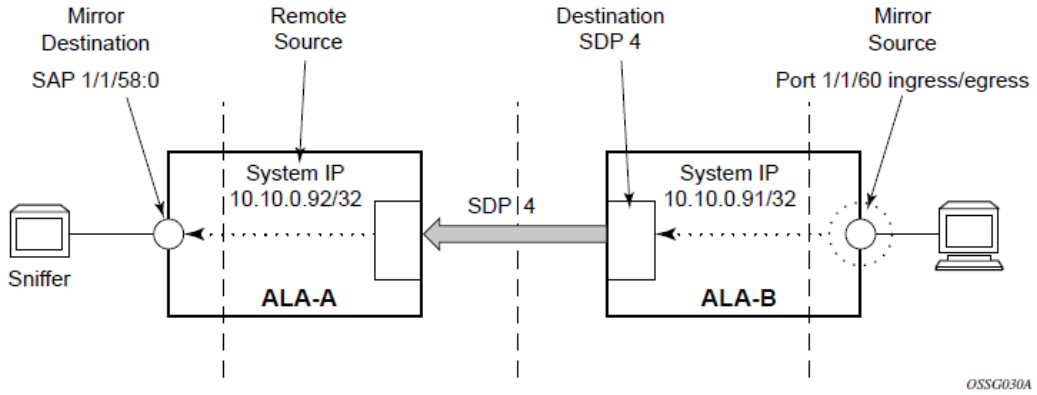
```
        port {port-id|lag lag-id} {[egress][ingress]}
        sap sap-id {[ingress]}
        no shutdown
```

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.

Figure 6: Remote mirrored service tasks



The following CLI output examples show 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: Configuration output

The following is a sample remote mirror destination output 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 10.2.2.2 ing-svc-label 14000
            exit
```


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

Example: Mirror destination configuration output for mirror service 1216 on ALA-A

```
*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 10.2.2.2 tldp
            exit
            sap 1/1/21:21 create
                egress
                    qos 1
                exit
            exit
            no shutdown
        exit
-------------------------------------------
*A:ALA-A>config>mirror#
```

Example: Remote mirror destination configuration output on ALA-B

```
*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
```


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

Example: Mirror source configuration output for ALA-B

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

Example: SDP configuration

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

```
*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 following service management tasks:

- Modifying a local mirrored service
- Deleting a local mirrored service

Use the following syntax to modify an existing mirrored service.

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


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```
            [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.

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

Example: Modifying 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: Configuration output of 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#
```


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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
```

2.9 Mirror service command reference

2.9.1 Command hierarchies

- Configuration commands
  - Mirror configuration commands for 7210 SAS-D and 7210 SAS-Dxp
  - Mirror configuration commands for 7210 SAS-K 2F1C2T
  - Mirror configuration commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
- Show commands
- Debug commands

2.9.1.1 Configuration commands

2.9.1.1.1 Mirror configuration commands for 7210 SAS-D and 7210 SAS-Dxp

```
config
    - mirror
        - mirror-dest service-id   [type encap-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
```


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2.9.1.1.2 Mirror configuration commands for 7210 SAS-K 2F1C2T

```
config
    - mirror
        - mirror-dest service-id   [type encap-type] [create]
        - no mirror-dest service-id
            - description description-string
            - no description
            - [no] fc [fc-name] [profile profile]
            - sap sap-id [create]
            - no sap
                - [no] egress
                    - [no] qos policy-id
            - service-name service-name
            - [no] service-name
            - [no] shutdown
```

2.9.1.1.3 Mirror configuration commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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

2.9.1.2 Show commands

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


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2.9.1.3 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
- Debug commands

2.9.2.1 Configuration commands

- Generic commands
- Mirror destination configuration commands

2.9.2.1.1 Generic commands

description

Syntax

description *description-string*

no description

Context

config>mirror>mirror-dest

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

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

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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

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

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

The operational state of the entity is disabled as well as the operational state of any entities contained within. Many objects must be shut down before they may be deleted.

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. Default administrative states for services and service entities are described in Special Cases.

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

Special Cases

Mirror Destination

When a mirror destination service ID is shut down, mirrored packets associated with the service ID are not accepted from the mirror source device, and the associated mirror source becomes operationally down. Mirrored packets are not transmitted out of the SAP. Each mirrored packet is silently discarded. If the mirror destination is a SAP, the SAP 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 shut down to remove them from the system.

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When a mirror source is shut down, 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 destination 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

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

Description

This command configures 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.

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

The mirror destination 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 using 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 destination 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 destination 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 the 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 shut down 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.

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Parameters

service-id

Specifies 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 where this service is defined.

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 with *service-id* 11 exists, a mirror destination with *service-id* 11 cannot be created.

Values 1 to 2147483647

type *encap-type*

Specifies the encapsulation type supported by the mirror service.

Values ether

mirror-source-type

Specifies 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. See Mirror sources and destinations for more information.

Values **local** — Specifies that the mirror service can be used only by local mirror sources.

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

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

Default local

mirror-dest

Syntax

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

no mirror-dest

Context

config>mirror

Platforms

7210 SAS-D, 7210 SAS-Dxp, and 7210 SAS-K 2F1C2T

Description

This command configures 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 destination service is comprised of destination parameters that define where the mirrored packets are to be sent. It also specifies whether the *service-id* receives mirrored packets from far-end devices over the network core.

The mirror destination 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 using 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 destination 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 destination 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 the 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 shut down first. The **mirror-dest** *service-id* must be shut down 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 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 where this service is defined.

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 with *service-id* 11 exists, a mirror destination with *service-id* 11 cannot be created.

Values 1 to 2147483647

type *mirror-type*

Specifies the encapsulation type supported by the mirror service.

Values ether

fc

Syntax

fc *fc-name* [**profile** *profile*]

no fc

Context

config>mirror>mirror-dest

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

This command configures a forwarding class for all mirrored 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 packet does not inherit the forwarding class of the original packet.

When the destination is on a SAP, a single egress queue is created that pulls buffers from the buffer pool associated with the *fc-name*.

On the 7210 SAS-D and 7210 SAS-Dxp, 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, a mirrored copy of the traffic sent out of the dot1q or Q1.* SAP shares the port-based egress queues with the other service traffic. Users can assign the profile (in addition to the forwarding class) to the mirrored copy of the packets, so that during periods of congestion, the mirrored copy of the packets that is marked as out-of-profile is dropped before in-profile service traffic (and possibly in-profile mirrored traffic, if mirrored traffic is configured as **in-profile**). The profile determines the slope policy for the packet and determines the packet drop precedence. Marking, if enabled, determines the marking value used in the packet header.

On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, the following QoS functionality is available for the mirror destination.

- A mirror destination that is a SAP on an access-uplink port uses port-based egress queues, which are shared by all the SAPs configured on the port. If the mirror destination SAP is configured to share an access-uplink port with service traffic, a mirrored copy of the traffic sent out of the port shares the port-based egress queues with other service traffic (and possibly in-profile mirrored traffic, if mirrored traffic is configured as **in-profile**). Users can assign the profile (in addition to the forwarding class) to the mirrored copy of the packets, so that during periods of congestion, the mirrored copy of the packets that is marked as out-of-profile is dropped before in-profile service traffic (and possibly in-profile mirrored traffic, if mirrored traffic is configured as **in-profile**). The profile determines the slope policy for the packet and determines the packet drop precedence. Marking, if enabled, determines the marking value used in the packet header.
- A mirror destination that is a SAP on an access port uses per-SAP egress queues. In this case, a SAP is dedicated for use as a mirror destination. Users can assign the profile (in addition to the forwarding class) to the mirrored copy of the packets, so that during periods of congestion, the mirrored copy of the packets that is marked as out-of-profile is dropped before in-profile service traffic (and possibly in-profile mirrored traffic, if mirrored traffic is configured as **in-profile**). The profile determines the slope policy for the packet and determines the packet drop precedence. Marking, if enabled, determines the marking value used in the packet header
- If the mirror destination is a SDP on an network port (applicable only to the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C), it uses per-port egress queues. Users can assign the profile (in addition to the forwarding class) to the mirrored copy of the packets, so that during periods of congestion, the mirrored copy of the packets that is marked as out-of-profile is dropped before in-profile service traffic (and possibly in-profile mirrored traffic, if mirrored traffic is configured as **in-profile**). The profile determines the slope policy for the packet and determines the packet drop precedence. Marking, if enabled, determines the marking value used in the packet header.

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

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

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Default

fc be profile 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* exists, 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 a mirrored copy of the service traffic. The profile is used to determine the slope policy for the packet and the packet drop precedence. Marking, if enabled, determines the marking value 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

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

Description

This command is used on a destination router in a remote mirroring solution. See the description of the remote-source command for more information.

This command allows the definition of accepted remote sources for mirrored packets to this *mirror-dest-service-id*. If a far end router has not been specified, packets sent to the router are discarded.

This command defines a remote source that may send mirrored packets to this 7210 SAS for handling by this mirror-dest *service-id*.

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

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

Values a.b.c.d

vc-id

Specifies the virtual circuit identifier.

Values 1 to 4294967295

ing-vc-label

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

The *ing-svc-label* parameter is entered into the ingress service label table and ingress packets with this service label are handled by this mirror destination service.

The *ing-svc-label* must not be 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

Keyword to specify the label is obtained through signaling via the LDP.

remote-source

Syntax

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

Context

config>mirror>mirror-dest

Platforms

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

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.

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

Specific far-end routers can be specified using the far-end command, which allows 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 reverts the *service-id* to the default condition, which does 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

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 on the router. The specified SAP must define an Ethernet port with a null, dot1q, or a Q1.* encapsulation type.

Note:

- Before using a dot1q or Q1.* SAP, users must dedicate a port for the mirroring application using the **config system loopback-no-svc-port** command. This is required only for the 7210 SAS-Dxp. For more information about this command, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide*.
- On the 7210 SAS-D and 7210 SAS-Dxp, a Q1.Q2 SAP cannot be used as a mirror destination SAP when the access port encapsulation is set to qinq or on an access-uplink port.

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- On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, a Q1.Q2 SAP cannot be used as a mirror destination SAP when the access port encapsulation is set to qinq or on an access-uplink port.

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 destination, or any other type, an error is generated.

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

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

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

Description

This command specifies an existing service name, which adds a name identifier to a specified service. The service name can be used to reference the service in configuration and show commands. This helps the service provider or administrator identify and manage services.

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 after it is initially created.

Parameters

service-name

Specifies a unique service name of up to 64 characters to identify the service. Service names may not begin with an integer (0 through 9).

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spoke-sdp

Syntax

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

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

no sdp *sdp-id:vc-id*

Context

config>mirror>mirror-dest

Platforms

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

Description

This command binds an existing mirror 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 shut down or operationally down, the SDP binding is down. When the binding is defined and the service and SDP are operational, the far-end router configured by the **config service sdp***sdp-id***far-end** command 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 router supports the use of 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 protocols 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.

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.

Note:
When using remote mirroring with spoke-SDP configured as a mirror destination, users must allocate resources of another port for use by this features. See Configuration guidelines for more information.

By default, no 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 bound to another router over the core network.

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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

Specifies a locally unique SDP ID. The SDP ID must exist. If the SDP ID does not exist, an error occur and the command does not execute.

Values 1 to 17407

vc-id

Specifies the virtual circuit identifier. 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. To avoid this, the mirror service SDP bindings now accept *vc-ids*.

Values 1 to 4294967295

name

Specifies the name of the endpoint associated with the SAP.

no-endpoint

Keyword that 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

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

Description

Commands in this context configure spoke SDP egress parameters.

vc-label

Syntax

vc-label *egress-vc-label*

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

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Context

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

Platforms

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

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

Description

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

qos

Syntax

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

Context

config> mirror> sap> egress

Platforms

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

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Description

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

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

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 associate with SAP egress. The QoS policy referred to by the *policy-id* is configured using the **config qos sap-egress** command.

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 for the specified application.

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

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Output

The following output is an example of debug 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**]

Context

show>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays mirror service information.

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 service information, and Table 7: Output fields: service-using mirror 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
```


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```
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 7: Output fields: service-using mirror

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.
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 or a service name up to 64 characters.

Values 1 to 2147483648, *svc-name*

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Output

The following output is an example of mirror configuration and operation information, and Table 8: Output fields: mirror destination describes the output fields.

Sample output — 7210 SAS-D, 7210 SAS-Dxp, or 7210 SAS-K 2F1C2T

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

===============================================================================
Mirror Service
===============================================================================
Service Id       : 1000                Type          : Ether
Description      : (Not Specified)
Admin State      : Up                  Oper State    : Up
Forwarding Class : be                  Remote Sources: No
Profile          : out

Destination SAP  : 1/1/1:10.*          Egr QoS Policy: 1

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

-Port                                  1/1/4                          Egr
-Port                                  1/1/7                              Ing
-SAP                                   1/1/1:20.*                         Ing
-IP Filter       1          Entry 1
-MAC Filter      1          Entry 1
```

Sample output — 7210 SAS-K 2F6C4T or 7210 SAS-K 3SFP+ 8C

```
*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$
```

Table 8: Output fields: mirror destination

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.
Admin State	Up — The mirror destination is administratively enabled. Down — The mirror destination is administratively disabled.

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Label	Description
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 SAP associated with this mirror destination service is defined.
Egr QoS Policy	Indicates the egress QoS policy ID. A value of 0 indicates that no QoS policy is specified.
mirror sources allowed	The type of mirror sources allowed to be configured.

2.9.2.3 Debug commands

mirror-source

Syntax

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

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 enables the mirroring of packets specified by the association of the **mirror-source** to sources of packets defined within the context of the mirror destination 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 destination service ID based on the following hierarchy:

1. filter entry
2. SAP
3. physical port

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The hierarchy is structured so the most specific match criterion 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; 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 destination 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** *svc-id* context 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 will be defined. The *service-id* must already exist within the system.

Values 1 to 2147483647

ip-filter

Syntax

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

no ip-filter *ip-filter-id*

no ip-filter *ip-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 configures the mirroring of packets that match specific entries in an existing IP filter.

The **ip-filter** command directs packets that 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 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 will not be enabled (there are no packets to mirror). When the IP filter is defined to a SAP or IP interface, mirroring is enabled.

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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 be mirrored to only 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** form of this command, without the **entry** keyword, removes mirroring on all *entry-id*s within the *ip-filter-id*.

When the **no** form of the 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 *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 occur for that *entry-id* and the command executes as usual.

Parameters

ip-filter-id

Specifies the IP 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 begins when the *ip-filter-id* is defined on a SAP or IP interface.

entry

Keyword that begins a list of *entry-id*s for mirroring.

entry-id

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

If the filter *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 criteria.

ipv6-filter

Syntax

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

no ipv6-filter *ip-filter-id*

no ipv6-filter *ip-filter-id* **entry** *entry-id* [*entry-id …*]

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

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

The **ipv6-filter** command directs packets that 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 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 will not be 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 be mirrored to only 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** form of this 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 as usual.

Parameters

ipv6-filter-id

Specifies 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.

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, and 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 *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 criteria.

mac-filter

Syntax

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

no mac-filter *mac-filter-id*

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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 that 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 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 is not 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.

The **no** form of this 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 as usual.

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.

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, and 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* must be manually added to the list, if mirroring is still desired.

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

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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 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. A port may be a single port or a 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 that have the **ingress** keyword defined. The same port may not be associated with multiple mirror source definitions that have the **egress** keyword 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 also take 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 mirror based on 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** keywords are specified in the **no** command, only the ingress or egress mirroring condition is removed.

Parameters

port-id

Specifies the port ID.

Values 1 to 10 (7210 SAS-D)
1 to 5 (7210 SAS-K 2F1C2T)
1 to 12 (7210 SAS-K 2F6C4T, 7210 SAS-Dxp)
1 to 11 (7210 SAS-K 3SFP+ 8C)

lag-id

Specifies the LAG identifier, expressed as a decimal integer.

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Values 1 to 5 (7210 SAS-D)
1 to 6 (7210 SAS-Dxp)
1 to 3 (7210 SAS-K 2F1C2T)
1 to 6 (7210 SAS-K 2F6C4T)
1 to 6 (7210 SAS-K 3SFP+ 8C)

egress

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

ingress

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

sap

Syntax

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

Context

debug>mirror-source

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables mirroring of traffic ingressing a 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** keyword that defines 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.The same SAP cannot be associated with multiple mirror source definitions for egress packets.

If a particular SAP is not associated with a mirror source name, that SAP will 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 is terminated. Mirroring of packets on the SAP can continue if more specific mirror criteria are configured. If the **ingress** keyword is specified in the **no** command, only the ingress mirroring condition is removed.

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Parameters

sap-id

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

ingress

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

egress

Keyword to specify that packets egressing the SAP should be mirrored. Egress packets are mirrored to the mirror destination before egress packet modification. Only supported on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

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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 that 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.

3.1.1 LSP diagnostics: LSP ping and trace

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

The following guidelines and restrictions apply:

- LDP LER ECMP is not supported. The following description on LDP ECMP as an LER node does not apply to 7210 SAS nodes.
- The 7210 SAS supports 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 7750 SR nodes, with 7210 SAS nodes acting as the LER node.
- The 7210 SAS does not support ECMP for BGP 3107 labeled routes. The description on use of ECMP routes for BGP 3107 labeled routes does not apply to the 7210 SAS. It is provided as follows for completeness and better understanding of the behavior in end-to-end network solution deployed using 7210 SAS and 7750 SR 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

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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.

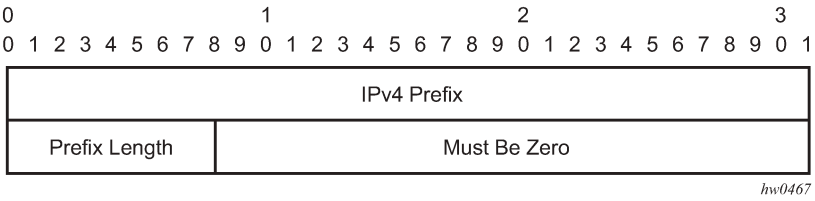
When the responder node has multiple equal cost next-hops for an LDP FEC prefix, the downstream mapping TLV can further be used to exercise a specific path of the ECMP set using the path-destination option. The behavior in this case is described in the following ECMP subsection.

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 structure is 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* [**profile** {**in**|**out**}]] [**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**]

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* [**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*] [**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

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to a BGP IPv4 label route. In other words 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:
The following restrictions apply for this section.

- LDP ECMP for LER and LSR is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.
- BGP 3107 labeled route ECMP is not supported on 7210 SAS platforms. References to BGP 3107 labeled 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.
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:

1. 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.
2. 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

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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.

3. 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, which is part of the same **destination-path** 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.
4. 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, which is part of the same **destination-path** 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.
5. 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.
6. 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.
7. 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 operates over a network using unnumbered links without any changes. LSP trace are modified such that the unnumbered interface is correctly encoded in the downstream mapping (DSMAP/DDMAP) TLV.

In an RSVP P2P 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 an LDP unicast 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.

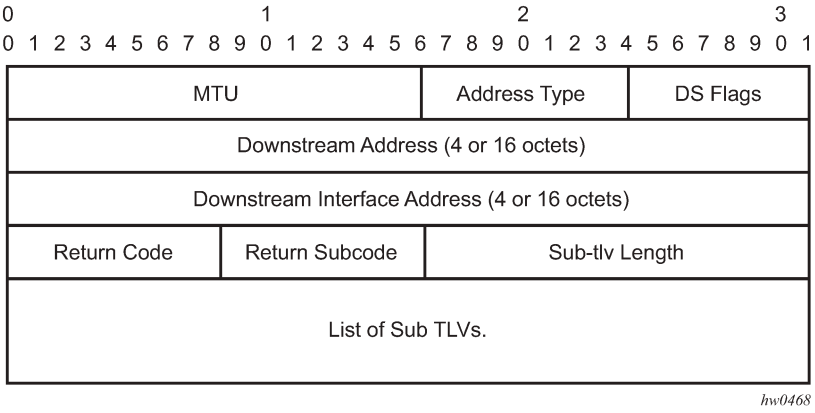
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3.1.1.4 Downstream Detailed Mapping (DDMAP) TLV

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

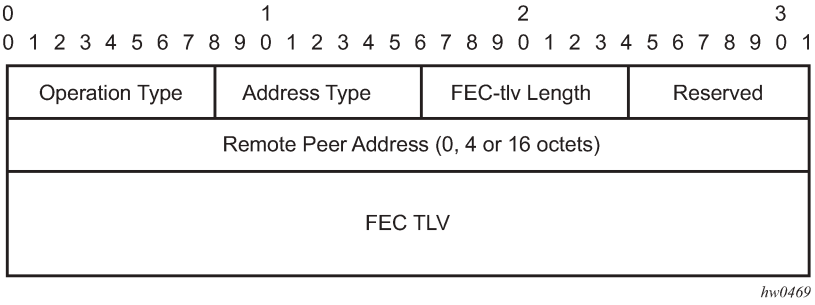
The DDMAP TLV provides with exactly the same features as the existing DSMAP TLV, plus the enhancements to trace the details of LSP stitching and LSP hierarchy. The latter is achieved using a new sub-TLV of the DDMAP TLV called the FEC stack change sub-TLV. Figure 8: DDMAP TLV and Figure 9: FEC stack change sub-TLV are 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



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.

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The following shows the command usage to configure which downstream mapping TLV to use globally on a system.

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 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 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.

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3.1.1.5 Using DDMAP TLV in LSP stitching and LSP hierarchy

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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

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.
   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.

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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 a 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

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. In other words, 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.
   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.

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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. 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), or 15 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 exists 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 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` since 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-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

MPLS OAM supports segment routing extensions to **lsp-ping** and **lsp-trace** as specified 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

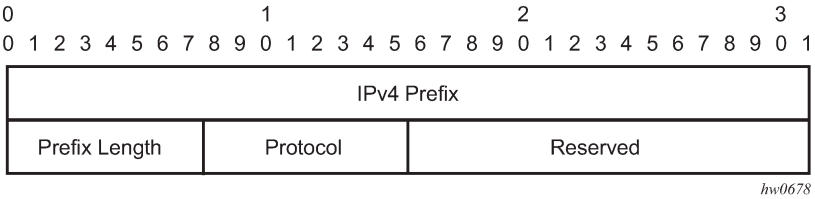
This section describes how MPLS OAM models the SR tunnel types.

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.

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

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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

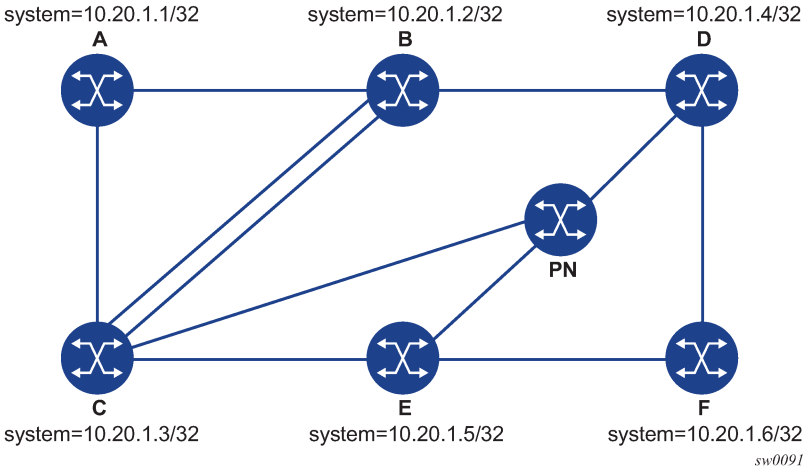
The following operating guidelines apply to **lsp-ping** and **lsp-trace**.

- 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



The following examples use the topology shown in the preceding figure.

Example: LSP-PING on DUT-A

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
```

Example: LSP-TRACE on DUT-A (DSMAP TLV)

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
```

Example: LSP-TRACE on DUT-A (DDMAP TLV)

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

Example: LSP trace for LDP-to-SR direction

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.
10.3.2
2  10.20.1.2  rtt=4.32ms rc=3(EgressRtr) rsc=1
*A:Dut-E#
```

Example: LSP trace for SR-to-LDP direction

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

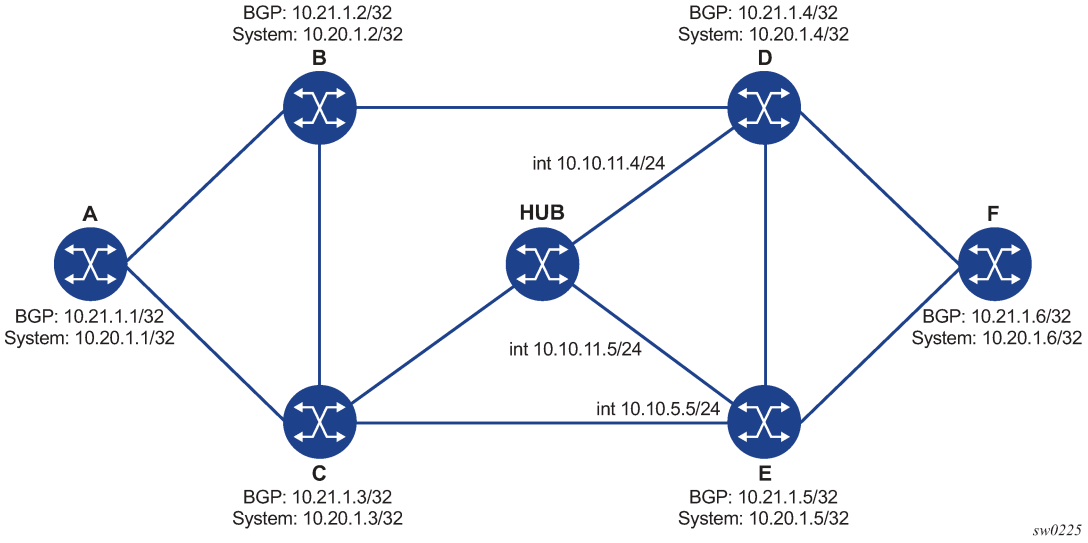
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transport tunnel at both ingress PE and at the ABR or ASBR. The list of downstream next-hops is reported in the DSMAP or DDMAP TLV.

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.

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

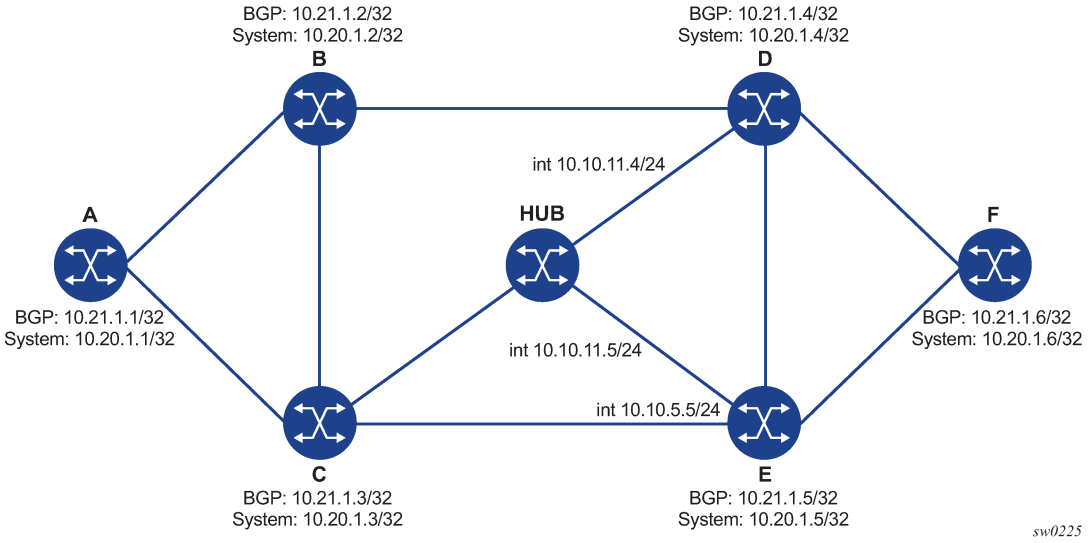

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Example: BGP over SR-ISIS

```
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



Example: 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
     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)
```


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```
            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 SDP diagnostics

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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

3.1.3.1 SDP ping

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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. Because 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
- round trip forwarding class mapping

3.1.3.2 SDP MTU path discovery

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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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).

3.1.4 Service diagnostics

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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

3.1.5 Epipe diagnostics

The Epipe diagnostic tool is described in the CPE ping for Epipe section. CPE ping for Epipe provides the ability to check network connectivity to the specified client device within the Epipe.

3.1.5.1 CPE ping for Epipe

Note:

- CPE ping for Epipe is only supported on the 7210 SAS-Dxp 12p, 7210 SAS-Dxp 16p, 7210 SAS-Dxp 24p, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.
- This feature does not support IPv6 CPEs.

The **cpe-ping** command is supported for local and distributed Epipe services. Any PE in an Epipe service can be the source PE, and users can apply the **cpe-ping** command on any PE to launch a test. The source PE builds an ARP request and sends it in the Epipe as if it came from a customer device by encapsulating the request using its chassis MAC as the source MAC address.

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The ARP request then egresses the remote PE device as any other packet on the Epipe. The remote CPE device responds to the ARP, and the reply is transparently sent on the Epipe toward the source PE. The source PE looks for a match on its chassis MAC in the inner customer DA. If a match is found, the source PE device intercepts this response packet.

This method is supported regardless of whether the network uses SDPs or SAPs. This feature is configured using the existing **oam>cpe-ping** command.

3.1.6 VPLS MAC diagnostics

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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.

- 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.

3.1.6.1 MAC ping

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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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 OAM label after 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.

3.1.6.2 MAC trace

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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 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).

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The Reply Mode is either 3 (that is, reply via the control plane) or 4 (tha 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.

3.1.6.3 CPE ping

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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 IP address of being learned by the CE.

3.1.6.4 MAC populate

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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).

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.

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

3.1.6.5 MAC purge

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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.

3.1.7 VLL diagnostics

This section describes VLL diagnostics.

3.1.7.1 VCCV ping

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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.

3.1.7.1.1 VCCV ping application

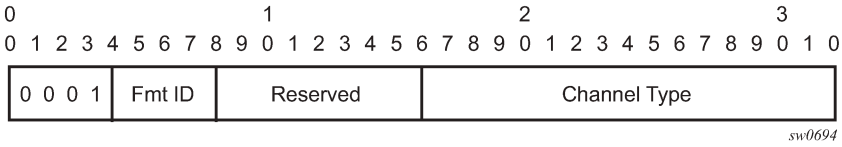
Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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 shown in the following figure.

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Figure 14: OAM control word format



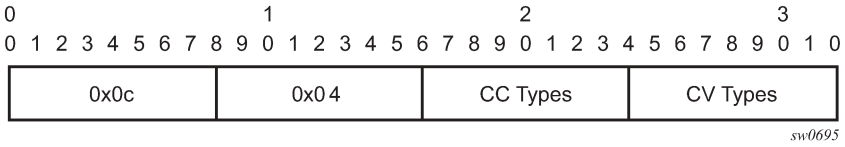
The first nibble is set to 0x1. The Format ID and the reserved fields are set to 0 and the channel type is the code point associated with the VCCV IP control channel as specified in the PWE3 IANA registry (RFC 4446). The channel type value of 0x21 indicates that the Associated Channel carries an IPv4 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 7210 SAS, X PE node will only advertise the router alert label as the CC capability in the Label Mapping message. This method is supported by the 7210 SAS.

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 by 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 format of the VCCV TLV is shown in the following figure.

Figure 15: VCCV TLV



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 14: 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, then 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) bit mask 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 types 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 Pseudo-wire". 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:

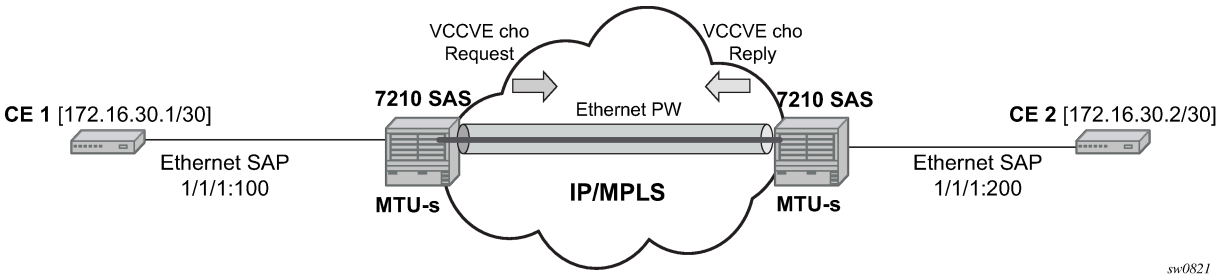
Reply mode, meaning:

1. Do not reply. This mode is supported by the 7210 SAS.
2. Reply via an IPv4 UDP packet. This mode is supported by the 7210 SAS.
3. Reply with an IPv4 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 inband 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 (Figure 16: VCCV ping application) 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.

Figure 16: VCCV ping application



3.1.7.1.2 VCCV ping in a multi-segment pseudowire

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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. Pseudo-wire 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*.

3.1.7.2 Automated VCCV-trace capability for MS-pseudowire

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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 Pseudowire*, 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 pseudo-wire 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 **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.

3.1.7.2.1 VCCV for static pseudowire segments

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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.

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3.1.7.2.2 Detailed VCCV-trace operation

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

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

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.

3.1.7.2.3 Control plane processing of a VCCV echo message in a MS-pseudo-wire

Note:
This feature is only supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C.

3.1.7.2.3.1 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-TLV's 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.

3.1.7.2.3.2 Receiving a 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.

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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.

3.1.7.2.3.3 Receiving a 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.

3.2 IP performance monitoring

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

3.2.1 Two-Way Active Measurement Protocol

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.

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- By default, the 7210 SAS uses TCP port number 862 to listen for TWAMP control connections. This is not user configurable.

3.2.2 Two-Way Active Measurement Protocol Light

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

TWAMP Light is an optional model included in the TWAMP standard RFC 5357 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 (*A Two-Way Active 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, 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 a 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 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. If 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**>**test-oam**>**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

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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-PM section of this guide provides more information describing the integration of TWAMP Light and the OAM-PM architecture, including hardware dependencies.

The following TWAMP Light functions are supported on the 7210 SAS-K 2F1C2T:

- base router instance for IES services
- IPv4 (must be unicast)
- reflector prefix definition for acceptable TWAMP Light sources:
  - A 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 TWAMP Light functions are supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C:

- base router instances for network interfaces and IES services
- per-VPRN service context
- IPv4 and IPv6 (must be unicast):
- reflector prefix definition for acceptable TWAMP Light sources:
  - A 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.

Example: Reflector configuration output

The following sample reflector configuration output shows the use of TWAMP Light to monitor two IP endpoints in a VPRN service on the 7210 SAS, including the default TWAMP Light values that were not overridden with configuration entries.

```
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
```


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```
                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
            exit
            no shutdown
-------------------------------------------------------------------------------
```

Example: Session controller configuration output

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


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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 ether-type 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 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 9: ETH-CFM acronym expansions

Acronym	Expansion
1DM	One way Delay Measurement (Y.1731)
AIS	Alarm Indication Signal
BNM	Bandwidth Notification Message (Y.1731 sub OpCode of GNM)
CCM	Continuity Check Message
CFM	Connectivity Fault Management
DMM	Delay Measurement Message (Y.1731)
DMR	Delay Measurement Reply (Y.1731)
GNM	Generic Notification Message
LBM	Loopback Message
LBR	Loopback Reply
LTM	Linktrace Message
LTR	Linktrace Reply
ME	Maintenance Entity
MA	Maintenance Association
MA-ID	Maintenance Association Identifier

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Acronym	Expansion
MD	Maintenance Domain
MEP	Maintenance Association Endpoint
MEP-ID	Maintenance Association Endpoint Identifier
MHF	MIP Half Function
MIP	Maintenance Domain Intermediate Point
OpCode	Operational Code
RDI	Remote Defect Indication
TST	Ethernet Test (Y.1731)

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, discussion 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, as follows:

- **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 IEEE format options, as follows:

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- 1 (Primary VID) - Values 0 — 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 — 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 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 10: ETH-CFM support matrix for 7210 SAS-D, Table 11: ETH-CFM support matrix for 7210 SAS-Dxp, Table 12: ETH-CFM support matrix for 7210 SAS-K 2F1C2T, Table 13: ETH-CFM support matrix

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for 7210 SAS-K 2F6C4T, and Table 14: ETH-CFM support matrix for 7210 SAS-K 3SFP+ 8C are general tables that indicates the ETH-CFM support for the different services and endpoints. They are not meant to indicate the services that are supported or the requirements for those services on the individual platforms.

Table 10: ETH-CFM support matrix for 7210 SAS-D

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)	✓	✓	✓		✓ [9]
R-VPLS	SAP					
IES	IES IPv4 interface					
	SAP					

Table 11: ETH-CFM support matrix for 7210 SAS-Dxp

Service	Ethernet Connection Type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP (access and access-uplink SAP)	✓	✓	✓	✓	✓ [9]
VPLS	SAP (access and access-uplink SAP)	✓	✓	✓		✓ [9]
R-VPLS	SAP					
IES	IES IPv4 interface					
	SAP					

[9] Supported only with Up MEP and dot1q range SAPs. See the 7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Services Guide for more information.

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Table 12: ETH-CFM support matrix for 7210 SAS-K 2F1C2T

Service	Ethernet Connection Type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP (access and access-uplink SAP)	✓	✓	✓	✓	✓ [10]
VPLS	SAP (access and access-uplink SAP)	✓	✓	✓	✓	
R-VPLS	SAP					
IES	IES IPv4 interface					
	SAP					

Table 13: ETH-CFM support matrix for 7210 SAS-K 2F6C4T

Service	Ethernet Connection Type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP (access and access-uplink SAP)	✓	✓	✓	✓	
	Spoke-SDP	✓	✓	✓	✓	
VPLS	SAP (access and access-uplink SAP)	✓	✓	✓	✓	
	Spoke-SDP	✓	✓	✓	✓	
	Mesh-SDP	✓	✓	✓	✓	
R-VPLS	SAP					
	IP interface (IES or VPRN)					

[10] Supported for Up MEPs only

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Service	Ethernet Connection Type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
IES	IES IPv4 interface					
	SAP					

Table 14: ETH-CFM support matrix for 7210 SAS-K 3SFP+ 8C

Service	Ethernet Connection Type	MEP		MIP		Primary VLAN
		Down MEP	Up MEP	Ingress MIP	Egress MIP	
Epipe	SAP (access and access-uplink SAP)	✓	✓	✓	✓	✓ [10]
	Spoke-SDP	✓	✓	✓	✓	
VPLS	SAP (access and access-uplink SAP)	✓	✓	✓	✓	
	Spoke-SDP	✓	✓	✓	✓	
	Mesh-SDP	✓	✓	✓	✓	
R-VPLS	SAP					
	IP interface (IES or VPRN)					
IES	IES IPv4 interface					
	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 17: MEP and MIP

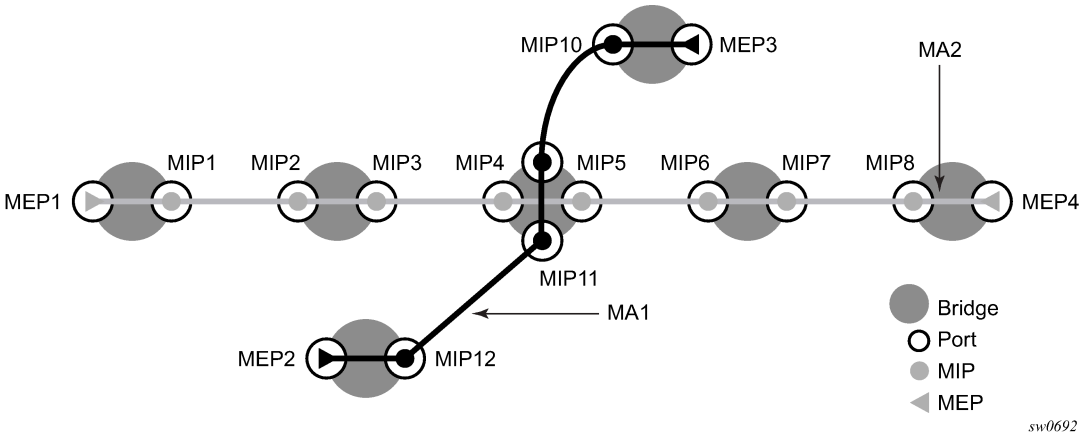
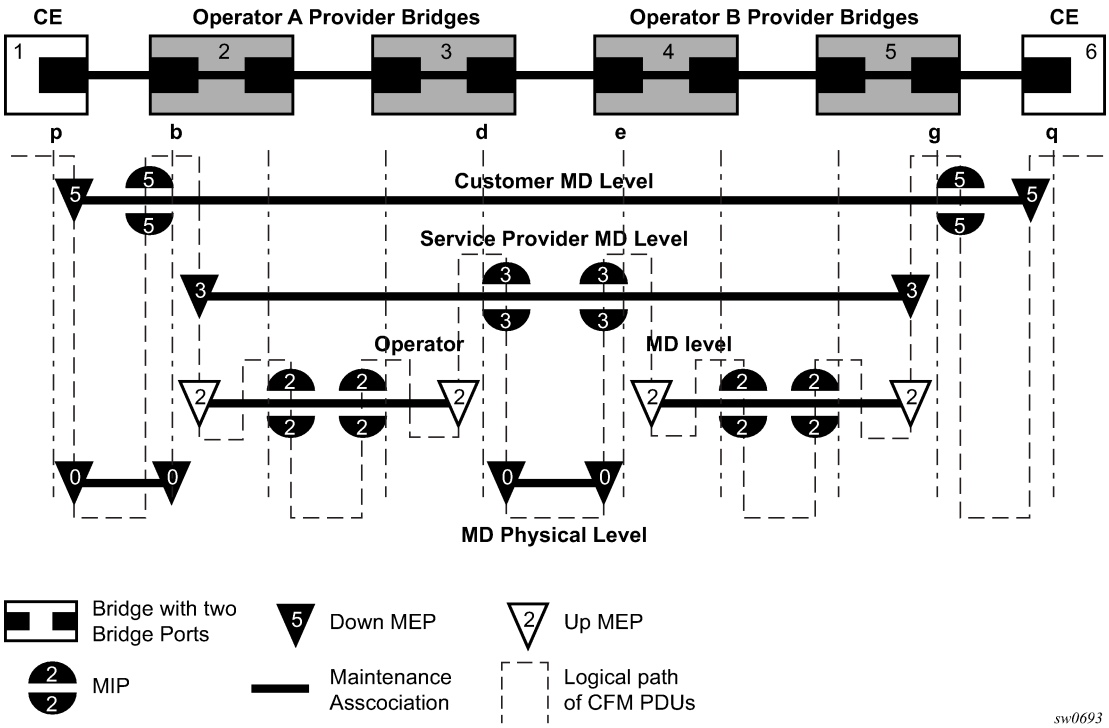


Figure 18: MEP, MIP and MD levels

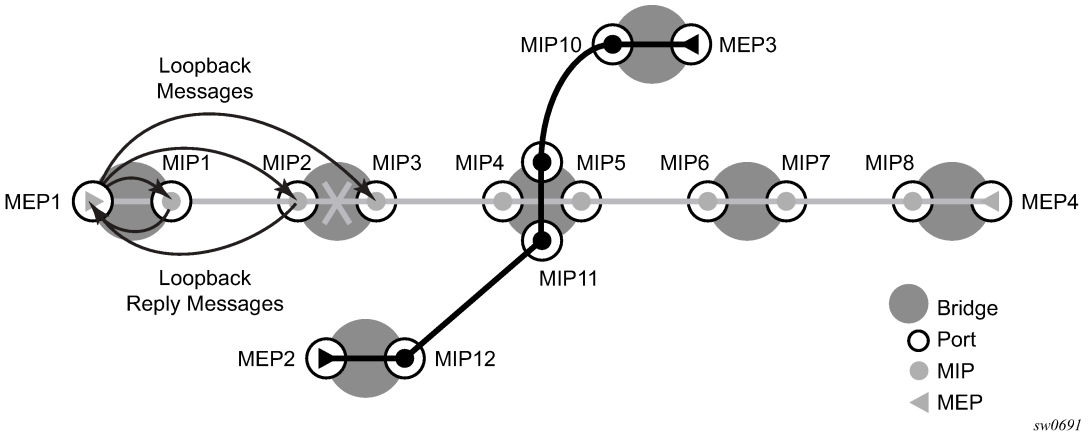


3.3.1.1 Loopback

A loopback message is generated by a MEP to its peer MEP (Figure 19: CFM loopback). The functions are similar to an IP ping to verify Ethernet connectivity between the nodes.

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Figure 19: 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 a MEP and targeted to a peer MEP in the same MA and within the same MD level (see Figure 20: 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 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 determine the route to the target bridge.

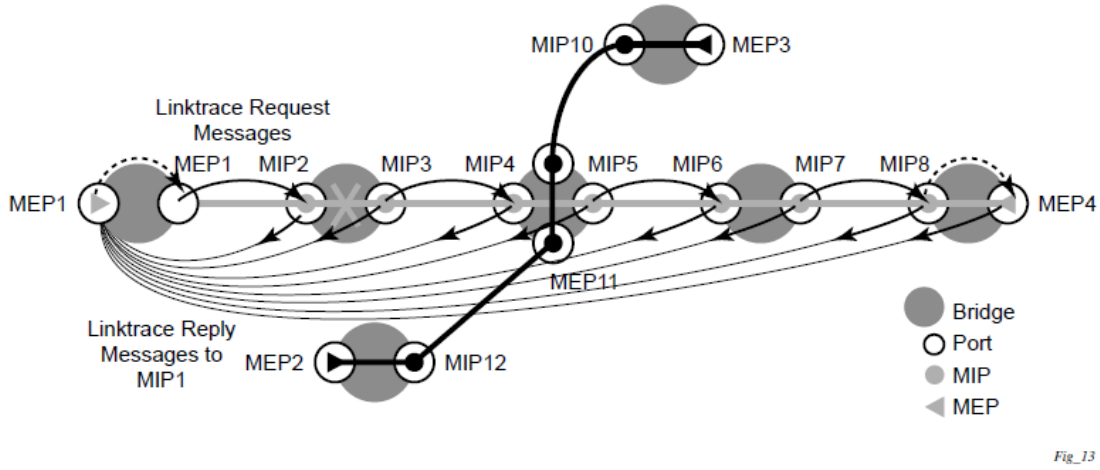
A traced MAC address (the targeted MAC address) is carried in the payload of the linktrace message. Each MIP and MEP receiving the linktrace message checks whether it has learned the target MAC

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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 20: CFM linktrace



The following linktrace-related functions are supported:

- Linktrace functions can be enabled or disabled on a MEP.
- A MEP supports generating linktrace messages and responding with linktrace reply messages.
- 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.
- 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.

Example

The following display output shows the Sender ID TLV contents if they are included in the LBR.

```
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.
```

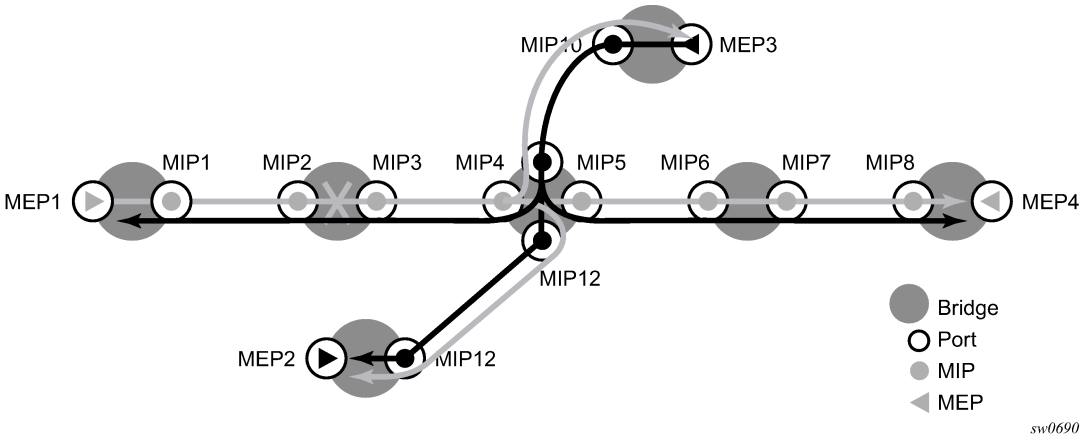
3.3.1.3 Continuity Check (CC)

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.

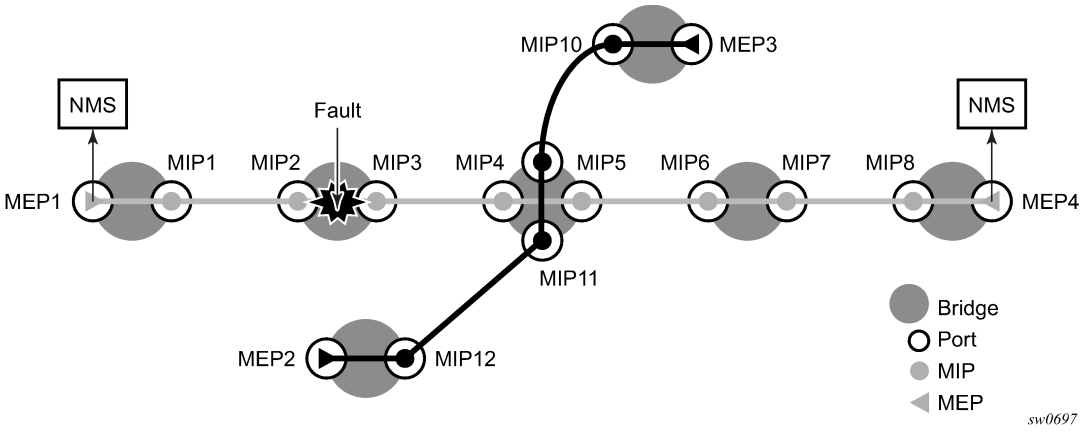
The following figure shows a CFM continuity check.

Figure 21: CFM continuity check



The following figure shows a CFM CC failure scenario.

Figure 22: CFM CC failure scenario



The following functions are supported:

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- CC can be enabled or disabled for a 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 can be configured for 100 ms (only supported on the 7210 SAS-D).

  When configuring MEPs with subsecond CCM intervals, bandwidth consumption must be taken into consideration. Each CCM PDU is 100 bytes (800 bits). Taken individually, this is a small value. However, the bandwidth consumption increases rapidly as multiple MEPs are configured with 10 ms timers, 100 packets per second. Subsecond CCM-enabled MEPs are supported on the following:

  – Down MEPs configured on Ethernet SAPs.

  – Lowest MD-level, when multiple MEPs exist on the same Ethernet SAP.

  – Individual Ethernet tunnel paths requiring EAPs but not on the Ethernet tunnel itself. This requires the MEPs to be part of the Y.1731 context because of the EAPS.
- The CCM will declare a fault when:
  – the CCM stops hearing from one of the remote MEPs for 3.5 times the 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 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 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 TLV is supported for service (**id-permission**) MEPs.

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.

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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 timestamp capability

Timestamps for different Y.1731 messages are obtained as follows:

- The 7210 SAS-D 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 for computing 1-way delay.
  - 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. It uses the system clock (free-running or synchronized to NTP) to obtain the timestamps.
- For the 7210 SAS-Dxp, Y.1731 2-DM and 1-DM messages for both Down MEPs and Up MEPs use software-based timestamps on Tx and hardware-based timestamps on Rx. Timestamps are obtained from the system clock, which is free-running or synchronized to NTP.
- The 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C support hardware time-stamping for Y.1731 1-DM, 2-DM and SLM. The timestamp values are obtained using a synchronized clock. The synchronized clock provides timestamp values as follows:
  - When neither PTP nor NTP is enabled in the system, the synchronized clock is same as free-run system clock. Therefore, accurate two-way delay measurements are possible. However, one-way delay measurements can result in unexpected values.
  - When NTP is enabled in the system, the synchronized clock is derived by the NTP clock.
  - When PTP is enabled in the system, the synchronized clock is derived by PTP clock.

Note:
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.

3.3.2.1 One-way delay measurement (ETH-1DM Y.1731)

One-way delay measurement allows the operator the ability to check unidirectional delay between MEPs. An ETH-1DM packet is time stamped by the generating MEP and sent to the remote node. The remote node time stamps the packet on receipt and generates the results. The results, available from the receiving MEP, will indicate the delay and jitter. Jitter, or delay variation, is the difference in delay between tests. This means the delay variation on the first test will not be valid. It is important to ensure that the clocks are

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synchronized on both nodes to ensure the results are accurate. NTP can be used to achieve a level of wall clock synchronization between the nodes.

3.3.2.2 Two-way delay measurement (ETH-DMM Y.1731)

Two-way delay measurement is similar to one way delay measurement except it measures the round trip delay from the generating MEP. In this case wall clock synchronization issues will not influence the test results because four timestamps are used. This allows the remote nodes time to be removed from the calculation and as a result clock variances are not included in the results. The same consideration for first test and hardware based time stamping stated for one way delay measurement are applicable to two-way delay measurement.

Delay can be measured using one-way and two-way on demand functions. The two-way test results are available single-ended, test initiated, calculation and results viewed on the same node. There is no specific configuration under the MEP on the SAP to enabled this function. The latest test result is stored for viewing. Further tests will overwrite the previous results. Delay Variation is only valid if more than one test has been executed.

Example: On demand test and results

```
oam eth-cfm two-way-delay-test d0:0d:1e:00:01:02 mep 101 domain 4 association 1

Two-Way-Delay-Test Response:
Delay 2955 microseconds        Variation 111 microseconds

# show eth-cfm mep 101 domain 4 association 1 two-way-delay-test
===============================================================
Eth CFM Two-way Delay Test Result Table
===============================================================
Peer Mac Addr         Delay (us)          Delay Variation (us)
---------------------------------------------------------------
d0:0d:1e:00:01:02     2955                111
```

3.3.3 ITU-T Y.1731 Ethernet Bandwidth Notification

Note:
This feature is supported only on the 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T.

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-**

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

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.

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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-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C 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).

The following table shows the BNM PDU format fields.

Table 15: 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

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Label	Description
	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.

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 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. No other CFM and Y.1731 messages are supported on these port-based MEPs.

Note:
Port-based MEPs are designed to be used with the ETH-BN application. Nokia recommends not to use port-based MEPs for other applications.

3.3.5 ETH-CFM statistics

Note:
The ETH-CFM statistics feature is supported on all platforms as described in this document, except the 7210 SAS-D.

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.

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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 ...

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 pre-standard and will not inter-operate with future releases of SLM or SLR that supports the standard OpCode values.

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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 multi-point 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. Nokia 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 packets are the number of packets 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. 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. Since 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 wish 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.

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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. Since the same MAC for multiple MEPs is only truly valid on the same remote node this should is an acceptable approach

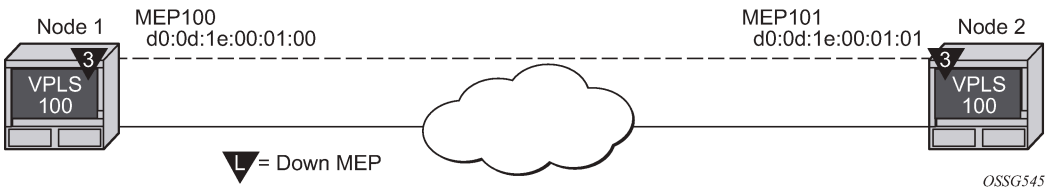
There is no way for the responding node to understand when a test is completed. For this reason a configurable "inactivity-timer" determines the length of time a test is valid. The timer will maintain an active test as long as it is receiving packets for that specific test, defined by the test-id, remote 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.

3.3.6.1 Configuration example

The following figure shows the configuration required for proactive SLM test using SAA.

Figure 23: SLM example



Example

The following is a sample MIB output of an on-demand test. Node1 is tested for this example. The SAA configuration does not include the accounting policy required to collect the statistics before they

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are overwritten. NODE2 does not have an SAA configuration. NODE2 includes the configuration to build the MEP in the VPLS service context.

```
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
```

```
----------------------------------------------
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
            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#
```


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Example

The following sample output is meant to demonstrate the different loss conditions that an operator may see. The total number of attempts is "100" is because the final probe in the test was not acknowledged.

```
*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
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
```


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

Example

The following is an example of an on demand tests that and the associated output. Only single test runs are stored and can be viewed after the fact.

```
#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.

These are default behavioral changes without CLI options.

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3.3.8 ETH-CFM configuration guidelines

Note: For information about CPU protection for ETH-CFM, see "ETH-CFM ingress squelching" in the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C System Management Guide*.

The following are ETH-CFM configuration guidelines:

- The 7210 SAS platforms support only ingress MIPs in some services or bidirectional MIPs (that is, ingress and egress MIPs) in some services. Table 10: ETH-CFM support matrix for 7210 SAS-D, Table 11: ETH-CFM support matrix for 7210 SAS-Dxp, Table 12: ETH-CFM support matrix for 7210 SAS-K 2F1C2T, Table 13: ETH-CFM support matrix for 7210 SAS-K 2F6C4T, and Table 14: ETH-CFM support matrix for 7210 SAS-K 3SFP+ 8C list the MIP and MEP support for different services on different platforms.
- On the 7210 SAS-D and 7210 SAS-Dxp, Up MEPs cannot be created by default on system bootup. Before Up MEPs can be created, the user must first use the commands in the following context to explicitly allocate hardware resources for use with this feature.

  ```
  configure system resource-profile
  ```

  The software will reject the configuration to create an Up MEP and generate an error until resources are allocated. See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide* for more information.
- On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, no explicit resource allocation is required before configuring Up MEPs.
- On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, all MIPs are bidirectional. A MIP responds to OAM messages that are received from the wire and also responds to OAM messages that are being sent out to the wire. MIP support for SAP, SDP bindings, and services varies. See the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Services Guide* for more information.
- 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.

  This behavior is applicable to all 7210 SAS platforms where the feature supported has been added in both access-uplink mode and network mode of operation. See the *7210 SAS Software Release Notes 26.x.Rx* for more information about which platform and MEPs or MIPs support this feature.
- To enable DMM version 1 message processing on the 7210 SAS-D (access-uplink mode) and 7210 SAS-Dxp (access-uplink mode) platforms, the following command must be used.

  ```
  configure eth-cfm system enable-dmm-version-interop
  ```
- To achieve better scaling on the 7210 SAS-D and 7210 SAS-Dxp, Nokia recommends that the MEPs are configured at specific levels. The recommended levels are 0, 1, 3, and 7.
- Ethernet rings are not configurable under all service types. Any service restrictions for the MEP direction or MIP support will override the generic capability of the Ethernet ring MPs. For more information about Ethernet rings, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide*.

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- The supported minimum CCM transmission interval values vary depending on the MEP type and 7210 SAS platform. The following table lists the supported minimum CCM timer values.

Table 16: Minimum CCM transmission interval value support by 7210 SAS platform

Platform	G.8032 down MEP	Service down MEP	Service up MEP
7210 SAS-D	100 ms	100 ms	1 s
7210 SAS-Dxp	10 ms	1 s	1 s
7210 SAS-Dxp 12p	3.3ms/300Hz	N/A	N/A
7210 SAS-K 2F1C2T	10 ms	1 s	1 s
7210 SAS-K 2F6C4T	10 ms	1 s	1 s
7210 SAS-K 3SFP+ 8C	10 ms	1 s	1 s

- Sender-ID TLV processing is supported only for service MEPs. It is not supported for G.8032 MEPs.

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).

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 comprised 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

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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.

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 specific MEP levels
- sending CCM with interface status TLV "down"
- stopping CCM transmission

Note:
7210 SAS 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 7210 SAS-D and 7210 SAS-Dxp, 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.

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

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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.

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. Since 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 Service down

This section describes procedures for the scenario where an Epipe service is down when service is administratively shutdown. When service is administratively shutdown, the fault is propagated to the SAP/SDP-bindings in the service.

3.4.3.3 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 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.

3.4.3.4 802.3ah 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.

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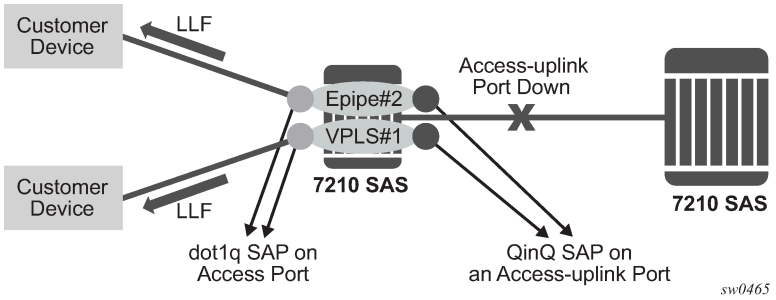
3.4.4 Fault propagation to access dot1q/QinQ ports with access-uplink ports

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 24: 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 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 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.

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3.4.4.1.1 Configuration example for fault propagation using oper-group

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:
For more information about the CLI, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Basic System Configuration Guide*.

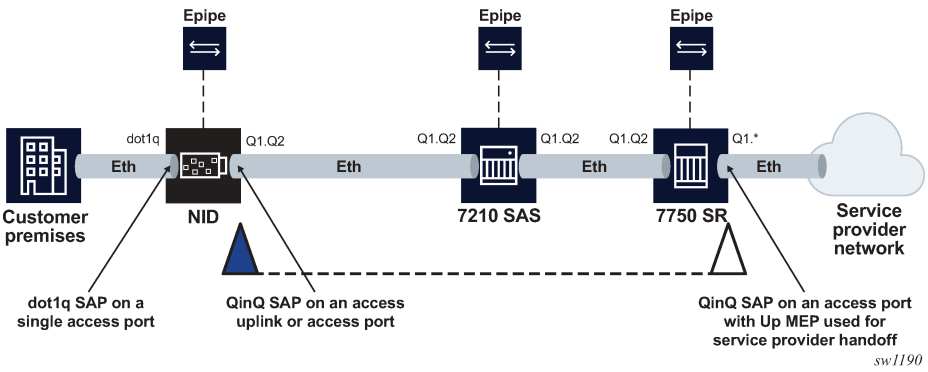
3.4.5 Fault propagation to access port using CFM on uplinks

Note:
This feature is not supported on the 7210 SAS-D.

Fault propagation allows the user to track an Epipe service link connectivity failure and propagate the failure toward customer devices connected to access ports.

The following figure shows an example Epipe service architecture.

Figure 25: Example Epipe service architecture



In the preceding figure, the 7210 SAS node is deployed as the network interface device (NID) and the customer premises equipment (CPE) is connected to the 7210 SAS over a dot1q SAP (may be a single VLAN ID dot1q SAP, range dot1q SAP, or default dot1q SAP). The 7210 SAS adds an S-tag to the packet received from the customer, and the packet is transported over the backhaul network to the service edge, which is typically a 7750 SR node acting as an external network-to-network interface (ENNI) where the service provider (SP) is connected. At the ENNI, the 7750 SR hands off the service to the SP over a SAP.

Service availability must be tracked end-to-end between the uplink on the 7210 SAS and the customer hand-off point. If there is a failure or a fault in the service, the access port toward the SP is brought down. For this reason, a Down MEP is configured on the 7210 SAS access-uplink SAP facing the network, or alternatively, an Up MEP can be configured on the access port connected to the CPE. The Down MEP has

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a CFM session with a remote Up MEP configured on the SAP facing the SP node that is the service hand-off point toward the SP. The customer-facing access port and the access-uplink or access SAP facing the network with the Down MEP are configured in an Epipe service on the 7210 SAS.

Connectivity fault management (CFM) continuity check messages (CCMs) are enabled on the Down MEP and used to track end-to-end availability. On detection of a fault that is higher than the lowest-priority defect of the configured MEP, the access port facing the customer is brought down (with the port tx-off action), which immediately indicates the failure to the CPE device connected to the 7210 SAS and allows the node to switch to another uplink, if available.

To enable fault propagation from the access-uplink SAP to the access port, the user can configure an operational group using the **defect-oper-group** command. An operational group configured on a service object (the CFM MEP on the Epipe SAP in this use case) inherits the operational status of that service object and on change in the operational state notifies the service object that is monitoring its operational state. The user can configure monitoring using the **monitor-oper-group** command under the service object (the access port connected to the customer in this use case).

For this use case, the user can configure an operational group under the CFM MEP to track the CMF MEP fault status so that when the CFM MEP reports a fault, the corresponding access ports that are monitoring the CFM MEP state is brought down (by switching off the laser on the port, similar to link loss forwarding (LLF)). When the CFM MEP fault is cleared, the operational group must notify the service object monitoring the MEP (that is, the access port) so that the access port can be brought up (by switching on the laser on the port, similar to LLF). The user can use the **low-priority-defect** command to configure the CFM session events that cause the MEP to enter the fault state.

If the MEP reports a fault greater than the configured low-priority defect, the software brings down the operational group so that the port configured to monitor that operational group becomes operationally down. After the MEP fault is cleared (that is, the MEP reports a fault lower than the configured low-priority defect), the software brings up the operational group so that the port monitoring the operational group becomes operationally up.

Fault detection is supported in only one direction from the MEP toward the other service endpoint. The fault is propagated in the opposite direction from the MEP toward the access port. Fault detection and propagation must not be configured in the other direction.

Note:
This feature does not support two-way fault propagation and must not be used for scenarios that require it.

3.4.5.1 Configuring an operational group for fault propagation

Before configuring an operational group, ensure that the **low-priority-defect allDef** option is configured on the MEP so that a fault is raised for all errors or faults detected by the MEP.

Use the following syntax to configure an operational group for a Down MEP configured in an Epipe service on an uplink SAP.

```
config>service>epipe>sap>eth-cfm>mep mep-id# defect-oper-group name
```

Example: Command usage to configure an operational group

```
config>service>epipe>sap>eth-cfm>mep 1# defect-oper-group “ccm-track-uplink”
```


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The access port on the 7210 SAS node to which the enterprise CPE is connected must be configured with the corresponding monitor object using the **monitor-oper-group** command.

Use the following syntax to configure monitoring of an operational group.

```
config>lag# monitor-oper-group
    config>port>ethernet# monitor-oper-group
```

Example: Command usage to configure operation group monitoring

```
config>port>ethernet# monitor-oper-group "ccm-track-uplink"
```

3.4.5.2 Fault propagation restrictions

The following restrictions apply for fault propagation:

- This feature is supported only on the 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.
- This feature is supported only for an Epipe service. It is not supported for a VPLS or R-VPLS service.
- The Epipe service can be configured with two access SAPs, or two access-uplink SAPs, or one access SAP and one access-uplink SAP. SDP bindings (spoke-SDP) are not supported:
  - On the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C, the SAPs in the Epipe service can be configured on access, access-uplink, or hybrid ports or LAGs.
  - On the 7210 SAS-Dxp and 7210 SAS-K 2F1C2T, the SAPs in the Epipe service can be configured on access or access-uplink ports or LAGs.
  - All supported encapsulation can be used with access, access-uplink, and hybrid ports. That is, unlike LLF, which provides similar capability but only for null SAPs, this feature is not restricted to only null-encapsulated ports.
- A MEP (Up or Down) with **defect-oper-group** enabled can be configured on one of the SAPs of the Epipe service:
  - The Down MEP, which is used to track service uplink connectivity, must be configured on a different port, and not the port to which the fault is propagated. That is, the Down MEP with **defect-oper-group** configured and the port with **monitor-oper-group** configured must not be the same.
  - The Up MEP used to track service uplink connectivity must be configured on the same port to which the fault is propagated. That is, the Up MEP with **defect-oper-group** configured and the port with the **monitor-oper-group** configured must be the same. In this case, it is mandatory for the user to enable **config**>**service**>**epipe**>**sap**>**ignore-oper-down** so that the Up MEP can continue to process the CFM messages received from the remote end. When an Up MEP is used, the fault must not be propagated to the other local endpoint in an Epipe service because it is likely to block all communications with the remote endpoint of an Epipe service.
  - The **defect-oper-group** configuration can only track the fault state of a single MEP. Multiple MEPs are not supported. Consequently, only a single uplink can be tracked in an Epipe service.
- The **monitor-oper-group** command can be configured on any port or LAG other than the one on which the CFM **defect-oper-group** command is configured. It does not need to be restricted to the port or LAG that has a SAP configured in the same Epipe service, even though this is the most common use case. Allowing the configuration of the **monitor-oper-group** command on any port allows the user to have one service to track multiple services between the same two endpoints and propagate the fault

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to all the service ports that use the same uplink or path for service connectivity to the same remote endpoint.

3.5 Service Assurance Agent overview

In the last few years, service delivery to customers has drastically changed. 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.

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 Traceroute implementation

In the 7210 SAS, for various applications, such as IP traceroute, control CPU inserts the timestamp in software.

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.

3.5.2 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.

3.5.3 Ethernet CFM

Loopback (LBM), linktrace (LTR) and two-way-delay measurements (Y.1731 ETH-DMM) can be scheduled using SAA. Additional timestamping is required for non Y.1731 delay-measurement tests, to be specific, loopback and linktrace tests. An organization-specific TLV is used on both sender and receiver nodes to carry the timestamp information. Currently, timestamps are only applied by the sender node. This means any time measurements resulting from loopback and linktrace tests includes the packet processing time of the remote node. Because Y.1731 ETH-DMM uses a four time stamp approach to remove the remote processing time it should be used for accurate delay measurements.

The SAA versions of the CFM loopback, linktrace and ETH-DMM tests support send-count, interval, timeout, and FC. The existing CFM OAM commands have not been extended to support send-count and

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interval natively. The summary of the test results are stored in an accounting file that is specified in the SAA accounting-policy.

3.5.4 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.

3.5.4.1 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.

3.5.4.2 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.

3.5.4.3 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.

3.5.5 Configuring SAA test parameters

Example: SAA configuration output

```
*A:7210 SAS>config>saa# info
----------------------------------------------
        test "abc"
            shutdown
            description "test"
            jitter-event rising-threshold 100 falling-threshold 10
            loss-event rising-threshold 300 falling-threshold 30
            latency-event rising-threshold 100 falling-threshold 20
        exit
----------------------------------------------
*A:7210 SAS>config>saa#
```


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3.6 Y.1564 testhead OAM tool

The 7210 SAS provides support for both the testhead tool and service test testhead tool. See the table below for the specfic 7210 SAS platform support.

Table 17: Y.1564 testhead OAM tool platform support

Platform	Testhead tool support	Service test testhead tool support
7210 SAS-D	✓	
7210 SAS-Dxp	✓	✓
7210 SAS-K 2F1C2T	✓	✓
7210 SAS-K 2F6C4T	✓	✓
7210 SAS-K 3SFP+ 8C		✓

For information about the service test testhead tool, see Service test testhead OAM Tool for the 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

Note:

- Port loopback with MAC swap and the Y.1564 testhead OAM tool is only supported on the 7210 SAS-D and 7210 SAS-Dxp, and only for Epipe and VPLS services.
- Per-SAP loopback with MAC swap and the Y.1564 testhead OAM tool is supported on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, and only for Epipe and VPLS services. Port loopback with MAC swap is not supported on these platforms.

ITU-T Y.1564 defines the out-of-service test methodology to be used and performance metrics to be measured to validate service SLA conformance during a service turn up. It primarily defines two test phases. The first test phase defines the service configuration test, which consists of validating whether the service is configured correctly. 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 so the service configuration can be modified to obtain the needed results by iteratively tuning the configuration and measuring the performance. 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. All traffic is generated up to the configured rate for all the services or forwarding classes of a specified service simultaneously and the service performance parameters are measured for each service.

The 7210 SAS supports the service configuration test for a user-configured rate and the measurement of delay, delay variation, and frame loss ratio with the testhead OAM tool. The testhead OAM tool only supports bidirectional measurement.

The testhead OAM tool supports the following number of services whose performance metrics can be validated simultaneously using the multi-stream capability for test traffic generation:

- On the 7210 SAS-D, the testhead OAM tool can generate test traffic for only one service at a specific time.

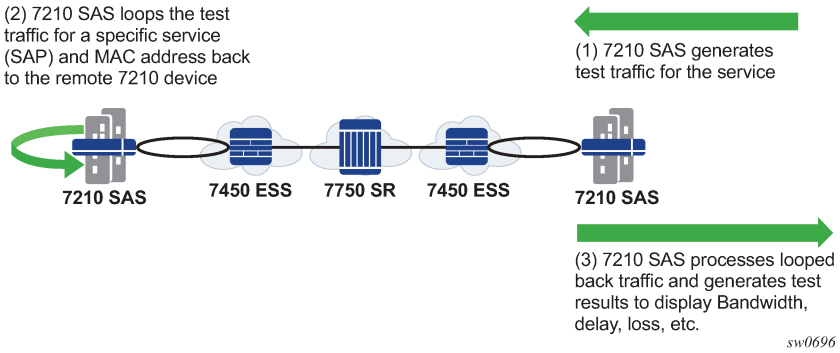
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- On the 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T, the testhead OAM tool can generate test traffic for up to four services simultaneously.
- On the 7210 SAS-K 3SFP+ 8C, the testhead OAM tool can generate test traffic for up to eight streams or services simultaneously.

The tool validates if the user-specified rate is available and computes the delay, delay variation, and frame loss ratio for the service under test at the specified rate. The tool is capable of generating traffic at a rate of up to 1 Gb/s on the 7210 SAS-D, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T. The tool is capable of generating traffic at a rate of up to approximately 10 Gb/s on the 7210 SAS-Dxp and 7210 SAS-K 3SFP+ 8C. On some 7210 SAS devices, the front-panel port resources needed for this feature must be configured up front; on other 7210 SAS devices, the resources needed for this feature are automatically allocated by software from the internal ports. See Configuration guidelines for information about which 7210 SAS platforms need user configuration.

The following figure shows the remote loopback required and the flow of the frame through the network generated by the testhead tool.

Figure 26: 7210 SAS 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. This capability gives the user flexibility to test for different possible frame header encapsulations. The user can specify the appropriate VLAN tags, Ethertype, and dot1p values independent of the SAP configuration to mimic actual customer traffic. In other words, 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 only the parameters specified in the **frame-payload** CLI command. 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.

7210 SAS-D and 7210 SAS-Dxp support Y.1564 testhead for performing CIR or PIR tests for both color-blind mode and color-aware mode. In color-aware mode, 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 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.

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Note:
CIR and PIR tests in color-aware mode are only supported on the 7210 SAS-D and 7210 SAS-Dxp.

The 7210 SAS testhead OAM tool supports the following functionality:

- Only access SAPs can be configured as the test measurement point.
- Supports all port encapsulations on all service SAP types, with some exceptions as indicated in the following Configuration guidelines.
- Supported for SAPs configured for VPLS and Epipe service. SAPs configured for other services are not supported.
- Supports two-way measurement of service performance metrics. The tests measure throughput, frame delay, frame delay variation, and frame loss ratio.
- On the 7210 SAS-D and 7210 SAS-Dxp, for two-way measurement of the service performance metrics such as frame delay and frame delay variation, test frames (also known as marker packets) are injected into the test flow at a low rate at periodic intervals. Frame delay and frame delay variation is computed for these frames. On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, there are no separate marker packets used for delay measurements. Instead, samples of the test traffic are used for measuring the delay. Hardware-based timestamps are used for delay computation.
- The 7210 SAS supports configuration of a rate value and provides an option to measure performance metrics. The testhead OAM tool generates traffic up to the specified rate and measures service performance metrics such as delay, jitter, loss for in-profile traffic, and out-of-profile traffic.
- The testhead tool can generate traffic at a maximum rate of 1 Gb/s on the 7210 SAS-D, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T. The testhead tool can generate traffic at a maximum rate of approximately 10 Gb/s on the 7210 SAS-Dxp and 7210 SAS-K 3SFP+ 8C. The CIR and PIR can be specified by the user. These rates are rounded off to the nearest hardware-supported rate by using the adaptation rule configured by the user.
- Allows the user to specify a frame size ranging from 64 bytes to 9212 bytes. Depending on the platform and the tool (testhead or service testhead), one or more frame sizes can be specified per test stream. See Command descriptions for more information.
- The user can configure the following frame payload types: L2 payload, IP payload, and IP/TCP/UDP payload. The testhead tool uses these configured values for the IP header fields and TCP header fields in the generated frames. The user can optionally specify the data pattern to use 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 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 configured 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.
- On the 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T, the user can use the testhead tool to configure a test profile, also known as a policy template, that defines the test configuration parameters. The 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. For more information, see Configuring testhead tool parameters . An event is

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generated if the test results exceed the configured thresholds. At the end of the test, the measured values for frame delay (FD), frame delay variation (FDV), and frame loss ratio (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 are 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 the following tests:
  - **service configuration tests**

    Short duration tests used to check if the configuration is correct and can meet requested SLA metrics such as throughput, delay, and loss:
    - CIR configuration test (color-aware and non-color aware)
    - PIR configuration test (color-aware and non-color aware)
    - traffic policing test (color-aware and non-color aware)
  - **service performance test**

    Long duration test used to check the service performance metrics.

  Service configuration tests can be run by setting the rate value appropriately for the specific test. For example, traffic policing tests can be executed by specifying a PIR to be 125% of the desired PIR. A traffic policing test can be executed in either color-aware mode or color-blind (non-color-aware) mode. The 7210 SAS-D and 7210 SAS-Dxp support both color-aware and color-blind mode. The 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T support color-blind mode only. The 7210 SAS-K 3SFP+ 8C supports color-blind mode only using the service test testhead OAM tool.
- 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. Because 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.

3.6.1 Prerequisites for using the testhead tool

This section describes the prerequisites a user must be aware of before using the testhead OAM tool. It is divided into three sections. First, the generic prerequisites applicable to all 7210 SAS platforms are listed, followed by prerequisites specific to the 7210 SAS-D and 7210 SAS-Dxp platforms, and then followed by prerequisites specific to the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

These sections are applicable to both the testhead tool and service testhead tool. The service testhead tool may have additional prerequisites which are described in the following section.

3.6.1.1 Generic prerequisites for use of the Y.1564 testhead OAM tool (applicable to all 7210 SAS platforms)

- 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

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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/network 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 testhead OAM tool. For in-service performance metrics, user has the option to use SAA-based Y.1731/CFM tools or OAM-PM-based tools.

The following list describes some prerequisites for using the testhead tool on the 7210 SAS-D and 7210 SAS-Dxp:

- 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 testhead tool. For more information, see the description in the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide*.
- Users must configure resources for ACL MAC criteria in ingress-internal-tcam using the **config**>**system**>**resource-profile**>**ingress-internal-tcam**>**acl-sap-ingress**>**mac-match-enable** command. Additionally they must allocate resources to egress ACL MAC or IPv4 or IPv6 64-bit criteria (using the **config**>**system**>**resource-profile**>**egress-internal-tcam**>**acl-sap-egress**>**mac-ipv4-match-enable** or **mac-ipv6-64bit-enable** or **mac-ipv4-match-enable** commands). 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 testhead fails to function. The testhead needs a minimum of about 6 entries from the ingress-internal-tcam pool and 2 entries from the egress-internal-tcam pool. If user allocates resources to egress ACLs IPv6 128-bit match criteria (using the **config**>**system**>**resource-profile**>**egress-internal-tcam**>**acl-sap-egress**>**ipv6-128bit-match-enable** command), then testhead fails to function.
- On the 7210 SAS-Dxp, resources required by the service-test testhead OAM tool used to generate multiple streams is as follows:
  - When a single loopback entry is created, it consumes two entries in "Network Ingress Cam Entries".
  - When a single service stream is running, it consumes six entries in "Ingress MAC ACL Entries" and two entries in "Egress MAC ACL Entries".
  - When multiple stream mode is configured and maximum service stream is running, it consumes total of 24 entries in "Ingress MAC ACL Entries" and eight entries in "Egress MAC ACL Entries".
- 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. In other words, 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.

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- 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 set up 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, or else there is 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 or 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 egress the access SAP and ingress back on the same port, using the resources of the loopback ports configured for use with this tool (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 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 a port loopback is service affecting. It affects all the services configured on the port. It is not recommended to use a SAP as a test SAP if the port they are configured on is used to transport the service packets toward the core. As a port loopback is required for the testhead to function correctly, doing so may result in loss of connectivity to the node when in-band management is in use. Additionally, all services being transported to the core are affected.
- Port loopback also affects services being delivered on the test SAP. Only out-of-service performance metrics can be measured using the testhead OAM tool. For in-service performance metrics, the user has the option to use SAA based Y.1731/CFM tools.
- The testhead tool uses marker packets with special header values. The QoS policies and ACL policies must ensure that same treatment as accorded to testhead traffic is given to marker packets. Marker packets are IPv4 packets with the 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 configured frame-payload. 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-payload. The 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 so that the classification for marker packets is similar to the 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 (source and destination) 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 can be sent out of the test SAP when the testhead tool is running as it may affect generated traffic and lead to the incorrect measurement of metrics.

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- The frame payload must be configured so that the 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.
- Before configuring a port loopback with MAC swap, see the configuration guidelines and restrictions described in the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide*.

The following list describes the prerequisites for using Y,1564 testhead OAM functionality on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

- 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. SAP 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.
- It is recommended to configure the MACs (source and destination) statically for VPLS service.
- Software validates the frame payload to ensure the VLAN tag matches the SAP configuration used for the test. The VLAN tag (or untagged) is the only field validated by the software. No other fields are validated by software.
- SAP loopback needs to be configured only on the remote endpoint, that is, on the remote node on which the remote SAP is configured in both Epipe and VPLS services. SAP loopback with MAC swap must be set up by the user on the remote end before invoking the testhead tool. The testhead tool injects packets on SAP ingress; therefore, a SAP loopback on the local endpoint (where the test SAP is located) is not required.
- Use of per-SAP loopback does not affect other services configured on the same port. It does affect service being delivered on that SAP.
- A cookie used to identify testhead packets is added after the protocol headers for every frame generated by the testhead tool. This cookie is used to identify testhead generated frames. The cookie follows immediately after the protocol header configured by the user (for example, in a TCP/IP packet configured by the user, the cookie is added immediately after the TCP/IP header, and forms the first 8 bytes of the payload, after which the data pattern specified by the user is added to the packet).
- The 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C do not require any loopback ports to be assigned for the testhead OAM tool.

3.6.2 Service test testhead OAM Tool for the 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

The 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C support the service test framework through the use of the service test testhead OAM tool. This tool allows for configuration of multiple streams (also called flows) for which service performance metrics can be obtained. See the *Platform Scaling Guide* to know the number of streams supported by the various platforms. With multiple streams, it is possible to configure one or more service tests to validate one or more services each with one or more forwarding classes (FCs), or validate a single service with one or more FCs, or validate a mix of a number of services and FCs as long as the number of streams are within the limit supported by the platform.

A set of streams under a single service test can be grouped together using the **service-stream** configuration commands and each stream can be configured with the options listed as follows:

- The CIR and/or PIR can be configured for each of the streams, along with the frame payload contents and the frame size.

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- Different acceptance criteria per stream can be configured and used to determine pass/fail criteria for the stream, along with the ability to monitor the streams that are in progress.
- For each stream, it is possible to use a single command to run a service configuration test, CIR test, PIR test, and service performance test concurrently instead of running each test individually.
- Instead of using threshold parameters to determine the pass/fail criteria for a test, it is possible configure the margin by which the measured throughput is off from the configured throughput to determine pass/fail criteria. The margin is configured using the **use-m-factor** CLI command.

The test results can be stored in an accounting record in XML format. The XML file contains the keywords and MIB references listed in the following table.

Table 18: OAM Y.1564 XML keywords and MIB reference

XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
acceptanceCriteriaId	Provides the ID of the acceptance criteria policy used to compare the measured results	tmnxY1564StreamAccCritId
accountingPolicy	Provides the ID of the accounting policy, which determines the properties of the accounting record generated, such as how frequently to write records, rollover interval, and so on	tmnxY1564ServTestAccPolicy
achievedThroughput	The throughput measured by the tool, as observed by measuring the rate of testhead packets received by the tool	tmnxY1564StreamResAchvdThruput
cirAdaptRule	The adaptation rule to apply to the configured CIR rate to match it to hardware-supported rates	tmnxY1564StreamCIRAdaptation
cirRate	The user-configured CIR rate	tmnxY1564StreamAdminCIR
cirTestDur	The duration, in seconds, of the CIR configuration test	tmnxY1564ServTestCirTestDuration
cirThreshold	The CIR rate threshold to compare with the measured value	tmnxY1564AccCritCirThres
dataPattern	The data pattern to include in the packet generated by the service testhead tool	tmnxY1564PayLddataPattrn
description	The user-configured description for the test	tmnxY1564ServTestDescription
desiredThroughput	The user-configured rate that is the target to achieve. The desired throughput value is either the user-configured CIR rate or PIR rate, based on the test type.	tmnxY1564StreamResDesiredThruput
dstIp	The destination IP address to use in the packet generated by the tool	tmnxY1564PayLdDstIpv4Addr

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XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
dstMac	The destination MAC address to use in the packet generated by the tool	tmnxY1564PayLdDstMac
dstPort	The destination TCP/UDP port to use in the packet generated by the tool	tmnxY1564PayLdDstPort
endTime	The time (wall-clock time) the test was completed	tmnxY1564ServTestCompletionTime
etherType	The Ethertype value to use in the packet generated by the tool	tmnxY1564PayLdEthertype
fc	The forwarding class for which the tool is being used to measure the performance metrics	tmnxY1564StreamFc
fixedFrameSize	The frame size to use for the generated packet; used to specify a single value for all frames generated by the tool	tmnxY1564StreamFrameSize
flr	The measured frame loss ratio	tmnxY1564StreamResMeasuredFLR
flrAcceptance	Indicates whether the measured FLR is within the configured loss threshold	tmnxY1564StreamResFLRAcceptanceResult
frameLossThreshold	The loss threshold configured in the acceptance criteria	tmnxY1564AccCritLossRiseThres
frameMixId[11]	The ID of the frame-mix policy. The testhead tool generates packets sizes as specified in the frame-mix policy. This is used to specify a mix of frames with different sizes to be generated by the tool.	tmnxY1564StreamFrameMixId
framePayloadId	The ID of the frame payload. The frame payload defines the format of the payload and provides the frame/packet header values and data pattern to use for the payload.	tmnxY1564StreamPayLdId
id	Provides information about either the frame mix policy ID, acceptance criteria policy ID, or frame payload ID to use for the service test, depending on the context it appears in	tmnxY1564StreamFrameMixId tmnxY1564StreamAccCritId tmnxY1564StreamPayLdId
ipDscp	The IP DSCP value used in the frame payload	tmnxY1564PayLdDSCP
ipProto	The IP protocol value used in the frame payload	tmnxY1564PayLdIpProto
ipTos	The IP ToS bits value used in the frame payload	tmnxY1564PayLdIpTos

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XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
ipTtl	The IP TTL value used in the frame payload	tmnxY1564PayLdIpTTL
jitter	The measured jitter value	tmnxY1564StreamResMeasuredJitter
jitterAcceptance	Indicates whether the measured jitter is within the configured jitter threshold	tmnxY1564StreamResJitter AcceptanceResult
jitterThreshold	The jitter threshold configured in the acceptance criteria	tmnxY1564AccCritJittrRiseThres
latencyAcceptance	Indicates whether the measured FLR is within configured loss threshold.	tmnxY1564StreamResLatency AcceptanceResult
latencyAvg	The average of latency values computed for the test stream	tmnxY1564StreamResMeasured Latency
latencyMax	The maximum value of latency measured by the tool	tmnxY1564StreamResMaxLatency
latencyMin	The minimum value of latency measured by the tool	tmnxY1564StreamResMinLatency
latencyThreshold	The latency threshold configured in the acceptance criteria	tmnxY1564AccCritLatRiseThres
measuredCir	The measured CIR rate	tmnxY1564StreamResMeasuredCIR
measuredpir	The measured PIR rate	tmnxY1564StreamResMeasuredPIR
measuredThroughput	The measured throughput	tmnxY1564StreamResMeasured Thruput
mfactor	A factor to use as a margin by which the observed throughput is off from the configured throughput to determine whether a service test passes or fails	tmnxY1564AccCritUseMFactor
perfTestDur	The duration, in seconds, of the performance test	tmnxY1564ServTestPerformanceTest Duration
pirAdaptRule	The PIR adaptation rule used	tmnxY1564StreamPIRAdaptation
pirRate	The PIR rate configured	tmnxY1564StreamAdminPIR
pirTestDur	The PIR test duration, in seconds	tmnxY1564ServTestCirPirTestDuration
pirThreshold	The PIR threshold configured in the acceptance criteria	tmnxY1564AccCritPirThres
pktCountRx	The received packet count	tmnxY1564StreamResRecvCount
pktCountTx	The transmitted packet count	tmnxY1564StreamResTransCount

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XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
policingTestDur	The policing test duration, in seconds	tmnxY1564ServTestPolicingTest Duration
resultStatus	Indicates whether the stream has passed or failed	tmnxY1564StreamResStatus
runningInstance	A counter used to indicate the run instance of the test	tmnxY1564ServTestRunningInstance
sap	The SAP used as the test endpoint	tmnxY1564StreamSapPortId tmnxY1564StreamSapEncapValue
sequence[11]	The sequence of payload sizes specified in the frame-mix policy	tmnxY1564StreamFrameMixSeq
serviceTest	A tag to indicate the start of the service test in the accounting record	None
sizeA[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeA specifies the frame size for the packet identified with the letter 'a' in the frame sequence.	tmnxY1564FrameMixSizeA
sizeB[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeB specifies the frame size for the packet identified with the letter 'b' in the frame sequence.	tmnxY1564FrameMixSizeB
sizeC[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeC specifies the frame size for the packet identified with the letter 'c' in the frame sequence.	tmnxY1564FrameMixSizeC
sizeD[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeD specifies the frame size for the	tmnxY1564FrameMixSizeD

[11] This keyword is not supported on the 7210 SAS-Dxp.

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XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
	packet identified with the letter 'd' in the frame sequence.	
sizeE[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeE specifies the frame size for the packet identified with the letter 'e' in the frame sequence.	tmnxY1564FrameMixSizeE
sizeF[11]	A frame sequence can be configured by user to indicate the sequence of frame-sizes to be generated by the tool. The sequence of frames is specified using letters a-h and u. sizeF specifies the frame-size for packet identified with letter 'f' in the frame-sequence.	tmnxY1564FrameMixSizeF
sizeG[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeG specifies the frame size for the packet identified with the letter 'g' in the frame sequence.	tmnxY1564FrameMixSizeG
sizeH[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeH specifies the frame size for the packet identified with the letter 'h' in the frame sequence.	tmnxY1564FrameMixSizeH
sizeU[11]	A frame sequence can be configured by the user to indicate the sequence of frame sizes to be generated by the tool. The sequence of frames is specified using letters a to h and u. sizeU specifies the frame size for the packet identified with the letter 'u' in the frame sequence. sizeU is the user-defined packet size.	tmnxY1564FrameMixSizeU
srcIp	The source IP address in the frame payload generated by the tool	tmnxY1564PayLdSrcIpv4Addr
srcMac	The source MAC address in the frame payload generated by the tool	tmnxY1564PayLdSrcMac
srcPort	The source TCP/UDP port in the frame payload generated by the tool	tmnxY1564PayLdSrcPort

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XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
startTime	The time at which the test was started (wall clock time)	tmnxY1564ServTestStartTime
streamId	The stream identifier	tmnxY1564StreamId
streamOrdered	Indicates if the streams configured for the service test were run one after another or run in parallel	tmnxY1564ServTestStreamOrder
testCompleted	Indicates if the test was completed or not	tmnxY1564StreamResCompleted
testCompletion	The execution status of the test (either completed or running)	tmnxY1564ServTestCompletion
testDuration	The duration of the entire test (including all test types)	tmnxY1564ServTestTime
testIndex	The service test index configured	tmnxY1564ServTestIndex
testResult	Indicates the result of the test	tmnxY1564ServTestTestResult
testStopped	Indicates if the test was stopped and did not complete	tmnxY1564ServTestStopped
testTime	The time taken for each stream. If the test is stopped, the time given is the execution time of the stream up until it was stopped.	tmnxY1564StreamResTestTime
testTypeCir	The CIR configuration test	tmnxY1564StreamTests
testTypeCirPir	The CIR-PIR configuration test	tmnxY1564StreamTests
testTypePerf	The performance test	tmnxY1564StreamTests
testTypePolicing	The policing test	tmnxY1564StreamTests
throughputAcceptance	Indicates whether the measured throughput matches the configure CIR/PIR rate	tmnxY1564StreamResThruput AcceptanceResult
trapEnabled	Indicates if the trap needs to be sent in completion of the test	tmnxY1564ServTestTrapEnable
type	The test type configured for the stream ID	tmnxY1564PayLdType
vlanTag1Dei[11]	The DEI value set for VLAN Tag #1 (outer most VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagOneDei
vlanTag1Id	The VLAN ID value set for VLAN Tag #1 (outer most VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagOne

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XML file keyword	Description	TIMETRA-SAS-OAM-Y1564-MIB
vlanTag1Tpid	The VLAN Tag TPID value set for VLAN Tag #1 (outer most VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagOneTpid
vlanTag2Dei[11]	The DEI value set for VLAN Tag #2 (inner VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagTwoDei
vlanTag2Dot1p	The Dot1p value set for VLAN Tag #2 (inner VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagTwoDot1p
vlanTag2Id	The VLAN ID value set for VLAN Tag #2 (inner VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagTwo
vlanTag2Tpid	The VLAN tag TPID value set for VLAN Tag #2 (inner VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagTwoTpid
vlanTag1Dot1p	ThenDot1p value set for VLAN Tag #1 (outermost VLAN tag) in the frame payload generated by the tool	tmnxY1564PayLdVTagOneDot1p

3.6.2.1 Ethernet frame size specification

On the 7210 SAS-Dxp, only a single frame size per stream is configurable with the service test framework.

On the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C, the service test testhead tool can be configured to generate a flow containing a sequence of frames of different sizes. The frame sizes and designations are defined by ITU-T Y.1564 and listed in the following table.

Table 19: Ethernet frame sizes and size designations

a	b	c	d	e	f	g	h	u
64	128	256	512	1024	1280	1518	MTU	User defined

The test tool can be configured to generate a flow containing frames with sizes ranging from 64 bytes to 9212 bytes using the designated letters to specify the frame size to use. The frame size is configured using the **fixed-size** command. The configured size applies to all the frames in the test flow.

It is also possible to configure the test tool to generate frames of different sizes in a flow. The **frame-mix** command creates a template that specifies sizes of the frames to be generated by the testhead tool. The frame sizes are defined in ITU-T Y.1564.The *frame-sequence* variable specifies a string of up to 16 characters that specifies the order in which the frames are to be generated by the testhead tool for a specific template. For example, a *frame-sequence* configured as "aabcdduh" indicates that a packet of **size-a** configured in the specified frame mix template should be generated first, followed by another packet

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of **size-a**, followed by packet of **size-b** and so on until a packet of **size-h** is generated. The tool then starts again and repeats the sequence until the rate of packets generated matches the required rate.

3.6.3 Configuration guidelines

This section lists the configuration guidelines for the testhead OAM tool and the service testhead OAM tool, unless indicated otherwise. These guidelines apply to all 7210 SAS platforms described in this guide unless a specific platform is called out explicitly.

- 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.
- On the 7210 SAS-D, software automatically assigns the resources associated with internal ports for use with the testhhead tool.
- On the 7210 SAS-D, testhead OAM tool uses internal loopback ports. On the 7210 SAS-Dxp, the user can assign the resources of an internal loopback port to the testhead OAM tool or port loopback with MAC swap. Depending on the throughput being validated, either a 1GE internal loopback port or 10GE internal loopback port can be used.
- On the 7210 SAS-D and 7210 SAS-Dxp, 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.
- The configured CIR/PIR 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).
- On the 7210 SAS-D and 7210 SAS-Dxp, 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.
- On the 7210 SAS-Dxp and 7210 SAS-K 3SFP+ 8C, the testhead OAM tool allows validation of speeds up to approximately 10 Gb/s.
- 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 the NSP NFM-P 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/or marker packets) remain in the loop created for testing when the tests are stopped. This is highly probable when using QoS policies with much lower shaper rate values, 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 interval 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 might 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.

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- 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.
- On the 7210 SAS-D and 7210 SAS-Dxp, 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.
- On the 7210 SAS-D and 7210 SAS-Dxp, the user must not use the CLI command to clear statistics of the test SAP port, testhead loopback port and 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.
- On the 7210 SAS-D and 7210 SAS-Dxp, the 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 1kb/s and it is achieved in the test loop, the throughput computed could still be printed as 0 if it is < 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.
- On the 7210 SAS-D and 7210 SAS-Dxp, as the rate approaches the maximum rate supported on the platform or the maximum rate of the loop (which includes the capacities of the internal loopback ports in use), the user needs to account for the marker packet rate and the meter behavior while configuring the CIR. In other words, if the user needs to test 1 Gb/s for a frame size of 512 bytes, then they will need to configure about 962396 Kb/s, instead of 962406 Kb/s, the maximum rate that can be achieved for this frame size. In general, they would need to configure about 98% to 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 the 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.

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- On the 7210 SAS-D and 7210 SAS-Dxp, the 2-way delay (also known as latency) values measured by the testhead tool are more accurate than those obtained using OAM tools, as the timestamps are generated in hardware.
- On the 7210 SAS-D and 7210 SAS-Dxp, the profile assigned to the 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. 7210 SAS access-uplink ingress and network port ingress is capable of providing appropriate QoS treatment to in-profile and out-of-profile packets.
- On the 7210 SAS-D and 7210 SAS-Dxp, the marker packets are sent over and above the configured CIR or PIR. The tool cannot determine the number of green packets injected and the number of yellow packets injected individually. Therefore, marker packets are not accounted for in the injected or received green or in-profile and yellow or out-of-profile packet counts. They are only accounted for in 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.
- On the 7210 SAS-D and 7210 SAS-Dxp, 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 (for 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.
- On the 7210 SAS-Dxp, to configure tests with multiple streams, use the **config>test-oam>testhead-num-streams multiple** command. This command must be executed both on the local (testhead generator end) and on the remote end (testhead reflector end) when the multiple stream mode is in use. When multiple stream mode is configured, the user must ensure that no traffic other than testhead traffic is being used by the stream on both the reflector and generator side in the services. In this mode, the software programs a different datapath that restricts the usage of flows other than test streams in the same service as the SAP to which the streams belongs. This command is stored across a reboot.
- On the 7210 SAS-Dxp, to configure tests with multiple streams, each stream must be specified and configured with the **config>test-oam>loopback entry** *entry-id internal* **port** *port-id* **service** *service-id* **sap** *sap-id* **src-mac** *ieee-address* **dst-mac** *ieee-address* command. This loopback entry commands is not stored across a reboot in the configuration file. The traffic streams are identified by the source MAC address and destination MAC address (regardless of traffic streams belonging to the same SAP/service or a different SAP/service and regardless of the type of service Epipe or VPLS).
- On the 7210 SAS-Dxp with the service test testhead tool, each stream must use a distinct source MAC and destination MAC. In other words, the source MAC and destination MAC address must not be repeated across the streams.
- On the 7210 SAS-Dxp with the service test testhead tool, the static MAC address must be configured in the VPLS for both the source MAC and destination MAC address used for each of the streams.
- On the 7210 SAS-Dxp, the DEI configuration with **vlan-tag-1** and **vlan-tag-2** is not supported.
- On the 7210 SAS-Dxp, while vaidating with multiple streams, the sum of all the streams must not exceed 99% of 1 Gb/s or 10 Gb/s (based on MAC swap loopback bandwidth).
- On the 7210 SAS-Dxp with the service test testhead tool, a stream can be configured with a fixed frame size. Each stream that makes up a service test can be configured with a different frame size. A mix of different frame sizes per stream is not allowed.
- On the 7210 SAS-Dxp with the service test testhead tool, only one service test can be run at a given point of time. One service test can be configured for different SAPs from different services, or the same SAPs with different FCs, or a mix of SAPs and FCs.

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- On the 7210 SAS-Dxp with the service test testhead tool, both the endpoints of the Epipe must be configured before a loopback entry is configured. This restriction does not apply to a VPLS.
- On the 7210 SAS-Dxp, a test duration of less than three minutes is not allowed to run a testhead session.
- On the 7210 SAS-Dxp configured with **svc-sap-type**, **dot1q-range**, and **null-star**, for particular VPLS services there can only be one test SAP (on that test SAP there can be one to four streams, but there cannot be a different SAP as part of same VPLS service, there can be different VPLS services to use for different test SAPs). This does not apply to VPLS services configured with **svc-sap-type any**.
- On the 7210 SAS-Dxp, the service test testhead OAM tool computes the operational rate based on the user-configured rate by deducting the metadata overhead of eight bytes added in the datapath. The additional eight bytes are required to maintain state information about the streams across the MAC swap loopback port.
- It is recommended that users should configure the **config>test-oam>acceptance-criteria>use-m-factor** value to account for latency packets that are generated over and above the configured CIR or PIR rate.
- When **test-type policing** is used, the testhead tool generates traffic at a 125% line rate. To account for the line rate, configure a maximum PIR rate less than 79% to 80% of maximum speed of the port on which the test SAP is configured.
- The following table describes SAP encapsulations that are supported for single-stream service testhead on 7210 SAS-D and 7210 SAS-Dxp.

Table 20: SAP encapsulations supported for single-stream service testhead on 7210 SAS-D and 7210 SAS-Dxp

Epipe service configured with svc-sap-type	Test SAP encapsulations
null-star	Null, :*, 0.*, Q.*
Any	Null , :0 , :Q , :Q1.Q2
dot1q-preserve[12], dot1q-range	:Q

- The following table describes SAP encapsulations that are supported for multi-stream service testhead on 7210 SAS-D and 7210 SAS-Dxp.

Table 21: SAP encapsulations supported for multi-stream service testhead on 7210 SAS-D and 7210 SAS-Dxp

Epipe service configured with svc-sap-type	Test SAP encapsulations
null-star	Null, :*
Any	Null , :0 , :Q , :Q1.Q2
dot1q-preserve[12], dot1q-range	:Q

[12] dot1q-preserve is supported for testhead OAM tool. It is not supported for the service test testhead OAM tool.

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3.6.4 Configuring testhead tool parameters

Note:

- On the 7210 SAS-D, **mac swap** and **testhead loopback port** are configured and do not require dedicated front-panel ports.
- On the 7210 SAS-Dxp, **mac swap** and **testhead loopback port** must be configured and can use either a 1GE or 10GE internal loopback port depending on the throughput being measured.

3.6.4.1 Allocating CAM resources for the OAM testhead tool on the 7210 SAS-D and 7210 SAS-Dxp

Example

The following output is an example of CAM resource allocation for use by the OAM testhead tool.

```
config> system> resource-profile
.............
resource-profile
ingress-internal-tcam
qos s-sap-ingress-resource 5
exit
acl-sap-ingress 5
mac-match-enable  max
exit
exit
egress-internal-tcam
acl-sap-egress 2
mac-ipv4-match-enable max
exit
exit
exit
..............
```

3.6.4.2 Loopback ports on the 7210 SAS-D and 7210 SAS-Dxp

Note:
The user does not need to allocate loopback ports on the 7210 SAS-D. They are allocated by the software and can be displayed using the **show system internal-loopback-ports** command.

Example

The following output is an example of **internal-loopback-ports** information. The output shows that virtual port 1/1/11 and 1/1/13 are allocated for MAC-swap and testhead application.

```
A:Dut-B# show system internal-loopback-ports
===============================================================================
Internal Loopback Port Status
===============================================================================
Port           Loopback       Application    Service        Speed Type
Id             Type                          Enabled        1G/10G
-------------------------------------------------------------------------------
```


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```
1/1/11         Virtual        Mac-Swap       No             1G
1/1/12         Virtual        Dot1q-Mirror   No             1G
1/1/13         Virtual        Testhead       No             1G
===============================================================================
```

3.6.4.3 Configuring the testhead profile for the OAM testhead tool

Example: Testhead profile configuration output

```
A:Dut-B>config>test-oam>#  info detail
----------------------------------------------
        testhead-profile 1 create
            description "Testhead_Profile_1"
            frame-size 512
            rate cir 962388 adaptation-rule max
            no dot1p
            no test-duration
            no test-completion-trap-enable
            frame-payload 1 payload-type tcp-ipv4 create
                description "Frame-payload_1"
                no data-pattern
                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
                no ethertype
                ip-proto 6
                ip-tos 8
                ip-ttl 64
                src-ip ipv4 10.1.1.1
                no vlan-tag-1
                no vlan-tag-2
            exit
        exit
----------------------------------------------
```

3.6.4.4 Starting the testhead test and displaying results

Before starting the test, return the testhead packets to the local node by ensuring that loopback with mac-swap is configured on the remote end point.

Example: Command usage to start the testhead session

```
oam testhead testhead-profile 1 test-me owner owner-me sap 1/1/2 fc be frame-
payload 1 color-aware disable
```

Example: Result and Sample testhead output

```
*A:Dut-B# show testhead "test-me" owner "owner-me" detail
===============================================================================
Y.1564 Testhead Session
===============================================================================
Owner              : owner-me
Test               : test-me
Profile Id         : 1                        SAP              : 1/1/2
```


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```
Accept. Crit. Id   : 0                        Completed         : Yes
Frame Payload Id   : 1                        Stopped           : No
Frame Payload Type : tcp-ipv4                 FC                : be
Color Aware Test   : No
Start Time         : 08/29/2018 08:56:03
End Time           : 08/29/2018 08:59:09
Total time taken   : 0d 00:03:05
-------------------------------------------------------------------------------
Latency Results
-------------------------------------------------------------------------------
 (total pkts in us):       Min       Max   Average    Jitter
         Roundtrip :        51        51        51         0
-------------------------------------------------------------------------------
Packet Count
-------------------------------------------------------------------------------
Total Injected     : 42290555
Total Received     : 42290555
-------------------------------------------------------------------------------
Test Compliance Report
-------------------------------------------------------------------------------
Throughput Configd : 962388
Throughput Oper    : 962384
Throughput Measurd : 962345
FLR Configured     : None
FLR Measurd        : 0.000000
FLR Acceptance     : Pass
Latency Configd(us): None
Latency Measurd(us): 51
Latency Acceptance : Not Applicable
Jitter Configd(us) : None
Jitter Measurd(us) : None
Jitter Acceptance  : Not Applicable
Total Pkts. Tx.    : 110                      Latency Pkts. Tx. : 100
OutPrf Latency Pkt*: 0                        InPrf Latency Pkt*: 0
Total Tx. Fail     : 0
===============================================================================
*indicates that the corresponding row element may have been truncated.
```

Example: Command usage to stop a testhead session

```
oam testhead "test-me" owner "owner-me" stop
```

Example: Command usage to clear testhead session results

```
clear testhead result "test-me" owner "owner-me"
```

3.6.5 Configuring service test OAM testhead tool parameters

Note:
This feature is only supported on the 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C.

Example: frame-mix parameters

```
*A:Dut-B# configure test-oam frame-mix 1 create
*A:Dut-B>config>test-oam>frame-mix# info detail
----------------------------------------------
no size-a
```


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```
no size-b
no size-c
no size-d
no size-e
no size-f
no size-g
no size-h
no size-u
-----------------------------------------------
*A:Dut-B>config>test-oam>frame-mix#
```

Note:
In the following example, fixed-sized frames are used. The device provides an option to configure a stream with frames of different frame sizes using the **frame-mix** option shown in the preceding example.

Example: frame-payload parameters

```
*A:Dut-B>config>test-oam>fr-payld# info detail
-----------------------------------------------
description "Frame_Payload_1"
no data-pattern
no dscp
no dst-ip
dst-mac 00:00:00:00:00:02
src-mac 00:00:00:00:00:01
no dst-port
no src-port
no ethertype
no ip-proto
no ip-tos
no ip-ttl
no src-ip
no vlan-tag-1
no vlan-tag-2
-----------------------------------------------
*A:Dut-B>config>test-oam>fr-payld#
```

Example: acceptance-criteria parameters

```
*A:Dut-B# configure test-oam acceptance-criteria 1
*A:Dut-B>config>test-oam>acc-criteria# info detail
-----------------------------------------------
description "Acceptance_Criteria_1"
jitter-rising-threshold 0
no jitter-rising-threshold-in
no jitter-rising-threshold-out
latency-rising-threshold 45
no latency-rising-threshold-in
no latency-rising-threshold-out
loss-rising-threshold 0
no loss-rising-threshold-in
no loss-rising-threshold-out
cir-threshold 199990
pir-threshold 249750
use-m-factor 1000
-----------------------------------------------
*A:Dut-B>config>test-oam>acc-criteria#
```


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Example: loopback for multiple streams output

```
*A:Dut-G# configure test-oam
*A:Dut-G>config>test-oam># info
----------------------------------------------
testhead-num-streams multiple
loopback entry 1 internal port 1/1/3 service 101 sap 1/1/3 src-mac 00:00:00:00:00:02 dst-
mac 00:00:00:00:00:01
loopback entry 2 internal port 1/1/3 service 101 sap 1/1/3 src-mac 00:00:00:00:00:04 dst-
mac 00:00:00:00:00:03
loopback entry 3 internal port 1/1/3 service 101 sap 1/1/3 src-mac 00:00:00:00:00:06 dst-
mac 00:00:00:00:00:05
loopback entry 4 internal port 1/1/3 service 101 sap 1/1/3 src-mac 00:00:00:00:00:08 dst-
mac 00:00:00:00:00:07
acceptance-criteria 1 create
exit
----------------------------------------------
*A:Dut-G>config>test-oam># exit
*A:Dut-G#
```

Example: service-test configuration output

```
*A:Dut-B>config>test-oam># service-test 1
*A:Dut-B>config>test-oam>serv-test# info detail
----------------------------------------------
            description "Service_Test_1"
            stream-run-type ordered
            no test-completion-trap-enable
            no collect-stats
            no accounting-policy
            test-duration cir minutes 1
            test-duration cir-pir minutes 3
            service-stream 1 create
                description "Stream_1"
                no fc
                frame-payload 1
                acceptance-criteria 1
                sap 1/1/2
                no wait-timeout
                frame-size fixed-size 512
                rate cir 200000 cir-adaptation-rule min pir 250000 pir-adaptation-
rule closest
                no dot1p
                test-type cir
                no shutdown
            exit
            service-stream 2 create
                description "Stream_2"
                no fc
                frame-payload 1
                acceptance-criteria 1
                sap 1/1/2
                no wait-timeout
                frame-size fixed-size 512
                rate cir 200000 cir-adaptation-rule min pir 250000 pir-adaptation-
rule closest
                no dot1p
                test-type cir
                shutdown
            exit
            service-stream 3 create
                description "Stream_3"
                no fc
```


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```
                frame-payload 1
                acceptance-criteria 1
                sap 1/1/2
                no wait-timeout
                frame-size fixed-size 512
                rate cir 200000 cir-adaptation-rule min pir 250000 pir-adaptation-
 rule closest
                no dot1p
                test-type cir
                shutdown
            exit
            service-stream 4 create
                description "Stream_4"
                no fc
                frame-payload 1
                acceptance-criteria 1
                sap 1/1/2
                no wait-timeout
                frame-size fixed-size 512
                rate cir 200000 cir-adaptation-rule min pir 250000 pir-adaptation-
rule closest
                no dot1p
                test-type cir
                shutdown
            exit
            no shutdown
-----------------------------------------
*A:Dut-B>config>test-oam>serv-test#
```

Example: Command usage to start a service

```
*A:Dut-B# oam service-test 1 start
INFO: CLI service test 1 started. instance is 3.
```

Example: service-test results show output

```
*A:Dut-B# show test-oam service-test 1 results
===============================================================================
Y.1564 service test 1 instance 3 results
===============================================================================
Service test id  : 1                      Run instance  : 3
Status           : finished               Stopped       : no
Start Time       : 06/17/2018 04:16:01    End Time      : 06/17/2018 04:19:06
Test result      : pass                   Total time ta*: 0d 00:03:05
===============================================================================
* indicates that the corresponding row element may have been truncated.
===============================================================================
Y.1564 service test 1 stream 1
===============================================================================
Stream Id        : 1                      Desc          : Stream_1
SAP              : 1/1/2                  FC            : be
Accept. Crit.    : 2                      Frame Payload : 1
Frame size       : 512
Cir              : 200000                 adaptation    : min
Pir              : 250000                 adaptation    : closest
Tests            : cir
===============================================================================
===============================================================================
Y.1564 service test 1 stream 1 instance 3 test-type cir results
===============================================================================
Start Time       : 06/17/2018 04:16:01    End Time      : 06/17/2018 04:19:06
Time taken       : 0d 00:03:05            Stopped       : no
```


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```
-------------------------------------------------------------------------------
Packet Count And Roundtrip Latency Results
-------------------------------------------------------------------------------
Total Pkts Injected:              8788729
Total Pkts Received:              8788729
    Min Latency(us):                   34
    Max Latency(us):                   53
Average Latency(us):                   34
     M-Factor(kbps):                 1000
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Test Compliance Report
-------------------------------------------------------------------------------
          Criteria : thruput(kbps) FLR(10000th%)   latency(us)    jitter(us)
        acceptable :        199990             0            45             0
        configured :        200000             0            45             0
          measured :        199992             0            34             0
            result :          Pass          Pass          Pass          Pass
-------------------------------------------------------------------------------
```

Example: results-summary show output

The following output is an example of an overview of all the service test results using **results-summary**.

```
A:Dut-B# show test-oam service-test 1 results-summary
-------------------------------------------------------------------------------
Y.1564 service test 1 results
-------------------------------------------------------------------------------
Run Inst.    |Svc |     |                    |                    | | | | | |
/SAP         |Str |Test |Start time          |End time            |S|R|B|F|L|J
-------------------------------------------------------------------------------
2            -    -     06/17/2018 04:14:57  06/17/2018 04:15:54  |Y|P|P|P|P|P
1/1/2        1    cir   06/17/2018 04:14:57  NA                   |Y|P|P|P|P|P
-------------------------------------------------------------------------------
3            -    -     06/17/2018 04:16:01  06/17/2018 04:19:06  |N|P|P|P|P|P
1/1/2        1    cir   06/17/2018 04:16:01  NA                   |N|P|P|P|P|P
-------------------------------------------------------------------------------
S - test stopped - Yes/No;
R - Result for all tests - Pass/Fail/NA;
B - Bandwidth/Throughput measured - Pass/Fail/NA;
F - Frame Loss Ratio(FLR) measured - Pass/Fail/NA;
L - Latency measured - Pass/Fail/NA;
J - Jitter measured - Pass/Fail/NA;
-------------------------------------------------------------------------------
```

3.6.6 Port loopback for Ethernet ports

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

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

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back functionality, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Interface Configuration Guide*.

3.6.7 SAP loopback for Ethernet SAPs

Note:
Per-SAP loopback with MAC swap is supported on all 7210 SAS platforms as described in this document, except the 7210 SAS-D and 7210 SAS-Dxp.

Per-SAP loopback with MAC swap is is useful for testing the service configuration and measuring performance parameters such as throughput, delay, and jitter on service turn-up. Typically, the testhead OAM tool is used to inject packets at a desired rate into the service from the remote site. It is also possible to use a third-party external test device to inject packets at a desired rate into the service at a central office location. For more information about SAP loopback functionality, see the *7210 SAS-D, Dxp, K 2F1C2T, K 2F6C4T, K 3SFP+ 8C Services Guide*.

3.6.8 SAP ingress loopback for Ethernet SAPs

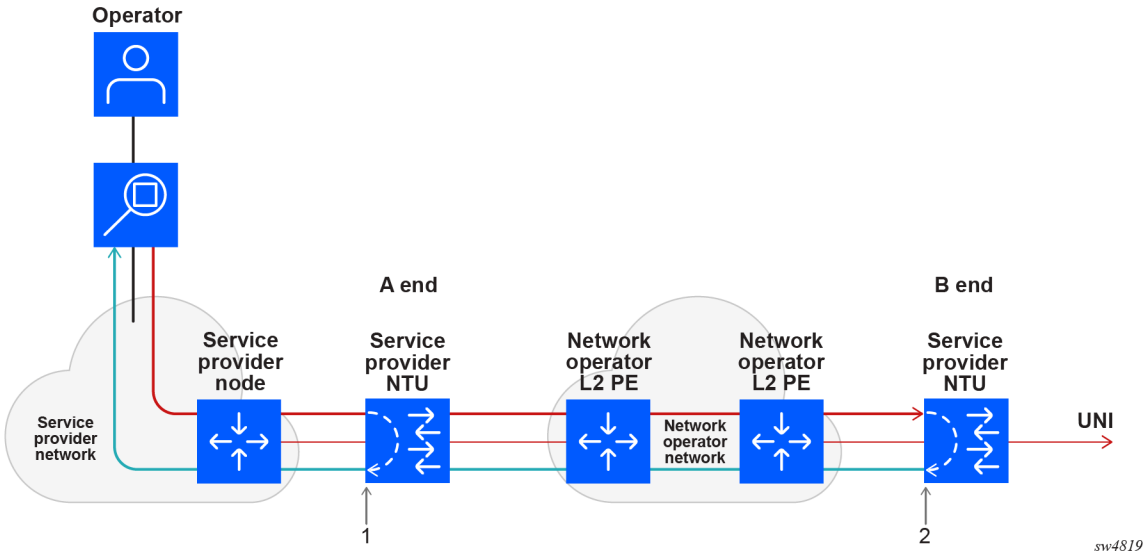
SAP ingress loopback, where traffic identified by destination MAC address and source MAC address, received on a SAP and service, is looped back out of the SAP on which it was received. All other traffic that does not match the source and destination MAC address is processed normally by the service and 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 27: 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-Dxp 12p) 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.

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Figure 27: Network example of SAP ingress loopback for Ethernet SAPs



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 27: 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 27: Network example of SAP ingress loopback for Ethernet SAPs).

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- 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-Dxp.

```
configure test-oam [no] loopback entry entry-id {internal | line} port port-id service service-id sap sap-id src-mac address dst-mac address
```

The **internal** keyword is used to specify that traffic is being sent out (egress) of the SAP (identified by the *sap-id*), and is looped back into the node. It is typically used with Y.1564 testhead functionality described in the section above.

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 is forwarded in the context of the service (in other words, configuring loopback entries does not affect other traffic flows in the service).

3.6.8.1 Configuration guidelines

The following configuration guidelines apply to SAP ingress loopback for Ethernet SAPs:

- On the 7210 SAS-Dxp, the **line** and **internal** keywords are mutually exclusive. In other words, the software does not allow the two keywords to be used at the same time across different loopback entries.
- On the 7210 SAS-Dxp, 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-Dxp, a SAP can be an access SAP on an access port or an access-uplink SAP on an access-uplink port.
  - A SAP can be a null SAP, dot1q (Q1, :0, *) SAP, QinQ (Q1.Q2, Q1.*, *.*) SAP, dot1q-preserve SAP, or dot1q range SAP.
  - A service can be Epipe, VPLS with **svc-sap-type** set to **any**, **null-star**, **dot1-preserve**, or **dot1q-range**.
  - R-VPLS service is supported. Only traffic received on the SAPs of the R-VPLS service is eligible for loopback.



Note: Traffic is typically not received on the IP interface of an R-VPLS service. The IP interface is only used to forward traffic out of the R-VPLS when received on other IP interfaces configured in the same routing instance on the node.

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- When the **line** keyword is configured, multiple loopback entries can be configured. Please contact a Nokia representative to learn more about the maximum number of allowed loopback entries with the **line** option.
- 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-Dxp, 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-Dxp, 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.

Example: Loopback entries configured on different SAPs and on different ports within the same service

```
configure test-oam loopback entry 1 line port 1/1/9 service 101 sap 1/1/9:101 src-mac macA
 dst-mac macB
configure test-oam loopback entry 2 line port 1/1/10 service 101 sap 1/1/10:101 src-mac
 macA dst-mac macB
configure test-oam loopback entry 3 line port 1/1/11 service 101 sap 1/1/11:101 src-mac
 macA dst-mac macB
```

3.6.8.2 Resource utilization

On the 7210 SAS-Dxp, the resources required for loopback streams are taken from the SAP ingress QoS resource pool (in other words, from the pool of resources that are statically allocated to access SAP ingress QoS classification using MAC criteria on bootup. This is over and above the resources configured by the user for access SAP ingress QoS classification.). In other words, the static pool of entries allocated to access SAP ingress QoS classification using MAC criteria is shared with loopback line feature. Resources are allocated on first come, first served basis among loopback line and access SAP ingress QoS classification using MAC criteria. If no resources are available, the configuration of **loopback line** command fails.

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Note: During system bootup, when using a default configuration, some resources are allocated to SAP ingress QoS by default; in this case, the user may not need to assign additional resources.

Use the **tools**>**dump**>**system**>**resources** command to monitor resource usage. Each **loopback** command with **line** keyword needs the following resources: two entries are taken from the ingress QoS slice.

3.6.8.3 Configuring a loopback port for MAC-swap

On the 7210 SAS-Dxp, 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 is comprised of the following foundational components:

- **session**

  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**

  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)**

  Time-based non-overlapping windows that capture all results that are received in that window of time.

- **data structures**

  The unique counters and measurement results that represent the specific protocol.

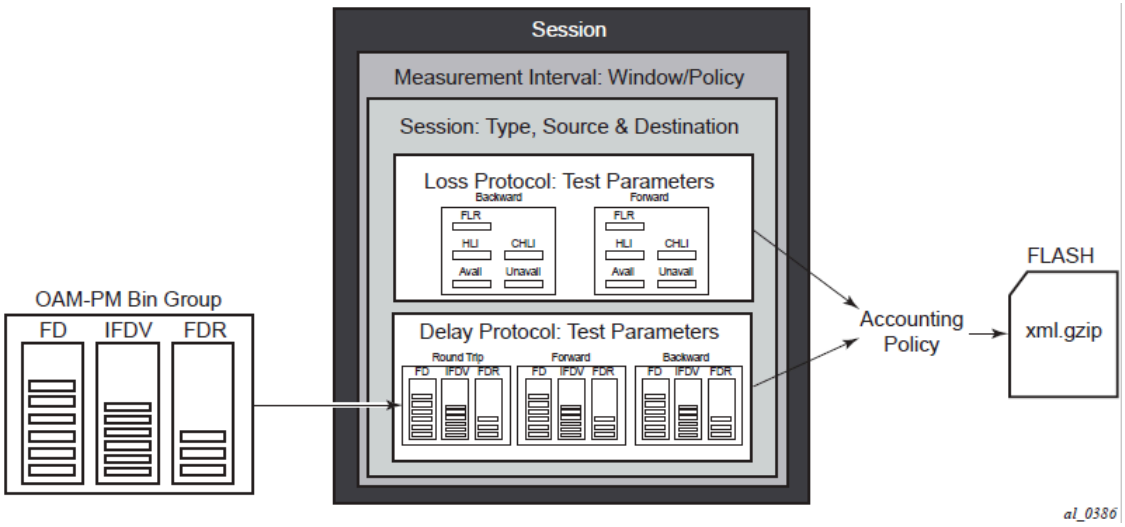
- **bin group**

  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 28: 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 subcomponents. 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.

Note:
OAM-PM is supported on all 7210 SAS platforms as described in this document, except the 7210 SAS-D.

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:

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- **session type**

  The 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 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 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 test ID 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

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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. 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 22: 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

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for troubleshooting or short term monitoring that does not require alignment or comparison to other PM data.

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. Because of 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 listed in the following table.

Table 23: 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

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XML file keyword	Description	TIMETRA-OAM-PM-MIB object
ela	Elapsed time (seconds)	tmnxOamPmStsBaseElapsedTime
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

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XML file keyword	Description	TIMETRA-OAM-PM-MIB object
xrf	Maximum frame delay range, forward	tmnxOamPmStsDelayDmmFwdMax
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

[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
uvb	Unavailable count in the forward direction	tmnxOamPmStsLossSlmUnavlIndBwd
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

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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.

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. Since 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 (FD)**

  FD is the amount of time required to send and receive the packet.

- **InterFrame Delay Variation (IFDV)**

  IFDV is the difference in the delay metrics between two adjacent packets.

- **Frame Delay Range (FDR)**

  FDR is the difference between the minimum frame delay and the individual packet.

- **Mean Frame Delay (MFD)**

  MFD 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.

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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.

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.

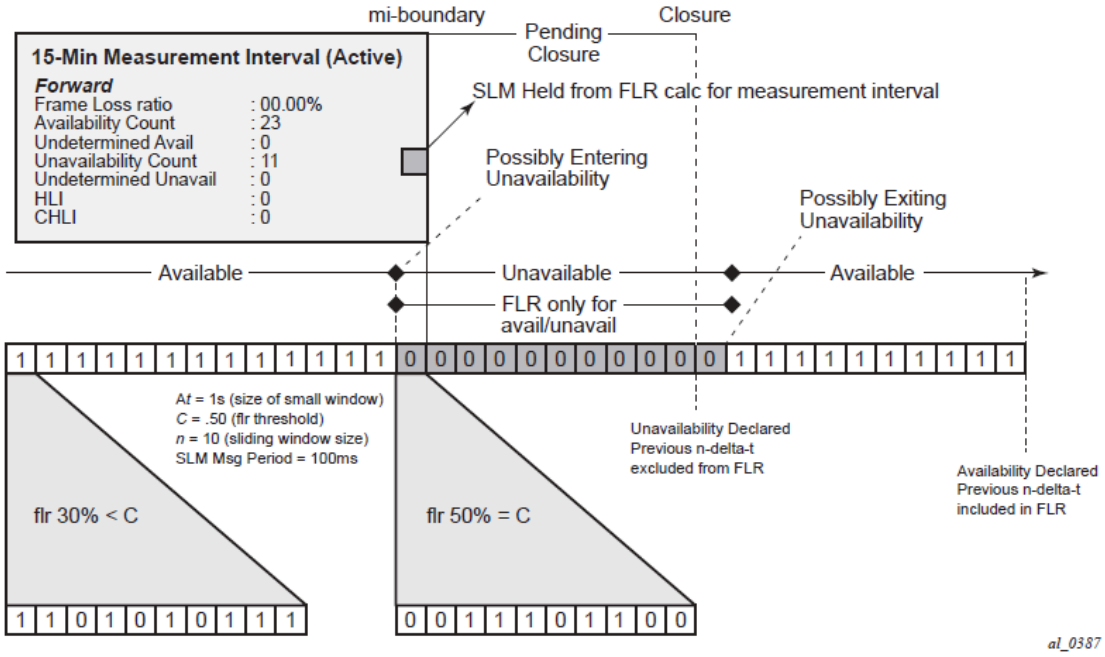
Availability can only be reasonably determined with synthetic packets. This is because the synthetic packet is the packet being counted and provides a uniform packet flow that can be used for the computation. Transmit and receive counter-based approaches cannot reliably be used to determine availability because

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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.

Figure 29: Evaluating and computing loss and availability 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 29: 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.

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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, and backward. Consideration must be taken when configuring 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:

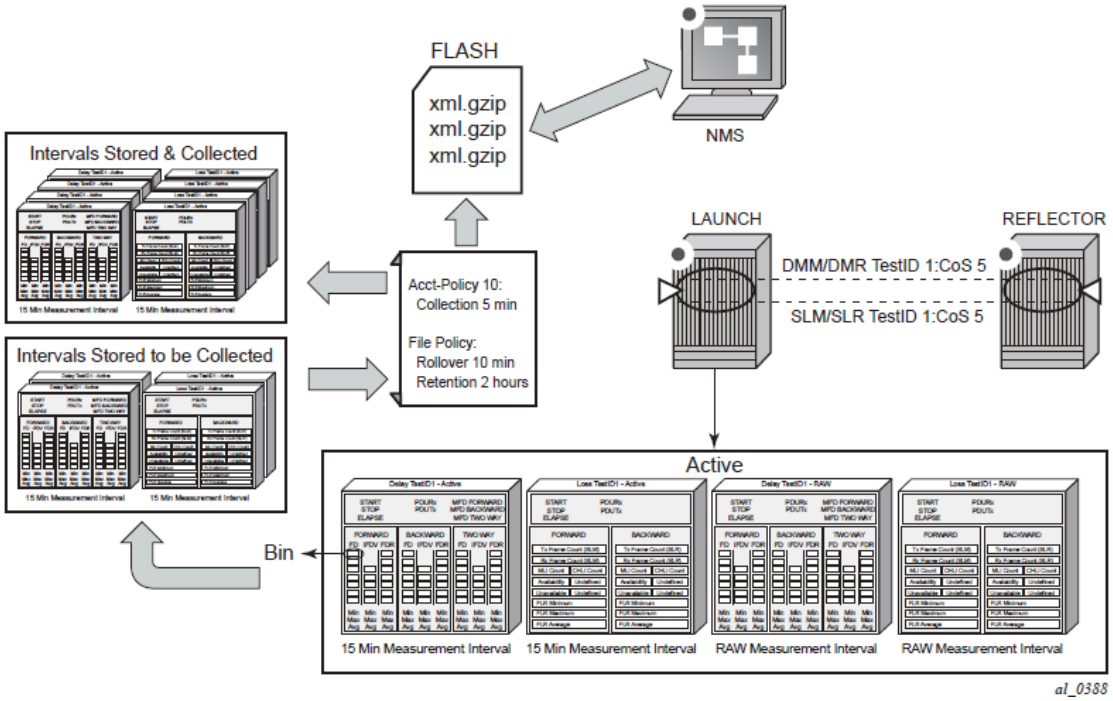
```
-------------------------------------------------------------------------------
Configured Lower Bounds for Delay Measurement (DMM) Tests, in microseconds
-------------------------------------------------------------------------------
Group Description                    Admin Bin     FD(us)    FDR(us)   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 30: 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

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

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

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

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

The **monitor** command can be used to automatically update the statistics for the raw measurement interval.

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
```


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```
                                        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 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
```


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```
Interval          : 1000 ms
-------------------------------------------------------------------------------

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


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```
Bin      Lower Bound       Forward      Backward    Round Trip
------------------------------------------------------------------
0              0 us           624            53             0
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%
-------------------------------------------
```


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```
-------------------------------------------------------------------------------
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" 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
```


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```
3             300 us           115           172           154
4             400 us            89            96           136
5             500 us            63            91           108
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
-------------------------------------------------------------------------------
```

3.8 Diagnostics command reference

- OAM commands
  - Base operational commands
  - LSP diagnostics 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
  - LDP diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
  - TWAMP commands for 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T
  - TWAMP Light commands for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
  - TWAMP Light commands for 7210 SAS-Dxp
  - SDP diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
  - VPRN diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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  - VLL diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
  - VPLS MAC diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C
  - Epipe diagnostics for 7210 SAS-Dxp
  - Ethernet in the First Mile (EFM) commands
  - ETH CFM OAM commands
  - ETH CFM configuration commands
  - Y.1564 testhead profile commands for 7210 SAS-D and 7210 SAS-Dxp
  - Y.1564 testhead profile commands for 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T
  - Y.1564 service test testhead commands for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
  - Y.1564 service test testhead commands for the 7210 SAS-Dxp
  - Y.1564 testhead OAM commands for 7210 SAS-D and 7210 SAS-Dxp
  - Y.1564 testhead OAM commands for 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T
  - OAM service test commands for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
- OAM Performance Monitoring, bin group, and session commands
  - OAM-PM session IP commands for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C
- SAA commands
- Show 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 ] [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]
```


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

```
GLOBAL
    - oam
        - 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 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]
```

3.8.1.1.1.2 LDP diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
GLOBAL
    - oam
        - ldp-treetrace {prefix ip-prefix/mask} [downstream-map-tlv {dsmap|ddmap}]  [fc fc-
name [profile profile]] [max-path max-paths] [max-ttl ttl-value] [retry-count retry-count]
 [timeout timeout]
    - 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
            - mpls-time-stamp-format {rfc4379 | unix}
```


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3.8.1.1.1.3 TWAMP commands for 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

```
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 timer
                    - [no] max-conn-server count
                    - [no] max-sess-server count
                    - [no] shutdown
```

3.8.1.1.1.4 TWAMP Light commands for 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
configure
    - router
        - 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 TWAMP Light commands for 7210 SAS-Dxp

```
configure
```


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```
    - router
        - 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
```

3.8.1.1.1.6 SDP diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
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]
        - svc-ping ip-addr service service-id [local-sdp] [remote-sdp]
```

3.8.1.1.1.7 VPRN diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
GLOBAL
    - oam
        - 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]
```

3.8.1.1.1.8 VLL diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
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-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]
```


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3.8.1.1.1.9 VPLS MAC diagnostics for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
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]
```

3.8.1.1.1.10 Epipe diagnostics for 7210 SAS-Dxp

```
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]
```

3.8.1.1.1.11 Ethernet in the First Mile (EFM) commands

```
GLOBAL
    - oam
        - efm port-id local-loopback {start | stop}
        - efm port-id remote-loopback {start | stop}
```

3.8.1.1.1.12 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 [priority priority] [send-count send-count] [size data-size] [timeout timeout]
 [interval interval]
```


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3.8.1.1.1.13 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
                    - bridge-identifier bridge-id
                    - id-permission {chassis}
                    - no id-permission
                    - mhf-creation {none | default | explicit | 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
            - [no] enable-dmm-version-interop
            - sender-id local local-name
            - sender-id system
            - no sender-id
```

3.8.1.1.1.14 Y.1564 testhead profile commands for 7210 SAS-D and 7210 SAS-Dxp

```
config
    - test-oam
        - testhead-profile profile-id create
            - [no] acceptance-criteria  acceptance-criteria-id [create]
                - [no] cir-threshold threshold
                - [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 ip-address
                - [no] dst-mac ieee-address [ieee-address-mask]
                - [no] dst-port dst-port-number
```


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```
                - [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 ip-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 [cir-adaptation-rule adaptation-rule] [pir cir-
rate-i n-kbp]
            - [no] test-completion-trap-enable
            - [no] test-duration [hours hours| minutes minutes| seconds seconds]
            - [no] test-duration
```

3.8.1.1.1.15 Y.1564 testhead profile commands for 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

```
config
    - test-oam
        - testhead-profile profile-num [create]
        - no testhead-profile profile-num
            - acceptance-criteria  acceptance-criteria-id [create]
            - no acceptance-criteria  acceptance-criteria-id
                - cir-threshold threshold
                - no cir-threshold
                - jitter-rising-threshold threshold
                - no jitter-rising-threshold
                -  jitter-rising-threshold-in threshold
                - no jitter-rising-threshold-in
                - jitter-rising-threshold-out threshold
                - no jitter-rising-threshold-out
                - latency-rising-threshold  threshold
                - no latency-rising-threshold
                - latency-rising-threshold-in threshold
                - no latency-rising-threshold-in
                - latency-rising-threshold-out threshold
                - no latency-rising-threshold-out
                - loss-rising-threshold  threshold
                - no loss-rising-threshold
                - loss-rising-threshold-in threshold
                - no loss-rising-threshold-in
                - loss-rising-threshold-out threshold
                - no loss-rising-threshold-out
                - pir-threshold threshold
                - no pir-threshold
            - description description-string
            - no description
            - frame-payload  payload-id [payload-type [l2 | tcp-ipv4 | udp-ipv4 | ipv4]]
 [create]
            - no frame-payload  payload
                - data-pattern data-pattern
                - no data-pattern
                - description description-string
                - no description
                - dscp  dscp-name
                - no dscp
                - dst-ip  ipv4 ipv4-address
                - no dst-ip
                - dst-mac ieee-address [ieee-address-mask]
```


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```
                - no dst-mac
                - dst-port dst-port-number
                - no dst-port
                - ethertype 0x0600..0xffff
                - no ethertype
                - ip-proto  ip-protocol-number
                - no ip-proto
                - ip-tos  type-of-service
                - no ip-tos
                - ip-ttl  ttl-value
                - no ip-ttl
                - src-ip  ipv4 ipv4-address
                - no src-ip
                - src-mac ieee-address [ieee-address-mask]
                - no src-mac
                - src-port  src-port-number
                - no src-port
                - vlan-tag-1 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value] [dei [0..1]]
                - no vlan-tag-1
                - vlan-tag-2 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value] [dei [0..1]]
                - no vlan-tag-2
            - frame-size  frame-size
            - no frame-size
            - [no] rate cir cir-rate-in-kbps [adaptation-rule adaptation-rule] [pir pir-rate-
in-kbps]
            - no rate
            - [no] test-completion-trap-enable
            - test-duration {[hours hours] [minutes minutes] [seconds seconds]}
            - no test-duration
```

3.8.1.1.1.16 Y.1564 service test testhead commands for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
config
    -  test-oam
        - acceptance-criteria acceptance-criteria-id [create]
        - no acceptance-criteria acceptance-criteria-id
            - cir-threshold threshold
            - no cir-threshold
            - jitter-rising-threshold threshold
            - no jitter-rising-threshold
            - latency-rising-threshold  threshold
            - no latency-rising-threshold
            - loss-rising-threshold  threshold
            - no loss-rising-threshold
            - pir-threshold threshold
            - no pir-threshold
            - use-m-factor
            - no use-m-factor
        - frame-mix frame-mix-id [create]
        - no frame-mix
            - size-a size
            - no size-a
            - size-b size
            - no size-b
            - size-c size
            - no size-c
            - size-d size
            - no size-d
            - size-e size
            - no size-e
```


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```
            - size-f size
            - no size-f
            - size-g size
            - no size-g
            - size-h size
            - no size-h
            - size-u size
            - no size-u
        - frame-payload  payload-id [payload-type [l2 | tcp-ipv4 | udp-ipv4 | ipv4]] [create]
        - no frame-payload  payload
            - data-pattern data-pattern
            - no data-pattern
            - description description-string
            - no description
            - dscp  dscp-name
            - no dscp
            - dst-ip  ipv4 ip-address
            - no dst-ip
            - dst-mac ieee-address [ieee-address-mask]
            - no dst-mac
            - dst-port dst-port-number
            - no dst-port
            - ethertype 0x0600..0xffff
            - no ethertype
            - ip-proto  ip-protocol-number
            - no ip-proto
            - ip-tos  type-of-service
            - no ip-tos
            - ip-ttl  ttl-value
            - no ip-ttl
            - src-ip  ipv4 ip-address
            - no src-ip
            - src-mac ieee-address [ieee-address-mask]
            - no src-mac
            - src-port  src-port-number
            - no src-port
            - vlan-tag-1 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value] [dei [0..1]]
            - vlan-tag-1 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value]
            - no vlan-tag-1
            - vlan-tag-2 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value] [dei [0..1]]
            - vlan-tag-2 vlan-id vlan-id [tpid tpid] [dot1p dot1p-value]
            - no vlan-tag-2
        - service-test test-id [create]
        - no service-test
            - accounting-policy acct-policy-id
            - no accounting-policy
            - description description-string
            - no description
            - service-stream stream-id [create]
            - no service-stream
                - acceptance-criteria acceptance-criteria-id
                - no acceptance-criteria
                - description description-string
                - no description
                - fc fc-name
                - no fc
                - frame-payload frame-payload-id
                - no frame-payload
                - frame-size frame-mix frame-mix-id [frame-sequence]
                - frame-size [fixed-size frame-size]
                - no frame-size
                - rate cir cir-rate-in-kbps [cir-adaptation-rule cir-adaptation-rule] [pir pir-
rate-in-kbps] [pir-adaptation-rule pir-adaptation-rule]
                - no rate
```


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```
                - sap sap-id
                - no sap
                - [no] shutdown
                - test-type [[cir] [cir-pir] [policing] [performance]]
                - no test-type
            - [no] shutdown
            - stream-run-type {ordered | parallel}
            - no stream-run-type
            - [no] test-completion-trap-enable
            - test-duration [[cir] [cir-pir] [policing] [performance {[hour hours]}]]
 {[minutes minutes] [seconds seconds]}
            - no test-duration
```

3.8.1.1.1.17 Y.1564 service test testhead commands for the 7210 SAS-Dxp

```
config
    -  test-oam
        - loopback entry entry-id {internal | line} port port-id service service-id sap sap-id
 src-mac ieee-address dst-mac ieee-address
        - no loopback entry entry-id
        - testhead-num-streams  {single | multiple}
        - no testhead-num-streams
```

3.8.1.1.1.18 Y.1564 testhead OAM commands for 7210 SAS-D and 7210 SAS-Dxp

```
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
```

3.8.1.1.1.19 Y.1564 testhead OAM commands for 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T

```
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]
    - testhead test-name [owner owner-name] stop
```

3.8.1.1.1.20 OAM service test commands for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
oam
    - service-test profile-num start
    - service-test profile-num stop
```

3.8.1.1.2 Show commands

```
show
```


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```
    - test-oam
        - acceptance-criteria acceptance-criteria-id [running-instance running-instance]
 [detail]
        - frame-payload payload-id [running-instance running-instance] [detail]]
        - service-test test-id [service-stream stream-id] [test-type test-type] [running-
instance running-instance] [detail]
        - service-test [test-id] [running-instance running-instance] resource-usage
        - service-test test-id [service-stream stream-id] [test-type test-type] running-
instance running-instance] results [detail]
        - service-test [test-id] [service-stream stream-id] [test-type test-type] running-
instance running-instance] results-summary
        - testhead-profile  profile-id
show
    - testhead  [test-name owner test-owner] [detail]
```

3.8.1.1.3 Clear commands

```
clear
    - test-oam
        - result service test test-id [running-instance running-instance]
        - twamp
    - testhead result [test-name] owner [test-owner]
    - testhead 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
```


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```
                    - 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]
                    - [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 for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
configure
    - oam-pm
```


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```
        - 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
                - 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
```


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3.8.1.2.2 CFM command for DMM interop on 7210 SAS-D and 7210 SAS-Dxp

```
config
    - eth-cfm
        - system
            - [no] enable-dmm-version-interop
```

3.8.1.3 SAA commands

```
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 threshold
                - [no] test-completion-enable
                - [no] test-fail-enable
                - [no] test-fail-threshold threshold
            - [no] type
                - 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 ]
                - 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} [profile {in | out}]] [count send-count] [size data-size] [timeout timeout]
 [interval interval]
                - 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 [profile {in | out}]] [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-
```


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```
name [profile {in | out}]] [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 [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] [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]][level 0..7] [direction up | down]
        - cfm-stack-table
        - cfm-stack-table port [{all-ports}][level 0..7][direction up | down]
        - cfm-stack-table port-id [vlan qtag[.qtag]] [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]
        - 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
```


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```
        - twamp-light
    - test-oam
        - ldp-treetrace [prefix ip-prefix/mask] [detail]
        - twamp
            - twamp-light
                - reflectors
        - 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 for TWAMP for 7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

```
clear
    - saa [test-name [owner test-owner]]
    - test-oam
        - twamp
            - server
```

3.8.1.3.4 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
```


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```
        - statistics
```

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 an SAA test. An existing test must be shut down before it can be modified. When a test is created, it is in shutdown mode until a **no shutdown** command is executed.

A **shutdown** can be performed only 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>twamp>server

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command administratively disables the TWAMP server.

The **no** form of this command administratively enables the TWAMP server.

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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

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

Description

This command performs DNS name resolution. If **ipv4-a-record** is specified, DNS names are queried for A-records only.

Parameters

ip-address

Specifies the IP address of the primary DNS server. IPv6 address is only supported on 7210 SAS-D and 7210 SAS-Dxp.

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 the message response is not received. Any response received after the request times out is silently discarded.

Default 5

Values 1 to 120

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.

Default 1

Values 1 to 10

record-type

Specifies a record type. The IPv6 address is only supported on 7210 SAS-D and 7210 SAS-Dxp.

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Values **ipv4-a-record** — Keyword for a record specific mapping a host name to an IPv4 address.

ipv6-aaaa-record— Keyword for 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

Description

This command verifies the reachability of a remote host.

Parameters

ip-address

Specifies the far-end IP address to which to send the **icmp-ping** request message in dotted-decimal notation. The IPv6 address is only supported on the 7210 SAS-D and 7210 SAS-Dxp.

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

dns-name

Specifies the DNS name of the far-end device to which to send the **icmp-ping** request message, expressed as a character string.

rapid

Specifies that packets be generated as fast as possible, instead of the default 1 per second.

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detail

Displays detailed information.

ttl ***time-to-live***

Specifies the TTL value for the IP TTL, 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 information is filled instead.

Values 0 to 65535

source ***ip-address***

Specifies the IP address to be used. IPv6 address is only supported on 7210 SAS-D and 7210 SAS-Dxp.

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

router ***router-instance***

Specifies the router name or service ID.

Values *router-name*: Base

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.

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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*

Specifies to only display static routes with the specified next-hop IP address. The IPv6 address is only supported on 7210 SAS-D and 7210 SAS-Dxp.

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

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*

Specifies 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 is not

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received. A "request timeout" message is displayed for each message request sent that expires. Any response received after the request times out is silently discarded.

Default 5

Values 1 to 10

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

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#
```

Parameters

ip-address

Specifies the far-end IP address to which to send the traceroute request message, in dotted-decimal notation. The IPv6 address is only supported on 7210 SAS-D and 7210 SAS-Dxp.

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.

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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.

Default 5000

Values 10 to 60000

no-dns

Specifies that 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 interfaces on the device, an error is returned. The IPv6 address is only supported on 7210 SAS-D and 7210 SAS-Dxp.

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

router *router-name*

Specifies an 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/prefix-length* [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

lsp-ping prefix *ip-prefix/prefix-length* [**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/prefix-length*}} [**src-ip-address** *ip-address*] [**size** *octets*] [**ttl** *label-ttl*] [**timeout** *timeout*] [**interval** *interval*] [**fc** *fc-name* [**profile** {**in** | **out**}]] [**send-count**

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send-count] {*lsp-name* [**path** *path-name*]} [**fc** *fc-name*] [**size** *octets*][**ttl** *label-ttl*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]

The following options are common to all **lsp-ping** cases**:** [**detail**] [**fc** *fc-name* [**profile in** | **out**]] [**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

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

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 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.

The **lsp-ping static** command performs an LSP ping using the protocol and data structures defined in RFC 4379, as extended by RFC 6426, *MPLS On-Demand Connectivity Verification and Route Tracing*.

The timestamp format to be sent, and to be expected when received in a PDU, is 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 a name that identifies an LSP to ping. The LSP name can be up to 32 characters long.

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.

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.

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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 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 name. The FC and profile parameters are used to indicate the forwarding class and profile 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 and profile parameter values. The marking of the packet 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 and profile parameter values are 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 and profile parameter values determined by the classification of the echo request packet, which is being replied to, at the incoming interface. The marking of the packet EXP is dictated by the LSP-EXP mappings on the outgoing interface. The TOS byte is not modified. The following table describes this behavior.

Table 24: Request packet and behavior

Node	Packet and description
cpm (sender node)	echo request packet: • packet{tos=1, fc1, profile1} • fc1 and profile1 are as entered by user in OAM command or default values • tos1 as per mapping of {fc1, profile1} to IP precedence in network egress QoS policy of outgoing interface
Outgoing interface (sender node)	echo request packet: • pkt queued as {fc1, profile1} • ToS field=tos1 not remarked • EXP=exp1, as per mapping of {fc1, profile1} to EXP in network egress QoS policy of outgoing interface
Incoming interface (responder node)	echo request packet: • packet{tos1, exp1}

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Node	Packet and description
	• exp1 mapped to {fc2, profile2} as per classification in network QoS policy of incoming interface
cpm (responder node)	echo reply packet: • packet{tos=1, fc2, profile2}
Outgoing interface (responder node)	echo reply packet: • pkt queued as {fc2, profile2} • 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

The LSP-EXP mappings on the receive network interface control the mapping of the message reply back to the originating router.

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

Default be

profile {in | out}

Specifies the profile state of the MPLS echo request packet.

Default out

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.

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. This parameter overrides the default number of message requests sent. Each message request

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must either time out 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 overrides 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 overrides 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***

Specifies to only display 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.

static ***lsp-name***

Specifies an LSP ping route using RFC 6426, *MPLS On-Demand Connectivity Verification and Route Tracing*.

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 10.4.4.4/32 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
```


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```
===============================================================================
LDP LSR ID: 1.1.1.1
===============================================================================
Legend: U - Label In Use,  N - Label Not In Use, W - Label Withdrawn
        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*]]

The following options are 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

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

Description

This command performs an LSP trace using the protocol and data structures defined in RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*, and 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 the data plane and awaits a TTL exceeded response or the MPLS echo reply packet from the device

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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.

The following 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 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.

Some restrictions apply when using this feature on 7210 SAS nodes, see LSP diagnostics: LSP ping and trace.

Parameters

lsp-name

Specifies a name, up to 32 characters, that identifies an LSP to ping.

path *path-name*

Specifies the LSP path name along which to send the LSP trace request.

Default the active LSP path

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. 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

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 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

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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 given 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 is not 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***

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

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fc *fc-name*

Specifies the fc and profile parameters used to indicate the forwarding class and profile 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 and profile parameter values. 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 and profile parameter values are 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 and profile parameter values 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. Table 24: Request packet and behavior summarizes this behavior:

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

Default be

profile {in | out}

Specifies the profile state of the MPLS echo request packet.

Default out

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. 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.

Default Inherited from global configuration of downstream mapping TLV in option **mpls-echo-request-downstream-map** {**dsmap** | **ddmap**}.

Output

The following output is an example of LSP trace information.

Sample output

```
*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
```


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```
     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 p
roto=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 p
roto=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
 p
roto=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#
```

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

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Platforms

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

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 given 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. OAM request messages sent within an IP SDP must have the 'DF' IP header bit set to 1 to prevent message fragmentation. 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 given 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.

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. Once 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 (once 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 below.

start-octets

Specifies the beginning size in octets of the first message sent for an incremental MTU test, expressed as a decimal integer.

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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. 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 0

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

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
```


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```
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

oam

Platforms

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

Description

Note:
The **oam**>**svc-ping** command is not supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C when the **hash-label** command is enabled.

This command tests a service ID for correct and consistent provisioning between two service end points.

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**:

- local and remote service existence
- local and remote service state
- local and remote service type correlation
- local and remote customer association
- local and remote service-to-SDP bindings and state
- 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>.

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Upon request timeout, message response, request termination, or request error, the information in the following table is displayed. Local and remote information is dependent upon service existence and reception of reply.

Table 25: 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
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

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Field	Description	Values
		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
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	resp-ip-addr
		N/A

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Field	Description	Values
	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.	
Responders Expected Far-end Address	The expected source of the originator **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-Up is displayed. If an originating **sdp-id** is not found, N/A is displayed.	Admin-Up Admin-Up 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

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Field	Description	Values
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
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*	originator-vc-id N/A

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Field	Description	Values
	If the **sdp-id** signaling is off, *originator-vc-id* is 0. If the *originator-vc-id* does not exist, N/A is displayed.	
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
Responding Egress Service Label Source	The responder's egress service label source If the responder's egress service label is manually defined, 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.	Manual 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,	Up Down

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Field	Description	Values
	Down is displayed. If the *service-id* does not exist or the responder's egress service label is non-existent, N/A is displayed.	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 ingress service label source If the originator 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 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
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	Up Down N/A

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Field	Description	Values
	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.	

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 locally 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 26: 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
SDP-ID Valid and Up, But No Service Label	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, 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.

Output

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#
```


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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

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

Description

This command performs a VPRN ping.

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

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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.

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.

Default 5

Values 1 to 100

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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
-------------------------------------------------------------------------------
...
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

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

Description

This command performs VPRN trace.

Parameters

service *service-id*

Specifies the VPRN service ID to diagnose or manage.

Values 1 to 2147483647

source *src-ip*

Specifies the IP prefix for the source IP address in dotted-decimal. notation

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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)
	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

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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

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
```


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```
  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#
```

3.8.2.3 VPLS MAC diagnostics

cpe-ping

Syntax

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*]

Context

oam

config>saa>test>type

Platforms

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

Description

Note: The **cpe-ping** command is not supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C when the **hash-label** command is enabled.

This command determines the IP connectivity to a CPE within a specified VPLS or Epipe service.

Parameters

service *service-id*

Specifies the service ID of the service to diagnose or manage.

Values 1 to 2147483647

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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 or Epipe service.

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-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*

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.

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Values 1 to 100

Default 1

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

mac-populate

Syntax

mac-populate *service-id* **mac** *ieee-address* [**flood**] [**age** *seconds*] [**force**] [**target-sap sap-id**] [**send-control**]

Context

oam

Platforms

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

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 to 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 given 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.

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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.

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 associates OAM MAC with the control plane (CPU)

send-control

Sends the mac-purge request using the control plane.

Default Request is sent using the data plane

mac-purge

Syntax

mac-purge *service-id* **target** *ieee-address* [**flood**] [**send-control**] [**register**]

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Context

oam

Platforms

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

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).

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

send-control

Sends the mac-purge request using the control plane.

Default Request is sent using the data plane.

register

Reserves the MAC for OAM testing.

Default Do not register OAM MAC.

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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*] [**count** *send-count*] [**send-control**] [**return-control**] [**interval** *interval*] [**timeout** *timeout*]

Context

oam

config>saa>test>type

Platforms

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

Description

Note:
The **mac-ping** command is not supported on the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C when the **hash-label** command is enabled.

This command determines the existence of an egress SAP binding of a given 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.

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.

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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

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 is 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

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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

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

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*] [**send-control**] [**return-control**] [**source** *ieee-address*] [**send-count** *send-count*] [**interval** *interval*] [**timeout** *timeout*]

Context

oam

config>saa>test>type

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Platforms

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

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.

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*

Specifies the minimum TTL value in the VC label for the MAC trace test, expressed as a decimal integer.

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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

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 ***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

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

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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

port-id

Context

oam>efm

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables Ethernet in the First Mile (EFM) OAM tests loopback tests on the specified port. The EFM OAM remote loopback OAMPDU is sent to the peering device to trigger remote loopback.

Parameters

port-id

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

local-loopback

Syntax

local-loopback {**start** | **stop**}

Context

oam>efm

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

This command enables local loopback tests on the specified port.

remote-loopback

Syntax

remote-loopback {**start** | **stop**}

Context

oam>efm

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables remote Ethernet in the First Mile (EFM) OAM loopback tests on the specified port. The EFM OAM remote loopback OAMPDU is sent to the peering device to trigger remote loopback.

3.8.2.5 ETH-CFM OAM commands

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

Description

This command initiates a linktrace test.

Parameters

mac-address

Specifies a unicast destination MAC address.

mep *mep-id*

Specifies the target MAC address.

Values 1 to 8191

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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.

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

Description

This command initiates a loopback test.

Parameters

mac-address

Specifies a unicast MAC address in the form xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx.

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.

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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

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

Default 0

priority *priority*

Specifies a 3-bit value to be used in the VLAN tag, if present, in the transmitted frame.

Values 0 to 7

Default The CCM and LTM priority for the MEP (7)

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

Description

This command issues an ETH-CFM test.

Parameters

mac-address

Specifies a unicast MAC address.

mep *mep-id*

Specifies 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

data-length *data-length*

Indicates the UDP data length of the echo reply, the length starting after the IP header of the echo reply.

Values 64 to 1500

Default 64

priority *priority*

Specifies the priority.

Values 0 to 7

Default The CCM and LTM priority of the MEP

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

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.

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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

priority *priority*

Specifies the priority.

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

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

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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

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

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.

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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

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 is not 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

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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

Description

Commands in this context configure 802.1ag ETH 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

Description

This command configures Connectivity Fault Management domain parameters.

The **no** form of this command removes the MD index parameters from the configuration.

Parameters

md-index

Specifies the Maintenance Domain (MD) index value.

Values 1 to 4294967295

format *md-name-format*

Specifies a value that represents the type (format).

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Values dns, mac, none, string

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

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

Description

This command configures the Maintenance Association (MA) for the domain.

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Parameters

ma-index

Specifies the MA index value.

Values 1 to 4294967295

ma-name-format

Specifies a value that represents the type (format).

Values icc-based, integer, string, vid, vpn-id

icc-based: Only applicable to a Y.1731 context where the domain format is configured as none. Allows for an 8 to 13 character name in raw ASCII.

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

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

Description

This command configures the cross-reference required to link the CFM function with the service context. The link is created when the bridge ID, service ID, and VLAN ID (for a primary VLAN) match.Under the association context, this command is used to specify various MEP and MIP creation parameters. The

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VLAN parameter is not tied to the bridge identifier statement, but rather is an object under the **bridge-identifier** context.

The **no** form of this command is only available under the association context, and removes the bridge identifier and the link between the ETH-CFM configuration and the matching service ID.

Parameters

bridge-id

Specifies the bridge ID for the domain association.

Note:
The system does not verify whether a service has been created with a matching service ID.

Values 1 to 2147483647

id-permission

Syntax

id-permission {**chassis**}

no id-permission

Context

config>eth-cfm>domain>association>bridge-identifier

Platforms

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

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 include 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

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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

Platforms

Supported on all 7210 SAS platforms as described in this document

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) not associated with a configured primary VLAN.

Note:
On 7210 SAS platforms, there is support for ingress MIPs and egress MIPs. 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 tables 5, 6, and 7 listing 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.

static

Specifies the exact level of the MHF (MIP) that to be created for this SAP. Multiple MHFs (MIPs) are allowed as long as the MD level hierarchy is properly configured for the particular primary VLAN.

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mip-ltr-priority

Syntax

mip-ltr-priority *priority*

Context

config>eth-cfm>domain>association>bridge-identifier

Platforms

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

Description

This command configures 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.

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

Description

This command configures the bridge-identifier primary VLAN ID. This configuration is optional as and no verification is done to ensure that MEPs on this association are on the configured VLAN.

Note:
Also see the description for the **config>eth-cfm>domain>association>bridge-identifier** command.

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Default

no vlan

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

Description

This command configures the CCM transmission interval for all MEPs in the association.

Note:
The supported minimum CCM transmission interval values vary depending on the MEP type and 7210 SAS platform. Table 16: Minimum CCM transmission interval value support by 7210 SAS platform lists the supported minimum CCM timer values.

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, in seconds unless otherwise specified, between CCM transmissions to be used by all MEPs in the MA.

Values 10ms, 100ms, 1, 10, 60, 600

300Hz (this value is only available on the 7210 SAS-Dxp 12p with G.8032 MEPs)

Default 10

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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

Description

This command configures the remote maintenance association end point (MEP) identifier.

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

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

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Context

config>eth-cfm>slm

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures the length of time that the responder keeps a test active. If the time between packets exceeds this value during 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.

Default

100

Parameters

timer

Specifies the amount of time in seconds.

Values 10 to 100

system

Syntax

system

Context

config>eth-cfm

Platforms

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

Description

Commands in this context configure connectivity fault management general system parameters.

enable-dmm-version-interop

Syntax

[**no**] **enable-dmm-version-interop**

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Context

config>eth-cfm>system

Platforms

7210 SAS-D, 7210 SAS-Dxp

Description

This command enables processing of DMM version 1 messages that are received by the node, as specified by ITU-T Y.1731 standards for interoperability for nodes that support either version 0 or version 1 implementations. 7210 SAS nodes support processing as recommended for DMM version 0 messages.If this command is disabled, 7210 SAS nodes only process DMM version 0 messages and do not respond to DMM version 1 messages.

When this command is enabled, the 7210 SAS processes all received DMM PDU messages according to version 0 rules. DMM reply messages are sent with version field values that are identical to that of the received DMM PDU. For example, if a DMM PDU with a version value of 1 is received, the DMM reply message is sent with a version field value of 1.

On the 7210 SAS-D, when this command is disabled, timestamping for DMM messages is applied in hardware for both receive and transmit directions. When this command is enabled, timestamping for DMM messages is applied in hardware for the receive direction only, and timestamping for the transmit direction is applied in software by the CPU.

Default

no enable-dmm-version-interop

sender-id

Syntax

sender-id local *local-name*

sender-id system

no sender-id

Context

config>eth-cfm>system

Platforms

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

Description

This command configures the ETH-CFM Sender ID used in CFM PDUs.

This command allows the operator to include 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.

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

Note:
LBR functions reflect back all TLVs received in the LBM unchanged, including the Sender ID TLVs.

Default

no sender-id

Parameters

local-name

Specifies to use a local name, up to 45 alphanumeric characters inlength, as the Sender ID.

system

Specifies to use the configured system name as the Sender ID.

3.8.2.7 Y.1564 test profile commands

test-oam

Syntax

test-oam

Context

config

Platforms

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

Description

Commands in this context configure Operations, Administration, and Maintenance test parameters

testhead-profile

Syntax

testhead-profile *profile-num* [**create**]

no testhead-profile *profile-num*

Context

config>test-oam

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

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 makes it possible to configure parameters such as the 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 performance parameters such as frame delay (FD), frame delay variation (FDV), and loss. At the end of the test run, the tool compares the measured values against the test acceptance criteria that are configured in the profile to determine if the service is within bounds of the acceptance criteria or not.

The **no** form the command removes configured profile from the system.

Parameters

profile-id

Identifies the profile.

Values 1 to 10

acceptance-criteria

Syntax

acceptance-criteria *acceptance-criteria-id* [**create**]

no acceptance-criteria *acceptance-criteria-id*

Context

configure>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command specifies the test acceptance criteria to be used by the testhead OAM tool for declaring the PASS/FAIL result at the completion of the test.

It is possible to create up to 4 different acceptance criteria per profile to measure different SLA needs. Users can optionally specify only one acceptance criterion to be used by the testhead OAM tool during the invocation of the test.

The **no** form of this command removes the test acceptance criteria.

Default

no defaults

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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

cir-threshold *cir-threshold*

no cir-threshold

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a CIR value that is compared to the measured CIR at the end of the test in order to declare the test result. If the measured value is greater than the configured value, the test is declared as "PASS"; otherwise, 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 cir-threshold

Parameters

threshold

Specifies the value for comparison with the measured value.

Values 0 to 1000000 kbps

jitter-rising-threshold

Syntax

jitter-rising-threshold *threshold*

no jitter-rising-threshold

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Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a jitter value that is compared to the measured jitter at the end of the test in order to declare the test result. If the measured value is greater than the configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no jitter-rising-threshold

Parameters

threshold

Specifies the value for comparison with measured value.

Values 0 to 2147483000, in microseconds

jitter-rising-threshold-in

Syntax

jitter-rising-threshold-in *threshold*

no jitter-rising-threshold-in

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a jitter value that is compared to 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 configured value, the test is declared as "FAIL"; otherwise, 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. Basically, the threshold value is ignored and not considered for declaring the test result.

Default

no jitter-rising-threshold-in

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Parameters

In-profile-threshold

Specifies the value, in microseconds, for comparison with the 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

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a jitter value that is compared to 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 configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no jitter-rising-threshold-out

Parameters

out-profile-threshold

Specifies the value, in microseconds, for comparison with the measured value.

Values 0 to 2147483000

latency-rising-threshold

Syntax

latency-rising-threshold *threshold*

no latency-rising-threshold

Context

configure>test-oam>testhead-profile>acceptance-criteria

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a latency value that is compared to the measured latency at the end of the test to declare the test result. If the measured value is greater than the configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no latency-rising-threshold

Parameters

threshold

Specifies the value, in microseconds, for comparison with the measured value.

Values 0 to 2147483000

latency-rising-threshold-in

Syntax

latency-rising-threshold-in *threshold*

no latency-rising-threshold-in

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a latency value that is compared to 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 configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no latency-rising-threshold-in

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Parameters

In-profile-threshold

Specifies the value, in microseconds, for comparison with the measured value.

Values 0 to 2147483000

latency-rising-threshold-out

Syntax

latency-rising-threshold-out *threshold*

no latency-rising-threshold-out

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a latency value that is compared to 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 configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no latency-rising-threshold-out

Parameters

out-profile-threshold

Specifies the value, in microseconds, for comparison with the measured value.

Values 0 to 2147483000

loss-rising-threshold

Syntax

loss-rising-threshold *threshold*

no loss-rising-threshold

Context

configure>test-oam>testhead-profile>acceptance-criteria

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a frame loss ratio (FLR) value that is compared to the measured FLR at the end of the test to declare the test result. If the measured value is greater than the configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The FLR is computed as a ratio of the difference of the number of received frames to the 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 so that the threshold value is ignored for declaring the test result.

Default

no loss-rising-threshold

Parameters

threshold

Specifies the value for comparison with the measured value, 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

loss-rising-threshold-in *ithreshold*

no loss-rising-threshold-in

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a frame loss ratio (FLR) value that is compared to 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 configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The FLR for green/in-profile packets is computed as a ratio of the difference of the number of received green or in-profile frames to the number of injected/sent green/in-profile frames divided by the number of sent green frames.

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The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no loss-rising-threshold-in

Parameters

in-profile-threshold

Specifies the value for comparison with the measured value, 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

loss-rising-threshold-out *threshold*

no loss-rising-threshold-out

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the frame loss ratio (FLR) value that is compared to 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 configured value, the test is declared as "FAIL"; otherwise, it is considered to be "PASS".

The FLR for yellow/out-of-profile packets is computed as a ratio of the difference of the number of received yellow frames to the 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 so that the threshold value is ignored for declaring the test result.

Default

no loss-rising-threshold

Parameters

out-profile-threshold

Specifies the value for comparison with the measured value, 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%.

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Values 1 to 1000000

pir-threshold

Syntax

pir-threshold *threshold*

no pir-threshold

Context

configure>test-oam>testhead-profile>acceptance-criteria

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the PIR value that is compared to the measured PIR at the end of the test to declare the test result. If the measured value is greater than the configured value the test is declared as "PASS"; otherwise, it is considered to be "FAIL".

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no pir-threshold

Parameters

threshold

Specifies the value, in kbps, for comparison with the measured value.

Values 0 to 1000000

dot1p

Syntax

[**no**] **dot1p in-profile** *dot1p-value* **out-of-profile** *dot1p-value*

Context

configure>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp

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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 than 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 than the value configured for green or in-profile packets.

Values 0 to 7

description

Syntax

description *description-string*

no description

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Context

config>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures a description for a testhead profile.

The **no** form the command removes the description.

Parameters

description-string

Specifies the description for the testhead profile.

Values ASCII string

frame-payload

Syntax

frame-payload *frame-payload-id* [**payload-type** [**l2** | **tcp-ipv4** | **udp-ipv4** | **ipv4**] [**create**]

no frame-payload *frame-payload*

Context

configure>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command specifies the packet header values to be used in frames generated by testhead tool.

One of 4 types of frame payload, representing different kinds of traffic, can be selected within a profile. The user chooses one among these when starting the throughput test.

The **payload-type** parameter determines the packet header fields that are used to populate the frame generated by the testhead OAM tool. The packet header fields use 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 below 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

Identifies the frame payload, it is an integer used to identify the frame type to use when starting the throughput test.

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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 generated by the testhead OAM tool. If no frame payload type value is specified during creation of the new frame payload, the default is **tcp-ipv4**.

Values **l2** | **tcp-ipv4** | **udp-ipv4** | **ipv4**

When **l2** is specified, use **src-mac**+**dst-mac**+**vlan-tag-1** (if available)+**vlan-tag-2** (if available)+**ethertype**+**data-pattern**.

When **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**+d**ata-pattern**.

When **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**.

data-pattern

Syntax

data-pattern *data-pattern*

no data-pattern

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the data pattern to populate the payload portion of the frame generated by the testhead tool.

This value can be specified when the **payload-type** is configured as **l2**, **ipv4**, **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

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Parameters

data-pattern

Specifies the data pattern to fill the payload data.

Values a string of 1 to 64 decimal or hexadecimal numbers

description

Syntax

description *frame-description*

no description

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command creates a text description for a frame generated by the testhead tool.

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

Default

no description

Parameters

frame-description

Specifies the ASCII string to describe the frame.

Values ASCII string

dscp

Syntax

dscp *dscp-name*

no dscp

Context

configure>test-oam>testhead-profile>frame-payload

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the IP DSCP value to use in the IP header for the frame generated by the testhead tool.

This value can be specified when the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. When the **payload-type** is set to **ipv4**, **tcp-ipv4**, or **udp-ipv4** but this command is not configured, the DSCP value defaults to 0. 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 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

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 |a f43 | 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

dst-ip ipv4 *ipv4-address*

no dst-ip ipv4

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

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Description

This command configures the destination IPv4 address to use in the IP header of the frame generated by the testhead tool.

This value must be specified if the **payload-type** is configured as **ipv4**, **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 ipv4 if the **payload-type** is set to **ipv4**, **tcp-ipv4** or **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 to 255

dst-mac

Syntax

dst-mac *ieee-address* [*ieee-address-mask*]

no dst-mac

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the destination 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

Specifies the unicast destination MAC address for Y.1564 packets.

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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 0 to 9 and a to f.

dst-port

Syntax

dst-port *dst-port-number*

no dst-port

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the destination port to use in the TCP header of 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

ethertype *0x0600..0xffff*

no ethertype

Context

configure>test-oam>testhead-profile>frame-payload

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the Ethertype for the frame generated by the testhead tool.

This value must be specified when the **payload-type** is **l2**. The testhead tool uses the value specified with this command only if the **payload-type** is **l2**. See the frame-payload command description for information when the **payload-type** is configured with an option other than **l2**.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

0x0800

Parameters

0x0600..0xffff

Specifies the Ethertype value as a hexadecimal string in the range 0x0600 to 0xffff.

ip-proto

Syntax

ip-proto *ip-protocol-number*

no ip-proto

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the IP protocol to use in the IP header of the frame payload generated by the testhead tool.

This value must be specified when the **payload-type** is configured as **ipv4**. If the **payload-type** is configured 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 when 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

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Parameters

ip-protocol-number

Specifies the IP protocol number to use in the IP header of Y.1564 packets.

Values a valid IP protocol number specified as a decimal number in the range 0 to 255

ip-tos

Syntax

ip-tos *type-of-service*

no ip-tos

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the IP TOS (Type of Service) value to use in the IP header of the frame generated by the testhead tool.

The value can be specified when the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. If this command is not configured and the **payload-type** is set to **ipv4**, **tcp-ipv4**, or **udp-ipv4**, the ToS value defaults to 0. The testhead tool does not use the value specified with this command when the **payload-type** is **l2**.

Note:
If both IP DSCP and IP ToS are configured, the IP DSCP value is used. 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 testhead tool.

Default

no ip-tos

Parameters

type-of-service

Specifies ToS bits to use in the IP header.

Values a valid number in the range 0 to 8

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ip-ttl

Syntax

ip-ttl *ttl-value*

no ip-ttl

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the IP TTL (Time-to-Live) value to use in the IP header of the frame generated by the testhead tool.

This value can be specified if the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. If this command is not configured and the **payload-type** is set to **ipv4**, **tcp-ipv4**, or **udp-ipv4**, the TTL value defaults to 0. The testhead tool does not use the value specified with this command when 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 to use in the IP header.

Values a decimal number in the range 1 to 255

src-ip

Syntax

src-ip ipv4 *ipv4-address*

no src-ip ipv4

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

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Description

This command configures the source IPv4 address to use in the IP header of the frame generated by the testhead tool.

This value must be specified when the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. The testhead tool does not use the value specified with this command when 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, or 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 (a.b.c.d) where a, b, c, and d are decimal values in the range of 1 to 255

src-mac

Syntax

src-mac *ieee-address* [*ieee-address-mask*]

no src-mac

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the 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 src-mac

Parameters

ieee-address

Specifies the unicast source 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.

src-port

Syntax

src-port *src-port-number*

no src-port

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the source port to use in the TCP header of the frame generated by the testhead tool.

This value must be specified when 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 set to **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

The source TCP/UDP port number to use in the frame's TCP/UDP header.

Values a valid TCP/UDP port number in decimal or hexadecimal, in the range 0 to 65535

vlan-tag-1

Syntax

vlan-tag-1 vlan-id *vlan-id-value* [**tpid** *tpid value*] [**dot1p** *dot1p-value*]

no vlan-tag-1

Context

configure>test-oam>testhead-profile>frame-payload

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the VLAN ID, dot1p bit, and TPID value to be used for the outermost VLAN tag (often called the outer VLAN) in the frame generated by the testhead OAM tool.

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:

- For the frame generated by the tool to be processed successfully on SAP ingress, the TPID value configured with this command must match either the QinQ Ethertype value in use on the port on which the test SAP is configured or it must match 0x8100 if the test SAP is configured on a dot1q encapsulation port. If this value does not match the value configured under the port, frames generated by the testhead tool are dropped by the node on SAP ingress due to an Ethertype mismatch.
- For the frame generated by the tool to be processed successfully on SAP ingress, the VLAN ID configured with this command must match the outermost VLAN tag of the QinQ SAP or the Dot1q SAP used for the test SAP. If this value does not match the value configured for the SAP, frames generated by the testhead tool are dropped by the node on SAP ingress due to a 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 used for the VLAN tag. A value must be specified if this command is configured; there is no default value.

Values 0 to 409

tpid-value

Specifies the TPID (also known as Ethertype) to use for the VLAN tag addition. If no value is specified, the TPID defaults to 0x8100.

Values any valid Ethertype value allowed for use with VLAN tags, in the range 0x0600 to 0xffff

dot1p-value

Specifies the value used to populate the dot1p bits in the VLAN tag. If no value is specified, the dot1p setting defaults to 0.

Values 0 to 7

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vlan-tag-2

Syntax

vlan-tag-2 vlan-id *vlan-id-value* [**tpid** *tpid value*] [**dot1p** *dot1p-value*]

no vlan-tag-2 vlan-id *vlan-id-value* [**tpid** *tpid value*] [**dot1p** *dot1p-value*]

Context

configure>test-oam>testhead-profile>frame-payload

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the VLAN ID, dot1p bit, and TPID value 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.

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 TPID value configured with this command must be 0x8100 in order for the frame generated by the testhead tool to be processed successfully on SAP ingress. If this value does not match 0x8100, frames generated by the tool are dropped by the node on SAP ingress due to an Ethertype mismatch (7210 SAS supports only 0x8100 as the Ethertype value for the inner VLAN tag).
- The VLAN ID configured with this command must match the outermost VLAN tag of the QinQ SAP or the dot1q SAP used for the test SAP in order for the frame generated by the tool to be processed successfully on SAP ingress. If this value does not match the value configured for the SAP, frames generated by the testhead tool are dropped by the node on SAP ingress due to a 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 used for the VLAN tag. A value must be specified if this command is configured; there is no default value.

Values 0 to 4094

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tpid-value

Specifies the TPID (also knows as Ethertype) to use for the VLAN tag addition. If no value is specified, the TPID defaults to 0x8100.

Values any valid Ethertype value allowed for use with VLAN tags, in the range 0x0600 to 0xffff

dot1p-value

Specifies the value used to populate the dot1p bits in the VLAN tag. If no value is specified, the dot1p setting defaults to 0.

Values 0 to 7

frame-size

Syntax

frame-size *frame-size*

no frame-size

Context

config>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command configures the frame size of the packets generated by the testhead tool. Any frame size in the given range can be specified.

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

Default

512 bytes

Parameters

frame-size

Specifies the size of the frame generated by the testhead tool, in bytes.

Values 64 to 9212

rate

Syntax

rate cir *cir-rate-in-kbps* [**adaptation-rule** *adaptation-rule*] [**pir** *pir-rate-in-kbps*]

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no rate

Context

config>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

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 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.

The **no** form of this command sets the CIR value to the default; 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 specified, 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

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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.

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

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

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 the test configuration, the measured values, the test completion status, and the PASS/FAIL result.

The **no** form of this command disables the generation of the trap upon test completion.

Default

no test-completion-trap-enable

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test-duration

Syntax

test-duration {[**hours** *hours*] [**minutes** *minutes*] [**seconds** *seconds*]}

no test-duration

Context

config>test-oam>testhead-profile

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T

Description

This command specifies the total test duration to be used for throughput measurement. The test duration can be specified in number of hours, number of minutes, or number of seconds. When all of 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

no test-duration (sets the test duration for 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 specified hours, minutes, and seconds.

Values 0 to 24

minutes

The total number of minutes to run the test.The total test duration is determined by the sum of the specified hours, minutes, and seconds.

Values 0 to 60

seconds

The total number of seconds to run the test. The total test duration is determined by the sum of the specified hours, minutes, and seconds.

Values 0 to 60

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3.8.2.8 OAM testhead commands

testhead

Syntax

testhead *test-name* [**owner** *owner-name*] **testhead-profile** *profile-id* [**frame-payload** *frame-payload-id*] [**acceptance-criteria** *acceptance-criteria-id* [**color-aware enable** | **disable**]] **sap** *sap-id* [**fc** *fc-name*] [**enforce-fc-check enable** | **disable**]

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*]

testhead *test-name* [**owner** *owner-name*] **stop**

Context

oam

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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. For the 7210 SAS-D and 7210 SAS-Dxp, both the CIR and PIR can be specified. For the 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T, only the CIR can be specified (the PIR is not supported).

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. 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

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- 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 values and declare a pass or fail result. The tool does not make any attempt to compare the in/out thresholds against measured values. The tool uses the *cir-threshold* as follows:

- 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).

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.
- The 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T support the generation of multiple streams of traffic using the testhead OAM tool. The user can run multiple testhead sessions on 7210 SAS-K 2F1C2T or 7210 SAS-K 2F6C4T devices simultaneously to validate multiple SAPs. The total throughput that can be generated is up to about 1Gb/s. In other words, the total traffic generated across all the streams is about 1Gb/s.
- The 7210 SAS-K 2F1C2T and 7210 SAS-K 2F6C4T do not support **color-aware** mode. That is, it is assumed that the **color-aware** mode parameter value is set to **disable**.

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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.

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-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

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. On the 7210 SAS-K 2F1C2T or 7210 SAS-K 2F6C4T, this parameter is set to **disable** by default and cannot be configured.

Default disable

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..200]

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qtag1 - [0..4094]

qtag2 - [*|1..4094]

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. This parameter is only supported on the 7210 SAS-D and 7210 SAS-Dxp.

Default disable

3.8.2.9 Y.1564 service test commands

acceptance-criteria

Syntax

acceptance-criteria *acceptance-criteria-id* [**create**]

no acceptance-criteria *acceptance-criteria-id*

Context

configure>test-oam

Platforms

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

Description

This command configures the test acceptance criteria policy to be used by the service test testhead OAM tool for determining the test result upon test completion.

By default, **acceptance-criteria 1** is created and associated with all streams that do not have an explicit **acceptance-criteria** policy already associated by the user. This acceptance criteria is attached to every **service-stream** created under the **service-test** context, for which no explicit acceptance-criteria policy is configured by the user. Changes cannot be made to the default.

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The **no** form of this command removes the currently associated acceptance-criteria policy and associates the default policy.

Default

acceptance criteria 1

Parameters

acceptance-criteria-id

Specifies a decimal number used to identify the test acceptance criteria and to use when starting the throughput test.

Values 1 to 1000

cir-threshold

Syntax

cir-threshold *cir-threshold*

no cir-threshold

Context

configure>test-oam>acceptance-criteria

Platforms

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

Description

This command configures a CIR value that is compared to the measured results for the **cir** and **policing** test types. If the measured value is greater than the configured value, the test passes; otherwise, it fails. For more information, see the use-m-factor command.

The **no** form of this command disables the comparison of the parameter with the measured value so that the CIR threshold value is ignored for declaring the test result.

Default

no cir-threshold

Parameters

threshold

The CIR value for comparison with the measured value.

Values 0 to 1000000 kb/s

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jitter-rising-threshold

Syntax

jitter-rising-threshold *threshold*

no jitter-rising-threshold

Context

configure>test-oam>acceptance-criteria

Platforms

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

Description

This command configures a jitter value that is compared to the measured jitter at the end of the test to declare the test result. If the measured value is greater than the configured value, the test fails; otherwise, it passes.

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no jitter-rising-threshold

Parameters

threshold

The jitter value for comparison with measured value.

Values 0 to 2147483000, in microseconds

latency-rising-threshold

Syntax

latency-rising-threshold *threshold*

no latency-rising-threshold

Context

configure>test-oam>acceptance-criteria

Platforms

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

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Description

This command configures a latency value that is compared to the measured latency at the end of the test to declare the test result. If the measured value is greater than the configured value, the test fails; otherwise, it passes. A measured latency value of zero also causes the test to fail.

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no latency-rising-threshold

Parameters

threshold

Specifies the latency value for comparison with the measured value.

Values 0 to 2147483000, in microseconds

loss-rising-threshold

Syntax

loss-rising-threshold *threshold*

no loss-rising-threshold

Context

configure>test-oam>acceptance-criteria

Platforms

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

Description

This command configures a frame loss ratio (FLR) value that is compared to the measured FLR at the end of the test to determine the test result. If the measured value is greater than the configured value, the test fails; otherwise, it passes. If the **loss-rising-threshold** is not configured explicitly, any non-zero value of loss causes the test to fail.

The FLR is computed as a ratio of the difference of the number of received frames to the 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 so that the threshold value is ignored for declaring the test result.

Default

no loss-rising-threshold

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Parameters

threshold

Specifies the threshold value for comparison with the measured value, 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

pir-threshold *threshold*

no pir-threshold

Context

configure>test-oam>acceptance-criteria

Platforms

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

Description

This command configures a PIR value that is compared to the measured results for the **cir-pir**, **policing**, and **performance** test types. If the measured value is greater than the configured value, the test passes; otherwise, it fails. For more information, see the use-m-factor command.

The **no** form of this command disables the comparison of the parameter with the measured value so that the threshold value is ignored for declaring the test result.

Default

no pir-threshold

Parameters

threshold

Specifies the value for comparison with the measured value.

Values 0 to 1000000 kb/s

use-m-factor

Syntax

use-m-factor *use-m-factor*

no use-m-factor

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Context

configure>test-oam>acceptance-criteria

Platforms

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

Description

This command configures the margin by which the observed throughput is off from the configured throughput to determine whether a service test passes or fails.

The list below describes how the M factor is used with **cir-threshold** and **pir-threshold** values for different test types to determine whether a test passes or fails.

- For **test-type cir**, if the measured throughout is less than the difference of the configured CIR threshold and the M factor, the test fails
- For **test-type cir-pir**, if the measured throughput is less than the difference of the configured PIR threshold and the M factor, the test fails
- For **test-type policing**:
  - if the measured throughput is less than the difference of the configured PIR threshold and the M factor, the test fails
  - if the measured throughput is greater than the sum of the configured PIR threshold and the M factor, the test fails
- For **test-type performance**, if the measured throughput is less than the difference of the configured PIR threshold and the M factor, the test fails

The **no** form of this command removes the M factor.

Default

no use-m-factor

Parameters

use-m-factor

Specifies the value to use for the M factor.

Values 0 to 1000000 kb/s

frame-mix

Syntax

frame-mix *frame-mix-id* [**create**]

no frame-mix

Context

configure>test-oam

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Platforms

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

Description

This command creates a policy for configuring frames of different sizes for use with a test stream configured under service test testhead OAM tool. The ITU-T Y.1564 standard designates the letters a to h with a default frame size. Users can order a sequence of letters to specify the frame sizes that configured streams can use for frame generation. The 7210 SAS offers the flexibility of assigning a different frame size to each of the letters.

The **no** form of this command deletes the specified **frame-mix** template.

Parameters

frame-mix-id

Specifies the identifier for a test flow with a given frame mix.

Values 1 to 1000

size-a

Syntax

size-a *size*

no size-a

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "a".

The **no** form of this command restores the default frame size associated with the letter "a".

Default

64 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "a".

Values 64 to 9212

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size-b

Syntax

size-b *size*

no size-b

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "b".

The **no** form of this command restores the default frame size associated with the letter "b".

Default

128 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "b".

Values 64 to 9212

size-c

Syntax

size-c *size*

no size-c

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "c".

The **no** form of this command restores the default frame size associated with the letter "c".

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Default

256 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "c".

Values 64 to 9212

size-d

Syntax

size-d *size*

no size-d

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "d".

The **no** form of this command restores the default frame size associated with the letter "d".

Default

512 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "d".

Values 64 to 9212

size-e

Syntax

size-e *size*

no size-e

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Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "e".

The **no** form of this command restores the default frame size associated with the letter "e".

Default

1024 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "e".

Values 64 to 9212

size-f

Syntax

size-f *size*

no size-f

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "f".

The **no** form of this command restores the default frame size associated with the letter "f".

Default

1280 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "f".

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Values 64 to 9212

size-g

Syntax

size-g *size*

no size-g

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "g".

The **no** form of this command restores the default frame size associated with the letter "g".

Default

1518 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "g".

Values 64 to 9212

size-h

Syntax

size-h *size*

no size-h

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "h".

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The **no** form of this command restores the default frame size associated with the letter "h".

Default

9212 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "h".

Values 64 to 9212

size-u

Syntax

size-u *size*

no size-u

Context

configure>test-oam>frame-mix

Platforms

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

Description

This command configures Ethernet frame size to be associated with the letter "u", which is user defined.

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

Default

0 bytes

Parameters

size

Specifies the value for Ethernet frame size to be associated with the letter "u".

Values 64 to 9212

frame-payload

Syntax

frame-payload *frame-payload-id* [**payload-type** [**l2** | **tcp-ipv4** | **udp-ipv4** | **ipv4**] [**create**]

no frame-payload *frame-payload*

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Context

configure>test-oam

Platforms

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

Description

This command specifies the packet header values to be used in frames generated by the service test testhead tool.

One of four types of frame payload, representing different kinds of traffic, can be selected when starting the throughput test.

The **payload-type** parameter determines the packet header fields that are used to populate the frames generated by the tool. The packet header fields use 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**. The parameter description below describe the parameters to be used when other values are specified with **payload-type**.

The **no** form of this command removes the frame payload context.

Parameters

frame-payload-id

Identifies the frame payload, it is an integer used to identify the frame type to use when starting the throughput test.

Values 1 to 1000

frame-payload-type

Identifies whether the frame payload is Layer 2 traffic, IP traffic, TCP/IP traffic or UDP/IP traffic and uses appropriate parameters to build the frame generated by the service test testhead OAM tool. If no frame payload type value is specified during creation of the new frame payload, the default is **tcp-ipv4**.

Values **l2** | **tcp-ipv4** | **udp-ipv4** | **ipv4**

When **l2** is specified, use **src-mac** + **dst-ma c**+ **vlan-tag-1** (if available) + **vlan-tag-2** (if available) + **ethertype** + **data-pattern**.

When **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**.

When **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

data-pattern *data-pattern*

no data-pattern

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the data pattern to populate the payload portion of the frame generated by the service test testhead OAM tool.

This value can be specified when the **payload-type** is configured as **l2**, **ipv4**, **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

0xa1b2c3d4e5f6

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 to 64

description

Syntax

description *frame-description*

no description

Context

configure>test-oam>frame-payload

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Platforms

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

Description

This command creates a text description for a frame generated by the service test testhead OAM tool.

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

dscp *dscp-name*

no dscp

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the IP DSCP value to use in the IP header for the frame generated by the service test testhead OAM tool.

This value can be specified when the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. When the **payload-type** is set to **ipv4**, **tcp-ipv4**, or **udp-ipv4** but this command is not configured, the DSCP value defaults to **be**. The 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 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

be

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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 |a f43 | 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

dst-ip ipv4 *ip-address*

no dst-ip

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the destination IPv4 address to use in the IP header of the frame generated by the service test testhead OAM tool.

This value must be specified if the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. The 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 ipv4 if the **payload-type** is set to **ipv4**, **tcp-ipv4** or **udp-ipv4**

Parameters

ip-address

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 to 255

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dst-mac

Syntax

dst-mac *ieee-address* [*ieee-address-mask*]

no dst-mac

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the destination MAC address to use in the frame generated by the service test 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

Specifies the unicast destination MAC address for Y.1564 packets.

Values 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 to f.

dst-port

Syntax

dst-port *dst-port-number*

no dst-port

Context

configure>test-oam>frame-payload

Platforms

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

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Description

This command configures the destination port to use in the TCP header of the frame generated by the service test testhead OAM tool.

This value must be specified if the **payload-type** is configured as **tcp-ipv4** or **udp-ipv4**. The 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

ethertype *0x0600..0xffff*

no ethertype

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the Ethertype for the frame generated by the service test testhead OAM tool.

This value must be specified when the **payload-type** is **l2**. The tool uses the value specified with this command only if the **payload-type** is **l2**. See the frame-payload command description for information when the **payload-type** is configured with an option other than **l2**.

The **no** form of this command indicates that the field is not to be used in the frame generated by the tool.

Default

0x0800

Parameters

0x0600..0xffff

An Ethertype value specified as a hexadecimal string in the range 0x0600 to 0xffff.

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ip-proto

Syntax

ip-proto *ip-protocol-number*

no ip-proto

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the IP protocol to use in the IP header of the frame payload generated by the service test testheadOAM tool.

This value must be specified when the **payload-type** is configured as **ipv4**. If the **payload-type** is configured as **tcp-ipv4** or **udp-ipv4**, the appropriate standard-defined values are used. The tool does not use the value specified with this command when 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 of Y.1564 packets.

Values a valid IP protocol number specified as a decimal number in the range 0 to 255

ip-tos

Syntax

ip-tos *type-of-service*

no ip-tos

Context

configure>test-oam>frame-payload

Platforms

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

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Description

This command configures the IP TOS (Type of Service) value to use in the IP header of the frame generated by the service test testhead OAM tool.

This value can be specified when the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. If this command is not configured and the **payload-type** is set to **ipv4**, **tcp-ipv4**, or **udp-ipv4**, the ToS value defaults to 0. The tool does not use the value specified with this command when the **payload-type** is **l2**.

Note:
If both IP DSCP and IP ToS are configured, the IP DSCP value is used. 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 ToS bits to use in the IP header.

Values a valid number in the range 0 to 8

ip-ttl

Syntax

ip-ttl *ttl-value*

no ip-ttl

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the IP Time-to-Live (TTL) value to use in the IP header of the frame generated by the service test testhead OAM tool.

This value can be specified if the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. If this command is not configured and the **payload-type** is set to **ipv4**, **tcp-ipv4**, or **udp-ipv4**, the TTL value defaults to 0. The tool does not use the value specified with this command when 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

255

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Parameters

ttl-value

Specifies the IP TTL value to use in the IP header.

Values a decimal number in the range 1 to 255

src-ip

Syntax

src-ip ipv4 *ip-address*

no src-ip ipv4

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the source IPv4 address to use in the IP header of the frame generated by the service test testhead OAM tool.

This value must be specified when the **payload-type** is configured as **ipv4**, **tcp-ipv4**, or **udp-ipv4**. The tool does not use the value specified with this command when 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 (a.b.c.d) where a, b, c, and d are decimal values in the range of 1 to 255

src-mac

Syntax

src-mac *ieee-address* [*ieee-address-mask*]

no src-mac

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Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the source MAC address to use in the frame generated by the service test 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 src-mac

Parameters

ieee-address

Specifies the unicast source MAC address.

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.

src-port

Syntax

src-port *src-port-number*

no src-port

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the source port to use in the TCP header of the frame generated by the service test testhead OAM tool.

This value must be specified when the **payload-type** is configured as **tcp-ipv4** or **udp-ipv4**. The tool does not use the value specified with this command if the **payload-type** is set to **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.

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Default

no src-port, if the **payload-type** is set to **tcp-ipv4** or **udp-ipv4**

Parameters

src-port-number

The source TCP/UDP port number to use in the frame's TCP/UDP header.

Values a valid TCP/UDP port number in decimal or hexadecimal, in the range 0 to 65535

vlan-tag-1

Syntax

vlan-tag-1 vlan-id *vlan-id* [**tpid** *tpid*] [**dot1p** *dot1p-value*] [**dei** [*0..1*]]

vlan-tag-1 vlan-id *vlan-id* [**tpid** *tpid*] [**dot1p** *dot1p-value*]

no vlan-tag-1

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the VLAN ID, dot1p bit, and TPID value to be used for the outermost VLAN tag (often called the outer VLAN) in the frame generated by the service test testhead OAM tool.

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:

- For the frame generated by the tool to be processed successfully on SAP ingress, the TPID value configured with this command must match either the QinQ Ethertype value in use on the port on which the test SAP is configured or it must match 0x8100 if the test SAP is configured on a dot1q encapsulation port. If this value does not match the value configured under the port, frames generated by the tool are dropped by the node on SAP ingress due to an Ethertype mismatch.
- For the frame generated by the tool to be processed successfully on SAP ingress, the VLAN ID configured with this command must match the outermost VLAN tag of the QinQ SAP or the Dot1q SAP used for the test SAP. If this value does not match the value configured for the SAP, frames generated by the tool are dropped by the node on SAP ingress due to a VLAN ID mismatch.
- The dot1p bits specified for the outermost tag can be used for SAP ingress QoS classification.

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Default

no vlan-tag-1

Parameters

vlan-id

Specifies the VLAN ID used for the VLAN tag. A value must be specified if this command is configured; there is no default value.

Values 0 to 4094

tpid

Specifies the TPID (also known as Ethertype) to use for the VLAN tag addition. If no value is specified, the TPID defaults to 0x8100.

Values any valid Ethertype value allowed for use with VLAN tags, in the range 0x0600 to 0xffff

dot1p-value

Specifies the value used to populate the dot1p bits in the VLAN tag. If no value is specified, the dot1p setting defaults to 0.

Values 0 to 7

dei

Specifies the a 1-bit field inside the VLAN header. This parameter does not apply to the 7210 SAS-Dxp.

Values 0 to 1

vlan-tag-2

Syntax

vlan-tag-2 vlan-id *vlan-id-value* [**tpid** *tpid value*] [**dot1p** *dot1p-value*] [**dei** [*0..1*]]

vlan-tag-2 vlan-id *vlan-id* [**tpid** *tpid*] [**dot1p** *dot1p-value*]

no vlan-tag-2 vlan-id

Context

configure>test-oam>frame-payload

Platforms

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

Description

This command configures the VLAN ID, dot1p bit, and TPID value to be used for the second VLAN tag (often called the inner VLAN or the C-VLAN) in the frame generated by the service test testhead OAM tool.

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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:

- For the frame generated by the tool to be processed successfully on SAP ingress, the TPID value configured with this command must be 0x8100. If this value does not match 0x8100, frames generated by the tool are dropped by the node on SAP ingress due to an Ethertype mismatch (7210 SAS supports only 0x8100 as the Ethertype value for the inner VLAN tag).
- For the frames generated by the tool to be processed successfully on SAP ingress, the VLAN ID configured with this command must match the outermost VLAN tag of the QinQ SAP or the dot1q SAP used for the test SAP. If this value does not match the value configured for the SAP, frames generated by the tool are dropped by the node on SAP ingress due to a 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 used for the VLAN tag. A value must be specified if this command is configured; there is no default value.

Values 0 to 4094

tpid

Specifies the TPID (also knows as Ethertype) to use for the VLAN tag addition. If no value is specified, the TPID defaults to 0x8100.

Values any valid Ethertype value allowed for use with VLAN tags, in the range 0x0600 to 0xffff

dot1p-value

Specifies the value used to populate the dot1p bits in the VLAN tag. If no value is specified, the dot1p setting defaults to 0.

Values 0 to 7

dei

Specifies the a 1-bit field inside the VLAN header.

Values 0 to 1

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loopback

Syntax

loopback entry *entry-id* {**internal** | **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-Dxp

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

internal

Keyword to specify that traffic egressing the SAP is looped back in toward the node.

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.

service-test

Syntax

service-test *test-id* [**create**]

no service-test

Context

config>test-oam

Platforms

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

Description

This command configures a service test. The **no** form of this command removes the service test.

The service test must be in the **shutdown** state in order for any commands under the **service-test** context to be configured or modified. If the service test is in the **no shutdown** state, no command parameters can be changed.

Parameters

test-id

Specifies an identifier for the service test profile.

Values 1 to 1000

accounting-policy

Syntax

accounting-policy *acct-policy-id*

no accounting-policy

Context

config>test-oam>service-test

Platforms

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

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Description

This command creates an accounting policy for the specified service test. The **no** form of this command removes the policy.

Parameters

acct-policy-id

Specifies an identifier for the service test accounting policy.

Values 1 to 99

description

Syntax

description *description-string*

no description

Context

config>test-oam>service-test

Platforms

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

Description

This command configures a description for the specified service test. The **no** form of this command removes the description.

Parameters

description-string

Specifies a description for the service test, up to 80 characters.

service-stream

Syntax

service-stream *stream-id* [**create**]

no service-stream *stream-id*

Context

config>test-oam>service-test

Platforms

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

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Description

This command configures an OAM service stream profile for the specified service test. A service test must be in a shutdown state before a new service stream can be configured or before parameters can be modified on an existing stream. Any tests currently running that reference the specified service test must be stopped before executing the **shutdown** command.

The **no** form of this command removes the specified profile.

Parameters

stream-id

Specifies an identifier for the service stream profile.

Values 1 to 4

acceptance-criteria

Syntax

acceptance-criteria *acceptance-criteria-id*

no acceptance-criteria

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures the acceptance criteria for the specified service stream. The **no** form of this command removes the acceptance criteria and configures back **acceptance-criteria 1**.

Default

acceptance-criteria 1

Parameters

acceptance-id

Specifies an identifier for the acceptance criteria.

Values 1 to 1000

description

Syntax

description *description-string*

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no description

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures a description for the specified service stream. The **no** form of this command removes the description.

Parameters

description-string

Specifies a description for the service stream, up to 80 characters.

fc

Syntax

fc *fc-name*

no fc

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command specifies the forwarding class that is validated for the service stream. The frames generated by the testhead go through the classification entries in the SAP ingress QoS policy applied to the test SAP, and a forwarding class is assigned. The *fc-name* specified in this command must match the FC configured in the QoS entries. On receiving the testhead packets from the peer-side after loopback, if the FC name received, matches the configured service-stream, the software obtains the counters required to determine throughput and loss metrics for the test.

The **no** form of this command removes the forwarding class association and sets it to the default value.

Default

be

Parameters

fc-name

Specifies the name of the forwarding class.

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Values be | l2 | af | l1 | ef | nc

frame-payload

Syntax

frame-payload *frame-payload-id*

no frame-payload

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures the frame payload for the specified service stream.

The **no** form of this command removes the frame payload from the service stream.

Parameters

frame-payload-id

Specifies the frame payload identifier.

Values 1 to 1000

frame-size

Syntax

frame-size [**frame-mix** *frame-mix-id*] [*frame-sequence*]

frame-size [**fixed-size** *frame-size*]

no frame-size

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures the frame size for the specified service stream. Users have the option to configure frames to have a fixed size or a mix of frames of different sizes. When configuring a mix of frame sizes, Ethernet frame sizes can be configured based on the size designations in Recommendation ITU-

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T Y.1564. When using the Y.1564 designations, it is possible to configure the order in which the frames are generated by the test tool by using the *frame-sequence* variable. Ethernet frame sizes can also be specified with the **fixed-size** parameter so that all frames generated by the tool have the same size payload.

Note:
On 7210 SAS-Dxp, only a fixed frame size is allowed to be configured per service stream.

The **no** form of this command sets the frame size in the service stream to the default value. Frames configured with **fixed-size** parameter have a default value of 1514 bytes.

Parameters

frame-mix-id

Specifies the frame mix identifier for the specified service stream.

Values 1 to 1000

frame-sequence

Specifies a string of 16 characters denoting the sequence of frames of different sizes to be generated by the testhead tool.

frame-size

Specifies the frame size of the packets to be generated by the service test testhead OAM tool.

Values 64 to 9212 bytes

Default 1514 bytes

rate

Syntax

rate cir *cir-rate-in-kbps* [**cir-adaptation-rule** *cir-adaptation-rule*] [**pir** *pir-rate-in-kbps*] [**pir-adaptation-rule** *pir-adaptation-rule*]

no rate

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures the CIR that must be validated for the specified stream. If specified, the PIR value must be greater than or equal to the CIR value. The service test testhead OAM tool generates traffic up to the specified rate based on the **test-type** command, as follows.

- For **test-type cir**, traffic is generated at a rate up to the configured CIR.

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- For **test-type cir-pir**, traffic is generated at a rate up to the configured PIR.
- For **test-type policing**, traffic is generated at a rate up to 125% of the configured PIR.
- For **test-type performance**, traffic is generated at a rate up to the configured PIR.

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 than that rate. For 512-byte Ethernet frames, the L2 rate is 962406 Kb/s and the Layer 1 rate is 1 Gb/s.

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.

The **no** form of this command sets the CIR value to the default; 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.

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 specified, the default CIR value applies.

Values 0 to 10000000

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 rate 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

sap

Syntax

sap *sap-id*

no sap

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures th test SAP to use for the specified stream.

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

Parameters

sap-id

Specifies the identifier for the SAP. See SAP syntax in Common CLI command descriptions for information about parameter format options.

shutdown

Syntax

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

Context

config>test-oam>service-test>service-stream

config>test-oam>service-test

Platforms

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

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Description

This command enables or disables the specified service test or stream.

The service test must be in the **shutdown** state in order for any commands under the **service-test** context to be configured or modified. If the service test is in the **no shutdown** state, no command parameters can be changed.

Default

shutdown

test-type

Syntax

test-type [[**cir**] [**cir-pir**] [**policing**] [**performance**]]

no test-type

Context

config>test-oam>service-test>service-stream

Platforms

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

Description

This command configures the types of tests to perform on the specified service stream.

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

Parameters

cir

Specifies the CIR on the service stream.

cir-pir

Specifies both the CIR and PIR on the service stream.

policing

Specifies the policing function on the service stream.

performance

Specifies performance of the service stream.

stream-run-type

Syntax

stream-run-type {**ordered** | **parallel**}

no stream-run-type

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Context

config>test-oam>service-test

Platforms

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

Description

This command configures the sequence in which service streams are executed during the specified service test.

The **no** form of this command removes the run type.

Default

ordered

Parameters

ordered

Specifies that the streams run consecutively, in order of service stream ID.

parallel

Specifies that the streams run concurrently.

test-completion-trap-enable

Syntax

[**no**] **test-completion-trap-enable**

Context

config>test-oam>service-test

Platforms

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

Description

This command enables the test completion SNMP trap. The **no** form of this command disables the trap.

test-duration

Syntax

test-duration [[**cir**] [**cir-pir**] [**policing**] [**performance** {[**hours** *hours*]}]] {[**minutes** *minutes*] [**seconds** *seconds*]}

no test-duration

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Context

config>test-oam>service-test

Platforms

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

Description

This command configures the duration for the specified test type. Default test duration values are based on the test type.

The **no** form of this command returns the duration value to its default setting for all test types.

Parameters

cir

Specifies the test duration is for the CIR test. The default duration for this test is 300 seconds.

cir-pir

Specifies the test duration is for the CIR and PIR test. The default duration for this test is 600 seconds.

policing

Specifies the test duration is for the policing test. The default duration for this test is 600 seconds.

performance

Specifies the test duration is for the performance test. The default duration for this test is 900 seconds.

hours

Specifies the number of hours to run the test. This parameter only applies to the performance test type.

Values 0 to 24

minutes

Specifies the number of minutes to run the test. This parameter applies to all test types.

Values 0 to 60

seconds

Specifies the number of seconds to run the test. This parameter applies to all test types.

Values 0 to 60

testhead-num-streams

Syntax

testhead-num-streams {**single** | **multiple**}

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no testhead-num-streams

Context

config>test-oam

Platforms

7210 SAS-Dxp

Description

This command configures whether the testhead operates in the single or multiple stream mode.

When the **single** parameter is configured, only the testhead OAM tool commands are allowed. Similarly, the use of the service test testhead framework commands requires the configuration of multiple stream mode.

This command must be executed on both the local end (testhead generator end) and remote end (testhead reflector end) when multiple-stream mode is in use.

Note:
When multiple stream mode is configured, users must ensure no traffic other than testhead traffic on both the reflector side and generator side in the services is being used by the stream. In multiple stream mode, the software programs a different datapath that restricts the usage of flows other than test streams in the same service as the SAP to which the streams belongs.

This command is not stored in the configuration file over a system reboot.

The **no** form sets this command to the defualt value.

Default

testhead-num-streams single

Parameters

single

Keyword to enable single stream mode for the testhead.

multiple

Keyword to enable multiple stream mode for the testhead.

3.8.2.10 OAM service test commands

service-test

Syntax

service-test *profile-num* **start**

service-test *profile-num* **stop**

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Context

oam

Platforms

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

Description

This command starts a specified OAM service test using the **start** keyword or stops a specified OAM service test that is currently running using the **stop** keyword.

Parameters

profile-num

Specifies an OAM service test, in the range of 1 to 1000.

start

Keyword to start a specified OAM service test.

stop

Keyword to stop a specified OAM service test that is running.

3.8.2.11 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

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

Description

This command starts and stops the specified 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.

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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

Platforms

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

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

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

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.

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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.

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

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

Description

This command enables the specified delay metric configuration context.

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

Default

bin-type fd

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Parameters

fd

Specifies the frame delay bin threshold configuration context.

fdr

Specifies the frame delay range bin threshold configuration context.

ifdv

Specifies the inter-frame delay variation bin threshold configuration context.

bin

Syntax

bin *bin-number*

Context

config>oam-pm>bin-group>bin

Platforms

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

Description

Commands in this context configure 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

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

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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.

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

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

Description

This command sets the bin number, the threshold and the direction that is 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.

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The **no** form 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.

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

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Context

config>oam-pm>bin-group

config>oam-pm>session

Platforms

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

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.

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

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

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.

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session

Syntax

session *session-name* [**test-family** {**ethernet** | **ip**} [**session-type** {**proactive** | **on-demand**}] **create**]

no session *session-name*

Context

config>oam-pm

Platforms

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

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 be based on the Ethernet layer.

ip

Specifies that the test be 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*

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no bin-group

Context

config>oam-pm>session

Platforms

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

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

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

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

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Context

config>oam-pm>session>ethernet

Platforms

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

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

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

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.

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data-tlv-size

Syntax

data-tlv-size *octets*

no data-tlv-size

Context

config>oam-pm>session>ethernet>dmm

config>oam-pm>session>ethernet>slm

Platforms

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

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

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

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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.

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-Dxp, 7210 SAS-K 2F6C4T)

50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000 (7210 SAS-K 2F1C2T, 7210 SAS-K 3SFP+ 8C)

test-duration

Syntax

test-duration *seconds*

no test-duration

Context

config>oam-pm>session>ethernet>dmm

config>oam-pm>session>ethernet>slm

Platforms

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

Description

This optional 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.

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Parameters

seconds

Specifies the interval, in seconds, during which the test continues to execute after the start time.

Values 1 to 86400

priority

Syntax

priority *priority*

no priority

Context

config>oam-pm>session>ethernet

Platforms

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

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

priority 0

Parameters

priority

Specifies the CoS 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

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

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

Platforms

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

Description

This command configures the frame loss threshold that is used to determine if 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 restores the default value.

Default

flr-threshold 50

Parameters

percentage

Specifies the percentage of the threshold.

Values 50

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oam-pm

Syntax

oam-pm session *session-name* {**dmm** | **slm** | **twamp-light**} {**start** | **stop**}

Context

oam

Platforms

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

Description

This command starts and stops on-demand OAM-PM sessions.

Parameters

session *session-name*

Specifies the session name that the test is associated with.

dmm

Specifies the DMM test.

slm

Specifies the SLM test.

twamp-light

Specifies the TWAMP-light test (not applicable to the 7210 SAS-K 3SFP+ 8C).

start

Manually starts the test.

stop

Manually stops the test.

oam-pm

Syntax

oam-pm

Context

config

Platforms

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

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Description

This is the top level context that contains the configuration parameters that defines storage parameters (including binning structures), availability/resiliency and the individual proactive, and on-demand tests used to gather the performance/statistical information.

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**]

Context

config>oam-pm

Platforms

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

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, this is assigned by default. The default values for bin-group 1 are (fd-bin-count 3 bin 1 lower-bound 5000us, bin 2 lower-bound 10000us fdr-bin-count 2 bin 1 lower-bound 5000us and ifdv-bin-count 2 bin 1 lower-bound 5000us)

Parameters

bin-group-number

Numerical identifier for a bin-group that is referenced by OAM-PM sessions. A bin group can only shutdown and modified when all the PM sessions referencing the bin group have been shutdown. The only exception is the description parameter.

Values 1 to 255

fd-bin-count *fd-bin-count*

Specifies the number of fd bins to be created.

Values 2 to 10

fdr-bin-count *fdr-bin-count*

Specifies the number of fdr bins to be created.

Values 2 to 10

ifdv-bin-count *ifdv-bin-count*

Specifies the number of ifdv bins to be created.

Values 2 to 10

create

Creates the bin group.

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description

Syntax

description *description-string*

no description

Context

config>oam-pm>bin-group

Platforms

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

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

Parameters

description-string

The description character string. Allowed values are any characters up to 80 characters long 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.

bin-type

Syntax

bin-type {**fd** | **fdr** | **ifdv**}

Context

config>oam-pm>bin-group

Platforms

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

Description

This command is the start of the hierarchy where the specific delay metric bin structure is defined.

Parameters

fd

Specifies the frame delay bin threshold configuration context.

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fdr

Specifies the frame delay range bin threshold configuration context.

ifdv

Specifies the inter-frame delay variation bin thresholds configuration context.

bin

Syntax

bin *bin-number* **lower-bound** *microseconds*

Context

config>oam-pm>bin-group>bin-type

Platforms

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

Description

This command specifies the individual floors thresholds for the bins. 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 each bin is bin-number * 5000 microseconds. Lower thresholds in the previous adjacent bin must be lower than the threshold of the next higher bin threshold. A separate line per bin is required to configured an operator specific threshold. An error prevents the bin from entering the active state if this is not maintained, at the time the "no shutdown" is issued. Bin 0 is the result of the difference between 0 and the configured lower-threshold 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 the lower-bound removes the user configured threshold value and applies the default for the bin.

Parameters

bin-number

Specifies bin to configure.

Values 1 to 9

lower-bound *microseconds*

Specifies the threshold that defines the floor of the bin. The bin range is the difference between its configured threshold and the threshold of the next higher bin in microsecond threshold value.

Values 1 to 4294967295

Default bin-number * 5000

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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

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

Description

This command sets the bin number, the threshold and the direction that is 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.

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.

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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 the value is 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

delay-event-exclusion

Syntax

delay-event-exclusion {**forward** | **backward** | **round-trip**} **lowest-bin** *bin-number*

no delay-event-exclusion {**forward** | **backward** | **round-trip**}

Context

config>oam-pm>bin-group>bin-type

Platforms

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

Description

This optional command allows results from probes that map to the specified bin and higher bins to be excluded from the TCA count. The TCA count is used to determine if a threshold has been reached by the event monitoring function. Individual counters are incremented in the bin, but the counts in the specified bin and higher bins are not included in the TCA threshold computation. A **delay-event** must be configured in the same direction, and the **lowest-bin** configured as part of the **delay-event-exclusion** command must be higher than the lowest bin specified by the corresponding **delay-event** command.

The bin group allows this optional command to be added, modified, or deleted while tests are actively referencing the bin group. The bin group does not need to be shut down during **delay-event-exclusion** configuration. If the values are modified while the active tests are executing, all configured TCAs for the specified direction within the bin group enter a pending (p) state until the start of the next measurement interval. Any existing stateful TCAs that were raised are cleared without creating a log event, and no further processing for the affected TCAs occurs in the active window. Depending on timing, the pending state may continue past the adjacent measurement interval until the start of the following measurement interval.

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The **no** form of this command does not exclude any values from the configured TCA threshold.

Default

no delay-event-exclusion forward

no delay-event-exclusion backward

no delay-event-exclusion round-trip

Parameters

forward

Specifies the forward direction bin.

backward

Specifies the backward direction bin.

round-trip

Specifies the round-trip direction bin.

bin-number

Specifies the number of the lowest bin to which the exclusion is applied. This bin and all higher bins are excluded from the **delay-event** (TCA) count. If no bin numbers are configured, this command is ignored.

Values 1 to 9

exclude-from-avg

Syntax

exclude-from-avg {**forward** | **backward** | **round-trip**} **bins** *bin-numbers*

no exclude-from-avg (**forward** | **backward** | **round-trip**}

Context

config>oam-pm>bin-group>bin-type

Platforms

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

Description

This optional command allows the results from probes that map to the specified bins within the bin type to be excluded from the average calculation. Individual counters are incremented in the bin, but the average is not affected by the value of the excluded delay metric for the individual probes in this bin. The bin group does not allow this command to be added, modified, or deleted when a test is actively referencing the bin group. Sessions that reference the bin group must have the bin group and tests shut down before changes can be made.

The **no** form of this command removes the exclusion, and all bins are included in the average calculation.

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Default

no exclude-from-avg forward

no exclude-from-avg backward

no exclude-from-avg round-trip

Parameters

forward

Specifies the forward direction bin.

backward

Specifies the backward direction bin.

round-trip

Specifies the round-trip direction bin.

bin-numbers

Specifies the bin numbers to be excluded from the average calculation. The values typically represent, but are not restricted to, the highest and lowest configured bins to eliminate outlying results that are not representative of network performance.

A hyphen can be entered between bin numbers to include a continuous sequence of bins; for example, typing "7-9" would specify bins 7, 8, and 9. Commas can be entered between bin numbers to include separate or non-continuous bins; for example, typing "0,8,9" would specify bins 0, 8, and 9. Both hyphens and commas can be used in this manner in the same configuration; for example, typing "0,7-9" would include bins 0, 7, 8, and 9. All bin numbers specified as part of this command must be configured. If a specified bin does not exist, the command fails.

Values 0 to 9

shutdown

Syntax

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

Context

config>oam-pm>bin-group

Platforms

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

Description

This command activates and deactivates the bin group. Only the description of the bin group can be modified when the bin group is in a **no shutdown** state. No other changes can be made while the bin group is active. The bin group can only be shutdown and modified when all references in the various PM Sessions or individual tests have been shutdown. If an active PM session is referencing the bin-group, it

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generates an error indicating there are x number of active tests referencing the bin-group, and it cannot be shutdown.

The **no** form of this command activates the bin group as available for PM Sessions and tests to use.

Default

shutdown

session

Syntax

session *session-name* **test-family** {**ethernet** | **ip**} [**session-type** {**proactive** | **on-demand**}] **create**

no session *session-name*

Context

config>oam-pm

Platforms

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

Description

This command creates 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 shutdown. Individual test sessions within the container may be shutdown. 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 shutdown. The only exception to this is the description value.

The **no** form of this command deletes the session.

Parameters

session-name

Specifies the session container.

test-family

Specifies the type family and sets the context for the individual parameters.

ethernet

Specifies that the test is based on the Ethernet layer.

ip

Specifies that the test is based on the IP layer.

session-type

Specifies how to set the Type bit in the Flags byte, and influences how different test criteria may be applied to the individual test. Not all test-families carry this information in the PDU.

proactive

Sets the type to always on with immediate start and no stop.

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on-demand

Sets the type a demand function with an immediate start and no stop, or stop based on offset.

Default proactive

create

Creates the PM session.

description

Syntax

description *description-string*

no description

Context

config>oam-pm>session

Platforms

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

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.

Parameters

description-string

Specifies the description character string. Allowed values are any characters up to 80 characters long 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.

bin-group

Syntax

bin-group *bin-group-number*

no bin-group

Context

config>oam-pm>session

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Platforms

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

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.

Parameters

bin-group-number

Specifies the number used to create the specific bin-group referenced for this session.

Values 1 to 255

Default 1

meas-interval

Syntax

meas-interval {**5-mins**|**15-mins**|**1-hour**|**1-day**} **create**

no meas-interval {**5-mins**|**15-mins**|**1-hour**|**1-day**}

Context

config>oam-pm>session

Platforms

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

Description

This command establishes the parameters of the individual measurement intervals used by the session. Multiple measurement intervals may be specified within 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 | 15-mins | 1-hour | 1-day}

Specifies the duration of the measurement interval.

create

Creates the measurement interval.

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accounting-policy

Syntax

accounting-policy *acct-policy-id*

no accounting-policy

Context

config>oam-pm>session>meas-interval

Platforms

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

Description

This optional command enables the context to assign an accounting policy and the policy-id (configured under **config>log>accounting-policy**) with a record-type of **complete-pm**. 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

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

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. Alignment with the time of day clock always defaults to the representative top of the hour. Clock aligned 15-minute measurement intervals divides the hour into four equal sections 00, 15, 30, 45. Clock aligned 1-hour measurement intervals start at 00. Clock aligned 1-day measurement

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intervals start at midnight. Test relative start times launch the measurement interval when the individual test enters the active (no shutdown) state. 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 the **no shutdown** exactly corresponds to the clock based measurement interval start time. Clock aligned measurement intervals can include an additional offset. See the clock-offset command under this context.

The **no** form of this command sets the boundary to the default clock-aligned.

Parameters

clock-aligned

Specifies to align the start of the measurement interval with the time of day clock.

test-relative

Specifies to align 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

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

Description

This command allows measurement intervals with a boundary-type of clock aligned to be offset from 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 five minutes from their default alignments with respect to the time of day clock.

The **no** form of this command sets the offset to 0.

Parameters

seconds

Specifies the number of seconds to offset a clock-alignment measurement interval from its default.

Values 0 to 86399

Default 0

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event-mon

Syntax

event-mon

Context

config>oam-pm>session>measurement-interval

Platforms

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

Description

This command allows for enabling of the 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

delay-events

[**no**] **delay-events**

Context

config>oam-pm>session>measurement-interval>event-monitoring

Platforms

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

Description

This command enables and disables the monitoring of all configured delay events. Adding this functionality starts the monitoring of the configured delay events at the start of the next measurement interval.

The **no** form of this command removes all monitoring of configured delay events, logging, and recording of new events for that session is suspended.

Any existing events at the time of the shutdown 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 having to shutdown all the tests in the session.

Default

[no] delay-events

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loss-events

Syntax

loss-events

[**no**] **loss-events**

Context

config>oam-pm>session>measurement-interval>event-monitoring

Platforms

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

Description

This command enables and disables the monitoring of all configured loss events. Adding this functionality starts the monitoring of the configured loss events at the start of the next measurement interval.

The **no** form of this command removes all monitoring of configured loss events, logging, and recording of new events for that session is suspended.

Any existing events at the time of the shutdown 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 having to shutdown all the tests in the session.

Default

no loss-events

shutdown

Syntax

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

Context

config>oam-pm>session>measurement-interval>event-monitoring

Platforms

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

Description

This command starts the monitoring of the configured events at the start of the next measurement interval. If a **shutdown** is issued, all monitoring of configured events, logging, and recording of new events for that session are suspended. Any existing events at the time of the shutdown are maintained until the active measurement window in which the **event-mon** shutdown was issued has completed. The state of this monitoring function can be changed without having to shutdown all the tests in the session.

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Default

shutdown

intervals-stored4

Syntax

intervals-stored *intervals*

no intervals-stored

Context

config>oam-pm>session>meas-interval

Platforms

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

Description

This command defines 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 memory is available. The numbers are increasing from 1 to the configured value + 1. The active pm data is stored in the interval number 1 and older runs are stored, in order, to the upper most number with the oldest rolling off when the number of completed measurement intervals exceeds the configured value+1. As new test measurement intervals complete for the session, the stored intervals get renumbered to maintain the described order. Care must be taken when setting 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 both intervals are required the sum total of both cannot exceed 96. The 1-hour and 1-day measurement intervals uses their own ranges.

If this command is omitted when configuring the measurement interval, the default values are used.

Parameters

intervals

Specifies the measurement interval.

5-mins

Specifies 5-minutes measurement interval.

Values 1 to 96

Default 32

15-mins

Specifies 15-minutes measurement interval.

Values 1 to 96

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Default 32

1-hour

Specifies 1-hour measurement interval.

Values 1 to 24

Default 8

1-day

Specifies 1-day measurement interval.

Values 1 to 1

Default 1

ethernet

Syntax

ethernet

Context

config>oam-pm>session

Platforms

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

Description

Commands in this context configure the Ethernet specific source and destination information, the priority, and the Ethernet tests tools on the launch point.

dest-mac

Syntax

dest-mac *ieee-address*

no dest-mac

Context

config>oam-pm>session>ethernet

Platforms

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

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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 two header to match. This must be a unicast address.

The **no** form of this command removes session parameter.

Parameters

ieee-address

Specifies the layer two 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)

priority

Syntax

priority *priority*

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command defines 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 removes changes the priority to the default value.

Parameters

priority

Specifies the CoS value.

Values 0 to 7

Default 0

source

Syntax

source mep *mep-id* **domain** *md-index* **association** *ma-index*

no source

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Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command defines the source launch point identification 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 frames and received as seen with the **show oam-pm statistics session session-name** … command are zero.

The **no** form of this command removes this session parameter.

Parameters

mep *mep-id*

Specifies the maintenance association end point identifier of the launch point.

Values 1 to 8191

domain *md-index*

Specifies the maintenance domain (MD) index value of the launch point.

Values 1 to 4294967295

association *ma-index*

Specifies the maintenance association (MA) index value of the launch point.

Values 1 to 4294967295

slm

Syntax

slm [**test-id** *test-id*] **create**

no slm

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command defines 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.

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Parameters

test-id

Specifies the value to be placed in the 4-byte test id field of an ETH-SLM PDU.

Values 0 to 2,147,483,647

create

Creates the test.

dmm

Syntax

dmm [**test-id** *test-id*] **create**

no dmm

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command defines 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 an ETH-DMM PDU.

Values 0 to 2,147,483,647

create

Creates the test.

data-tlv-size

Syntax

data-tlv-size *octets*

no data-tlv-size

Context

config>oam-pm>session>ethernet>slm

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config>oam-pm>session>ethernet>dmm

Platforms

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

Description

This command adds an optional Data TLV to PDU and increases the frame on the wire by the specified amount. This value is not the size of the frame on the wire. It is the size of the addition padding added to the PDU.

The **no** form of this command removes the optional TVL.

Parameters

octets

Specifies the octet size of the optional Data TLV.

Values 0 | 3 to 2000

Default 0

shutdown

Syntax

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

Context

config>oam-pm>session>ethernet>slm

config>oam-pm>session>ethernet>dmm

Platforms

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

Description

This command activates and deactivates the individual test. When the test is shutdown, no active measurements are being 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 individual test.

Default

shutdown

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test-duration

Syntax

test-duration *seconds*

no test-duration

Context

config>oam-pm>session>ethernet>slm

config>oam-pm>session>ethernet>dmm

Platforms

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

Description

This optional 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. On-demand tests do not start until the **config>oam-pm>session>start** command is issued and they stop when the **config>oam-pm>session>stop** command is issued.

The **no** form of this command removes a previously configured test-duration and allow the test to execute until manually stopped.

Default

no test-duration

Parameters

seconds

Specifies the number of seconds the test executes from its start time.

Values 1 to 86400

loss

Syntax

loss

Context

config>oam-pm>session>ip>twamp-light

Description

Commands in this context configure loss parameters for the TWAMP-Light test.

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flr-threshold

Syntax

flr-threshold *percentage*

no flr-threshold

Context

config>oam-pm>session>ethernet>slm

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This command defines the frame loss threshold used to determine if the delta-t is available or unavailable. An individual delta-t with a frame loss threshold equal to 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 of 50%.

Parameters

percentage

Specifies the percentage of the threshold.

Values 1 to 100

Default 50 percent

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

config>oam-pm>session>ip>twamp-light

Platforms

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

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Description

This command defines various availability parameters and the probe spacing (interval) for the SLM frames. The maximum size of the availability window cannot exceed 10s (10,000ms).

The **no** form of this command installs the default values for all timing parameters and use those values to compute availability and set the SLM frequency. If an SLM test is in "no shutdown", it always has timing parameters, whether default or operator configured.

Parameters

frames-per-delta-t

Defines the size of the small measurement window. 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.

frames

Specifies the number of SLM frames that define the size of the delta-t.

Values 1 to 50

Default 10

consec-delta-t

Specifies the number of consecutive delta-t small measurement intervals that make up the sliding window over which availability and unavailability are determined. Transitions from one state to another occur when the consec-delta-t are in a new state.

deltas

Specifies the number of consecutive delta-t used for the sliding window.

Values 2 to 10

Default 10

interval

Specifies the message period, or probe spacing, for the transmission of the SLM frame.

milliseconds

Specifies the number of milliseconds between the transmission of the SLM frames. The default value for the SLM interval is different than the default interval for DMM. This is intentional.

Values 100 | 1000

Default 100

chli-threshold

Specifies the number of consecutive high loss intervals (unavailable delta-t), that when equal to or exceeded, increment the CHLI counter. A CHLI counter is an indication that the sliding window is available but has crossed a threshold consecutive of unavailable delta-t intervals. A CHLI can only be incremented once during a sliding window and is only incremented during times of availability.

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threshold

Specifies the number of consecutive unavailable delta-t that cause the CHLI counter to be incremented.

Values 1 to 9

Default 5

interval

Syntax

interval *milliseconds*

no interval

Context

config>oam-pm>session>ethernet>dmm

Platforms

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

Description

This command defines the message period or probe spacing for the transmission of the DMM or LMM frame.

The **no** form of this command sets the interval to the default. If an LMM test is in **no shutdown**, it always has timing parameters, whether default or operator configured.

Parameters

milliseconds

Specifies the number of milliseconds between the transmission of the DMM or LMM frames. The default value for the DMM or LMM interval is different than the default interval for SLM. This is intentional.

Values 100, 1000, 10000

Default 1000

loss-events

Syntax

loss-events

Context

config>oam-pm>session>ethernet>slm

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config>oam-pm>session>ip>twamp-light

Platforms

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

Description

Note:
The **twamp-light** context is not supported on the 7210 SAS-K 3SFP+ 8C.

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

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; twamp-light context is not applicable to the 7210 SAS-K 3SFP+ 8C

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 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

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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

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; twamp-light context is not applicable to the 7210 SAS-K 3SFP+ 8C

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.

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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.

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

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; twamp-light context is not applicable to the 7210 SAS-K 3SFP+ 8C

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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.

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**}

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Context

config>oam-pm>session>ethernet>slm>loss-events

config>oam-pm>session>ip>twamp-light>loss-events

Platforms

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; twamp-light context is not applicable to the 7210 SAS-K 3SFP+ 8C

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

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

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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

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; twamp-light context is not applicable to the 7210 SAS-K 3SFP+ 8C

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 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

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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 *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

Platforms

7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, 7210 SAS-K 3SFP+ 8C; twamp-light context is not applicable to the 7210 SAS-K 3SFP+ 8C

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

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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.

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

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Platforms

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

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 use 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 are 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, 10000 (7210 SAS-Dxp, 7210 SAS-K 2F6C4T)

50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000 (7210 SAS-K 2F1C2T, 7210 SAS-K 3SFP+ 8C)

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

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source

Syntax

source mep *mep-id* **domain** *md-index* **association** *ma-index*

no source

Context

config>oam-pm>session>ethernet

Platforms

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

Description

This command configures the source launch point for Y.1731 parameters 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.

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

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Platforms

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

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

Platforms

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

Description

This optional 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.

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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

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

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 launches 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 divides 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.

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.

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clock-offset

Syntax

clock-offset *seconds*

no clock-offset

Context

config>oam-pm>session>meas-interval

Platforms

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

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

event-mon

Syntax

event-mon

Context

config>oam-pm>session>measurement-interval

Platforms

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

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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

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

Description

This command 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, the monitoring of configured delay events, logging, and recording of new events for that session is 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. You can change the state of this monitoring function without shutting down the current tests in the session.

The **no** form of this command disables the monitoring of all configured delay events.

loss-events

Syntax

[**no**] **loss-events**

Context

config>oam-pm>session>measurement-interval>event-mon

Platforms

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

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

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performed has completed. You can change the state of this monitoring function without shutting down the current 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

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

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 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 sum 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)

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enable-dmm-version-interop

Syntax

[**no**] **enable-dmm-version-interop**

Context

config>eth-cfm>system

Platforms

7210 SAS-D, 7210 SAS-Dxp,

Description

This command enables processing of DMM version 1 messages that are received by the node, as specified by ITU-T Y.1731 standards for interoperability for nodes that support either version 0 or version 1 implementation. 7210 SAS nodes support processing as recommended for DMM version 0 messages. In other words, without the use of this command, 7210 SAS nodes only process DMM version 0 messages and do not respond to DMM version 1 messages.

When this command is enabled, the 7210 SAS processes all received DMM PDU messages according to version 0 rules. DMM reply messages are sent with version field values that are identical to that of the received DMM PDU. For example, if a DMM PDU with a version value of 1 is received, the DMM reply message is sent with a version field value of 1.

On the 7210 SAS-D, when this command is disabled, timestamping for DMM messages is applied in hardware for both receive and transmit directions. When this command is enabled, timestamping for DMM messages is applied in hardware for the receive direction only, and timestamping for the transmit direction is applied in software by the CPU.

Default

no enable-dmm-version-interop

3.8.2.12 Service Assurance Agent (SAA) commands

saa

Syntax

saa

Context

config

Platforms

Supported on all 7210 SAS platforms as described in this document

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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

Platforms

Supported on all 7210 SAS platforms as described in this document

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. In order 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

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Platforms

Supported on all 7210 SAS platforms as described in this document

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

Enters the accounting *policy-id* as configured in the **config>log>accounting-policy** context.

Values 1 to 99

description

Syntax

description *description-string*

no description

Context

config>saa>test

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

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.

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continuous

Syntax

[**no**] **continuous**

Context

config>saa>test

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command specifies whether the SAA test is continuous. Once 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.

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

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.

Once 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. 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

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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 milliseconds

Default 0

falling-threshold ***threshold***

Specifies a falling threshold jitter value. 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 generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Values 0 to 2147483 milliseconds

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

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.

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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. When the test run is completed, the calculated latency value is compared to the configured latency rising threshold. If 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 milliseconds

Default 0

falling-threshold *threshold*

Specifies a falling threshold latency value. 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 milliseconds

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

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Context

config>saa>test

Platforms

Supported on all 7210 SAS platforms as described in this document

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. 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 packets

Default 0

falling-threshold *threshold*

Specifies a falling threshold loss event value. 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 packets

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

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probe-history

Syntax

probe-history [**auto** | **drop** | **keep**]

Context

config>saa>test

Platforms

Supported on all 7210 SAS platforms as described in this document

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 default 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

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure trap generation for the SAA test.

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

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

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

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

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

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

Description

Commands in this context provide 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 shut down mode.

After a test type has been configured the command can be modified by re-entering the command, 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**]

Context

oam

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config>saa>test>type

Platforms

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

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.

Default 255

Values 1 to 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-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.

Default be

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

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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.

Default 1

Values 1 to 10

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.

Default 1

Values 1 to 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

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

<GLOBAL>

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

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. Is a keyword to specify the domain name or IP address to be looked up.

dns-name

Specifies the DNS name to be resolved to an IP address. Specifies the domain name or IP address to be looked up.

name-server *ip-address*

Specifies the server connected to a network that resolves network names into network addresses. The IPv6 address is supported only on the 7210 SAS-D and 7210 SAS-Dxp.

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

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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 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. The IPv6 address is supported only on the 7210 SAS-D and 7210 SAS-Dxp.

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-linktrace

Syntax

eth-cfm-linktrace *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**ttl** *ttl-value*]

[**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

Description

This command configures a CFM linktrace test in SAA.

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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 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 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.

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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 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. The IPv6 address is supported only on 7210 SAS-D the 7210 SAS-Dxp.

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

Description

This command configures an Ethernet CFM loopback test in SAA.

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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

size *data-size*

Specifies 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.

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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 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

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.

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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*

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.

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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

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

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.

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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

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 is not 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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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*] [**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

config>saa>test>type

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures an ICMP ping test.

Parameters

ip-address

Specifies the far-end IP address to which to send the **icmp-ping** request message in dotted-decimal notation. The IPv6 address is supported only on the 7210 SAS-D and 7210 SAS-Dxp.

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 **icmp-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 displays of detailed information.

ttl *time-to-live*

Specifies the TTL value for the IP packet, expressed as a decimal integer.

Values 1 to 128

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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 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.

Values ipv4-address: a.b.c.d

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 to 10

Default 1

next-hop *ip-address*

Specifies the next hop IP address for which to only display static routes.

Values 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

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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
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

Description

This command configures an ICMP traceroute test.

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Parameters

ip-address

Specifies the far-end IP address to which to send the **icmp-ping** request message in dotted-decimal notation. The IPv6 address is supported only on the 7210 SAS-D and 7210 SAS-Dxp.

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 **icmp-ping** request message, expressed as a character string to 63 characters maximum.

ttl *time-to-live*

Specifies the TTL value for the IP TTL, 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. The IPv6 address is supported only on the 7210 SAS-D and 7210 SAS-Dxp.

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 (7210 SAS-D and 7210 SAS-Dxp)
service-id — 1 to 2147483647

Default Base

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

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

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

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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 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

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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

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


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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

config>saa>test>type

Platforms

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

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 timeout 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 27: SDP ping response messages by precedence

Result of request	Displayed response message	Precedence
Request timeout without reply	Request Timeout	1
Request not sent due to non-existent *orig-sdp-id*	Orig-SDP Non-Existent	2
Request not sent due to administratively down *orig-sdp-id*	Orig-SDP Admin-Down	3
Request not sent due to 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

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Result of request	Displayed response message	Precedence
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

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 28: 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	resp-sdp-id

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Field	Description	Values
	If **resp-sdp** is not specified, the responding router does not use an SDP-ID as the return path and N/A is displayed.	N/A
Responding SDP-ID Path Used	Displays whether the responding 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 return path, No is displayed. If **resp-sdp** is not specified, N/A is displayed.	Yes No N/A
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 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-ids** (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
	The expected IP address for the remote system IP interface	orig-sdp-far-end-addr

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Field	Description	Values
Expected Far End Address	This must be the **far-end** address configured for the *orig-sdp-id*.	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
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 (once the **interval** timer expires, sdp-ping attempts to send the next request if required).

Values 1 to 17407

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resp-sdp *resp-sdp-id*

Specifies the optional parameter to identify the return SDP-ID 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 than 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.

Default null. Use the non-SDP return path for message reply.

Values 1 to 17407

fc *fc-name*

Specifies the forwarding class of the SDP encapsulation. The actual forwarding class encoding is controlled by the network egress DSCP or LSP-EXP mappings.

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.

Default be

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

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

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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

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

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
```


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```
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#
```

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

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

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 dataplane 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 **sdpld:vcld**, **src-ip-address ip-addr**, **dst-ip-address ip-addr**, **ttl vc-label-ttl** and **pw-id pw-id** parameters are used where:

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- 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 is not signaled peer VCCV CC bits to the far end, consequently VCCV ping cannot be successfully initiated on that specific spoke SDP.

Parameters

sdp-id:vc-id

Specifies the VC ID of the pseudowire being tested must be indicated with this parameter. 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*

If a FEC 129 PW is being tested, its *spoke-sdp-fec-id* must be indicated with this parameter. 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.

The **spoke-sdp-fec** parameter 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

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 SAS T-PE node.

Values: 1 to 4294967295

prefix — The prefix on this 7210 SAS 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

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

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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

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.

Default be

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

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.

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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.

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*]

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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

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

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 Address field in the PW FEC TLV. Each S-PE that terminates and processes the message includes, in the MPLS echo reply message, the FEC 128 TLV corresponding to PW segment to its downstream node. The source T-PE or S-PE node can then 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 in order to correctly build the FEC of the desired subset of segments.

Parameters

sdpid:vcid

Specifies the VC ID of the pseudowire being tested must be indicated with this parameter. 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.

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 vccv control channel.

Note that when a VCCV trace message is originated from an S-PE node, the user should used the IPv4 reply mode as 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.

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Default control-channel

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 SAS T-PE node.

Values: 1 to 4294967295

prefix — The prefix on this 7210 SAS 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

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.

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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.

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*

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.

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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

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

3.8.2.13 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

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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.

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.

3.8.2.14 LDP diagnostics commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

test-oam

Syntax

test-oam

Context

config

Platforms

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

Description

Commands in this context configure Operations, Administration, and Maintenance test parameters.

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mpls-time-stamp-format

Syntax

mpls-time-stamp-format {**rfc4379** | **unix**}

Context

config>test-oam

Platforms

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

Description

This command configures the format of the timestamp used by for **lsp-ping**, **lsp-trace**, **p2mp-lsp-ping** and **p2mp-lsp-trace**, **vccv-ping**, **vccv-trace**, and **lsp-trace**.

If **rfc4379** is selected, the timestamp is in seconds and microseconds since 1900, otherwise it is in seconds and microseconds since 1970.

Changing this system-wide setting does not affect tests that are currently in progress, but SAAs start to use the new timestamp when they are restarted. When an SR OS node receives an echo request, it replies with the locally configured timestamp format, and does not try to match the timestamp format of the incoming echo request message.

Default

unix

Parameters

rfc4379

Specifies the RFC 4379 time stamp format. The time stamp **seconds** field holds the integral number of seconds since 1-Jan-1900 00:00:00 UTC. The time stamp **microseconds** field contains a microseconds value in the range 0 to 999999. This setting is used to interoperate with network elements which are fully compliant with RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures* (such as an SR OS system with the same setting, or any other RFC 4379 compliant router).

unix

Specifies the Unix time stamp format. The time stamps **seconds** field holds a Unix time, the integral number of seconds since 1-Jan-1970 00:00:00 UTC. The time stamps **microseconds** field contains a microseconds value in the range 0 to 999999. This setting is used to interoperate with network elements which send and expect a 1970-based timestamp in MPLS Echo Request/Reply PDUs (such as an SR OS system with the same setting, or an SR OS system running software earlier than R8.0 R4).

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mpls-echo-request-downstream-map

Syntax

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

no mpls-echo-request-downstream-map

Context

config>test-oam

Platforms

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

Description

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 new 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, 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 rules above 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.

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 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.

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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 includes in this case the DDMAP 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.

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. This includes the case of explicit configuration of the LDP-BGP stitching in which the BGP label route is active in Route Table Manager (RTM) and the case of a BGP IPv4 label route resolved to the LDP FEC due to the IGP route of the same prefix active in RTM. In this case, 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 the or from the stitching points.
4. Full validation of an LDP FEC tunneled over an RSVP LSP using LSP trace.

In order to properly 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 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 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

LDP-over-RSVP



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```
  \______/                                    \______/
    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
     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
```


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```
     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
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=10.10.1.2
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#
```

LDP-BGP stitching

```
A         B          C           D         E         F
o ------- o -------- o --------- o ------- o ------- o
  \_____/ |            \_______/           | \_____/
    LDP   |              RSVP              |   LDP
          |\_____________________________/|
          |               LDP              |
           \_____________________________/
                         BGP

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
```


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```
      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#

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 10.20.1.5/32 bgp-label downstream-map-
tlv ddmap detail lsp-trace to 10.20.1.5/32: 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
```


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```
            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#
```

3.8.2.15 LDP treetrace commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

ldp-treetrace

Syntax

ldp-treetrace {**prefix** *ip-prefixlmask*} [**downstream-map-tlv** {**dsmap**|**ddmap**}] [**fc** *fc-name* [**profile** *profile*]] [**max-path** *max-paths*] [**max-ttl** *ttl-value*] [**retry-count** *retry-count*] [**timeout** *timeout*]

Context

oam

Platforms

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

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.

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**}

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.

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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 29: 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: • 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

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Default be

profile profile

Specifies the profile state of the MPLS echo request packet.

Values in, out

Default out

max-paths *max-paths*

Specifies the maximum number of paths for an LDP treetrace test, expressed as a decimal integer.

Values 1 to 255

Default 128

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

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

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 waits for a message reply after sending the message request. When the message timeout expires, 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

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
```


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```
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
```

ldp-treetrace

Syntax

[**no**] **ldp-treetrace**

Context

config>test-oam

Platforms

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

Description

This command configures the LDP ECMP OAM tree trace, which includes LDP ECMP path discovery and path probing.

The **no** form of this command deletes the configuration for the LDP ECMP OAM tree discovery and path probing.

Output

The following output is an example 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 '
```


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

Description

This command configures 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** 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 header MPLS EXP field. The TOS byte is not modified. Table 29: 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

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path-discovery

Syntax

path-discovery

Context

config>test-oam>ldp-treetrace

Platforms

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

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 sends the next echo request message to a node that is 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.

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

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.

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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

Platforms

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

Description

This command configures the maximum number of ECMP paths that can be discovered for each interval.

The **no** form of this command reverts the maximum number of ECMP paths to the default value.

Default

16

Parameters

max-paths

Specifies the maximum number of paths for the tree discovery.

Values 1 to 128

max-ttl

Syntax

max-ttl *ttl-value*

Context

config>test-oam>ldp-treetrace>path-discovery

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Platforms

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

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

policy-statement

Syntax

policy-statement *policy-name* [**...**(**up to 5 max**)]

Context

config>test-oam>ldp-treetrace>path-discovery

Platforms

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

Description

This command configures FEC policy to determine which routes are imported from the LDP FEC database for the purpose of discovering the 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 be included or excluded in the LDP FEC database.

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

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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

config>oam-test>ldp-treetrace>path-probing

Platforms

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

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 the retry count to the default value.

Default

3

Parameters

retry-count

Specifies the maximum number of consecutive timeouts allowed before a path probe fails.

Values 1 to 10

timeout

Syntax

timeout *timeout*

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no timeout

Context

config>test-oam>ldp-treetrace>path-discovery

Platforms

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

Description

This command configures the maximum amount of time, in seconds, that the node waits 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 stops sending echo requests and returns either the available results or a failure message to the user.

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

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

Description

Commands in this context configure LDP tree trace path probing.

The validation process for LDP FEC ECMP paths 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 from the interface are not sent, but the ingress LER node does not raise alarms.

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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

Platforms

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

Description

This command configures the frequency of the LSP Ping messages used to probe the paths of all LDP FECs discovered during LDP tree trace path discovery.

The **no** form of this command resets the interval to the 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-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

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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 the command resets the timeout period to its default value.

Default

1

Parameters

timeout

Specifies the timeout period, in minutes.

Values 1 to 3

shutdown

Syntax

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

Context

config>test-oam>ldp-treetrace

Platforms

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

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.

3.8.2.16 TWAMP commands

twamp

Syntax

twamp

Context

config>test-oam

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Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

Description

This command enables TWAMP functionality.

Default

no twamp

server

Syntax

retry-count *retry-count*

Context

config>test-oam>twamp

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

Description

This command configures the node for TWAMP server functionality.

Default

TWAMP is disabled.

prefix

Syntax

prefix {*ip-prefix* | *mask*} [**create**]

no prefix

Context

config>test-oam>twamp>server

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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

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Default

no prefix

Parameters

prefix ip-prefix/mask

Specifies the address prefix and subnet mask of the destination node.

ip-prefix

Specifies an 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.

max-conn-prefix

Syntax

max-conn-prefix *count*

no max-conn-prefix

Context

config>test-oam>twamp>server>prefix

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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 reverts to the default value.

Default

no max-conn-prefix

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Parameters

count

Specifies the maximum number of control connections.

Values 0 to 8

Default 4

max-conn-server

Syntax

max-conn-server *count*

no max-conn-server

Context

config>test-oam>twamp>server

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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 reverts to the default value.

Default

no max-conn-server

Parameters

count

Specifies the maximum number of control connections.

Values 0 to 8

Default 4

inactivity-timeout

Syntax

inactivity-timeout *seconds*

no inactivity-timeout

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Context

config>test-oam>twamp>server

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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 in-progress tests are terminated.

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

Default

no inactivity-timeout

Parameters

retry-count

Specifies the duration of the inactivity timeout.

Values 60 to 3600

Default 900

max-sess-prefix

Syntax

max-sess-prefix *count*

no max-sess-prefix

Context

config>test-oam>twamp>server>prefix

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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 reverts to the default value.

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Default

no max-sess-prefix

Parameters

count

Specifies the maximum number of concurrent test sessions.

Values 0 to 8

Default 4

max-sess-server

Syntax

max-sess-server *count*

no max-sess-server

Context

config>test-oam>twamp>server

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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.

Default

no max-sessions

Parameters

count

Specifies the maximum number of concurrent test sessions.

Values 0 to 8

Default 4

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3.8.2.17 TWAMP Light commands

twamp-light

Syntax

twamp-light

Context

config>router

config>service>vprn

config>test-oam>twamp

Platforms

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

Description

Commands in this context configure TWAMP Light functionality.

Special Cases

7210 SAS-Dxp

The **config**>**service**>**vprn**>**twamp-light** command is not supported on 7210 SAS-Dxp.

reflector

Syntax

reflector [**udp-port** *udp-port-number*] [**create**]

no reflector

Context

config>router>twamp-light

config>service>vprn>twamp-light

Platforms

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

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.

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Special Cases

7210 SAS-Dxp

The **config**>**service**>**vprn**>**twamp-light**>**reflector** command is not supported on 7210 SAS-Dxp.

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 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

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

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.

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Special Cases

7210 SAS-Dxp

The **config**>**service**>**vprn**>**twamp-light**>**reflector**>**description** and **config**>**service**>**vprn**>**twamp-light**>**reflector**>**prefix**>**description** commands are not supported on 7210 SAS-Dxp.

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.

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

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

Description

This command configures the IP prefixes that the reflector accepts TWAMP Light packets from and responds to. Each prefix requires its own configuration entry.

The **no** form of this command removes the specifies prefix.

Special Cases

7210 SAS-Dxp

The **config**>**service**>**vprn**>**twamp-light**>**reflector**>**description** command is not supported on 7210 SAS-Dxp.

Parameters

ip-prefix

Specifies the IP address.

Values IPv4 address in the form a.b.c.d

IPv6 address in the form a.b.c.d (7210 SAS-Dxp, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C only)

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prefix-length

Specifies the length of the IP prefix.

Values IPv4 — 0 to 32

IPv6 — 0 to 32 (7210 SAS-Dxp, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C only)

create

Creates the IP prefix entry.

shutdown

Syntax

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

Context

config>router>twamp-light>reflector

config>service>vprn>twamp-light>reflector

Platforms

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

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.

Default

shutdown

Special Cases

7210 SAS-Dxp

The **config**>**service**>**vprn**>**twamp-light**>**reflector**>**shutdown** command is not supported on 7210 SAS-Dxp.

inactivity-timeout

Syntax

inactivity-timeout *seconds*

no inactivity-timeout

Context

config>test-oam>twamp>twamp-light

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Platforms

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

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 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

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

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.

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ethernet

Specifies that the test be based on the Ethernet layer.

ip

Specifies that the test be 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.

ip

Syntax

ip

Context

config>oam-pm>session

Platforms

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

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

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

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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.

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

dest-udp-port

Syntax

dest-udp-port *udp-port-number*

no dest-udp-port

Context

config>oam-pm>session>ip

Platforms

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

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 is responding 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

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

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

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

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 are 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 a.b.c.d (7210 SAS-Dxp, 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C only)

profile

Syntax

profile {**in** | **out**}

no profile

Context

config>oam-pm>session>ip

Platforms

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

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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

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

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 *Services Guide* for information about platform support for VPRN services.

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

Default

router base

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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

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

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 a.b.c.d (7210 SAS-Dxp, 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C only)

source-udp-port

Syntax

source-udp-port *udp-port-number*

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no source-udp-port

Context

config>oam-pm>session>ip

Platforms

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

Description

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. When this command is configured, the source UDP range is restricted. When this command is omitted, the source UDP port is dynamically allocated by the system.

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

Context

config>oam-pm>session>ip

Platforms

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

Description

This command configures the value of the TTL (time to live) field in the IP header.

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

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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

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

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

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*

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no interval

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This command configures the message period, or probe spacing, for the transmission of TWAMP Light frames.

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

Parameters

milliseconds

Specifies the number of milliseconds between the transmission of TWAMP Light frames.

Values 100, 1000, 10000 (7210 SAS-Dxp, 7210 SAS-K 2F6C4T)

100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000 (7210 SAS-K 2F1C2T, 7210 SAS-K 3SFP+ 8C)

pad-size

Syntax

pad-size *octets*

no pad-size

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

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

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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

Platforms

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

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 delay statistics using a single packet.

loss

Specifies to report loss statistics using a single packet.

delay-and-loss

Specifies to report both delay and loss statistics using a single packet.

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shutdown

Syntax

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

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

Description

This command starts or stops the test.

Default

shutdown

test-duration

Syntax

test-duration *seconds*

no test-duration

Context

config>oam-pm>session>ip>twamp-light

Platforms

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

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

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Parameters

seconds

Specifies the length of time, in seconds, that the TWAMP Light test runs.

Values 1 to 86400

3.8.2.18 Show commands

twamp-light

Syntax

twamp-light

Context

show>router

show>service

Platforms

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

Description

This command displays TWAMP Light information.

Output

The following output is an example of TWAMP light information, and Table 30: 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
-------------------------------------------------------------------------------
```


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

Table 30: 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
Description	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*]

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Context

show>saa

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

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.

This is an optional parameter.

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 31: 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 #
-------------------------------------------------------------------------------
```


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```
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

===============================================================================

===============================================================================
*A:7210 SAS>show#
```

Table 31: 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

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Label	Description
	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.

test-oam

Syntax

test-oam

Context

show

Platforms

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

Description

Commands in this context display Operations, Administration, and Maintenance test parameters.

A maximum of 1000 running instances are stored on the node. When the maximum is reached, the older entries are overwritten.

Output

The following output is an example of OAM test parameters.

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 #
```


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```
-------------------------------------------------------------------------------
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
===============================================================================
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#
```

acceptance-criteria

Syntax

acceptance-criteria *acceptance-criteria-id*] [**running-instance** *running-instance*] [**detail**]

Context

show>test-oam

Platforms

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

Description

This command displays the configuration of the acceptance criteria. Both summary and detailed information is available; detailed information is displayed using the **detail** keyword. The **running-instance** parameter specifies information for a particular instance of the service test.

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Parameters

acceptance-criteria- id

Specifies the acceptance criteria identifier.

Values 1 to 1000

running-instance

Specifies a particular instance of the service test.

Values 1 to 2147483647

Output

The following output is an example of acceptance criteria configuration information.

Sample output

```
*A:Dut-B# show test-oam acceptanc-criteria 2 detail
===============================================================================
Y.1564 Acceptance criteria 2
===============================================================================
Desc             : Acceptance_Criteria_2
cir              : 199990                  pir           : 249750
Latency Threshold: 45                      Frame Loss Th*: 0
Jitter threshold : 0                       M-Factor      : 1000
FLR. Thr. In     : -1                      FLR. Thr. Out : -1
Lat. Thr. In     : -1                      Lat. Thr. Out : -1
Jit. Thr. In     : -1                      Jit. Thr. Out : -1
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:Dut-B#
```

frame-payload

Syntax

frame-payload *frame-payload-id* [**running-instance** *running-instance*] [**detail**]

Context

show>test-oam

Platforms

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

Description

This command displays the configuration of the packet header values used in frames generated by the service test testhead tool. Both summary and detailed information is available; detailed information is displayed using the **detail** keyword. The **running-instance** parameter specifies information for a particular instance of the service test.

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Parameters

frame-payload-id

Specifies the acceptance test identifier.

Values 1 to 1000

running-instance

Specifies a particular instance of the service test.

Values 1 to 2147483647

Output

The following output is an example of frame payload configuration information, and Table 32: Output fields: frame payload describes the output fields.

Sample output

```
*A:Dut-B# show test-oam frame-payload 1 detail
===============================================================================
Y.1564 frame payload 1
===============================================================================
Type              : l2                      Desc          : Frame_Payload_1
Ether type        : 2048                    Ip proto      : 0
IP TOS            : 0                       Ip TTL        : 255
DSCP              : be                      Data Pattern  :
Dest IP           : 0.0.0.0                 Dest MAC      : 00:00:00:00:00:02
Src IP            : 0.0.0.0                 Src MAC       : 00:00:00:00:00:01
Dest port         : 0                       Src port      : 0
===============================================================================
*A:Dut-B#
```

Table 32: Output fields: frame payload

Label	Description
Desc	Displays the description configured by the user for the acceptance criteria
Dest IP	Displays the destination IP address
Dest MAC	Displays the destination MAC address
Src IP	Displays the source IP address
Src MAC	Displays the source MAC address
Dest port	Displays the destination port number
Src port	Displays the source port number

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ldp-treetrace

Syntax

ldp-treetrace [**prefix** *ip-prefix/mask*] [**detail**]

Context

show>test-oam

Platforms

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

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

Specifies to display 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
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
```


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```
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

……..

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#
```


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service-test

Syntax

service-test *test-id* [**service-stream** *stream-id*] [**test-type** *test-type*] [**running-instance** *running-instance*] [**detail**]

service-test [*test-id*] [**running-instance** *running-instance*] **resource-usage**

service-test *test-id* [**service-stream** *stream-id*] [**test-type** *test-type*] [**running-instance** *running-instance*] **results** [**detail**]

service-test [*test-id*] [**service-stream** *stream-id*] [**test-type** *test-type*] [**running-instance** *running-instance*] **results-summary**

Context

show>test-oam

Platforms

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

Description

This command displays the results of a specified service test. Both summary and detailed information is available; detailed information is displayed using the **detail** keyword. Further information is available when the optional parameters are specified. The **running-instance** parameter specifies information for a particular instance of the service test.

Parameters

test-id

Specifies the service test identifier.

Values 1 to 1000

stream-id

Specifies the identifier for a service stream.

Values 1 to 4

test-type

Specifies the type of service test.

Values cir | cir-pir | policing | performance

running-instance

Specifies a particular instance of the service test.

Values 1 to 2147483647

detail

Specifies to display detailed information.

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resource-usage

Displays the memory used by the stored results of a service test if a *test-id* is specified, or if no *test-id* is specified, displays the memory used by the stored results of all service tests that are under execution or completed.

results

Displays the results of the specified service test.

results-summary

Displays a summary output of service test results that provides basic information about the results of a service test if a *test-id* is specified, or if no *test-id* is specified, about the results of all service tests that are under execution or completed. This parameter is also applicable for a specific stream ID of a service test.

Output

The following outputs are examples of service test configuration information.

Sample output

```
A:Dut-B# show test-oam service-test resource-usage
-------------------------------------------------------------------------------
Y.1564 service test results
-------------------------------------------------------------------------------
Run  |Service |                    |                    |Mem.Use
Ins. |Test    |Start time          |End time            |(bytes)
-------------------------------------------------------------------------------
2        1    04/12/2018 14:25:40  04/12/2018 14:28:45  1060
3        1    04/12/2018 14:33:56  04/12/2018 14:36:06  1408
4        2    04/12/2018 14:34:00  04/12/2018 14:35:05  1060
```

```
*A:Dut-B# show test-oam service-test results-summary
-------------------------------------------------------------------------------
Y.1564 service test results
-------------------------------------------------------------------------------
Run      |Svc |                    |                    | | | | | | |
Instance |Tst |Start time          |End time            |S|R|B|F|L|J
-------------------------------------------------------------------------------
2        1    04/12/2018 14:25:40  04/12/2018 14:28:45  |N|P|P|P|P|P
3        1    04/12/2018 14:33:56  04/12/2018 14:36:06  |N|P|P|P|P|P
4        2    04/12/2018 14:34:00  04/12/2018 14:35:05  |N|P|P|P|P|P
-------------------------------------------------------------------------------
S - test stopped - Yes/No;
R - Result for all tests - Pass/Fail/NA;
B - Bandwidth/Throughput measured - Pass/Fail/NA;
F - Frame Loss Ratio(FLR) measured - Pass/Fail/NA;
L - Latency measured - Pass/Fail/NA;
J - Jitter measured - Pass/Fail/NA;
-------------------------------------------------------------------------------
```

```
A:Dut-B# show test-oam service-test 1 results-summary
-------------------------------------------------------------------------------
Y.1564 service test 1 results
-------------------------------------------------------------------------------
Run Inst.    |Svc |     |                    |                    | | | | | | |
/SAP         |Str |Test |Start time          |End time            |S|R|B|F|L|J
-------------------------------------------------------------------------------
2            -    -     04/12/2018 14:25:40  04/12/2018 14:28:45  |N|P|P|P|P|P
1/1/2        1    cir   04/12/2018 14:25:40  NA                   |N|P|P|P|P|P
```


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```
-------------------------------------------------------------------------------
3           -    -     04/12/2018 14:33:56  04/12/2018 14:36:06  |N|P|P|P|P|P
1/1/2       1    cir   04/12/2018 14:33:56  NA                   |N|P|P|P|P|P
1/1/2       2    cir   04/12/2018 14:35:01  NA                   |N|P|P|P|P|P
-------------------------------------------------------------------------------
S - test stopped - Yes/No;
R - Result for all tests - Pass/Fail/NA;
B - Bandwidth/Throughput measured - Pass/Fail/NA;
F - Frame Loss Ratio(FLR) measured - Pass/Fail/NA;
L - Latency measured - Pass/Fail/NA;
J - Jitter measured - Pass/Fail/NA;
-------------------------------------------------------------------------------
```

```
*A:Dut-B# show test-oam service-test 1
===============================================================================
Y.1564 service test 1
===============================================================================
Service test id  : 1                       Run instance  : 1
Status           : finished                Stopped       : no
Latest running i*: 4
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

```
===============================================================================
Y.1564 service test 1 stream 1
===============================================================================
Stream Id        : 1                       Desc          : Stream_1
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 service test 1 stream 2
===============================================================================
Stream Id        : 2                       Desc          : Stream_2
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 service test 1 stream 3
===============================================================================
Stream Id        : 3                       Desc          : Stream_3
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

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


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```
Y.1564 service test 1 stream 4
===============================================================================
Stream Id        : 4                       Desc          : Stream_4
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
*A:Dut-B#
```

```
*A:Dut-B#   show test-oam service-test 1 service-stream 1 detail
===============================================================================
Y.1564 service test 1
===============================================================================
Service test id  : 1                       Run instance  : 1
Status           : finished                Stopped       : no
Latest running i*: 4
test owner       :                         service-strea*: sequential
shutdown         : false                   trap enabled  : false
CIR test time    : 60                      CIR-PIR test *: 180
Policing test ti*: 600                     Performance t*: 900
FLR result       : not-applicable          Thruput result: not-available
Latency result   : not-applicable          Jitter result : not-applicable
accounting policy: 0                       stats collect*: false
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

```
===============================================================================
Y.1564 service test 1 stream 1
===============================================================================
Stream Id        : 1                       Desc          : Stream_1
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 frame payload 1
===============================================================================
Type             : l2                      Desc          : Frame_Payload_1
Ether type       : 2048                    Ip proto      : 0
IP TOS           : 0                       Ip TTL        : 255
DSCP             : be                      Data Pattern  :
Dest IP          : 0.0.0.0                 Dest MAC      : 00:00:00:00:00:02
Src IP           : 0.0.0.0                 Src MAC       : 00:00:00:00:00:01
Dest port        : 0                       Src port      : 0
===============================================================================
```

```
===============================================================================
Y.1564 Acceptance criteria 2
===============================================================================
Desc             : Acceptance_Criteria_2
cir              : 199990                  pir           : 249750
Latency Threshold: 45                      Frame Loss Th*: 0
Jitter threshold : 0                       M-Factor      : 1000
FLR. Thr. In     : -1                      FLR. Thr. Out : -1
```


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```
Lat. Thr. In     : -1                      Lat. Thr. Out : -1
Jit. Thr. In     : -1                      Jit. Thr. Out : -1
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:Dut-B#
```

```
*A:Dut-B# show test-oam service-test 1 running-instance 1 detail
===============================================================================
Y.1564 service test 1
===============================================================================
Service test id  : 1                       Run instance  : 1
Status           : finished                Stopped       : no
Latest running i*: 4
test owner       :                         service-strea*: sequential
shutdown         : false                   trap enabled  : false
CIR test time    : 60                      CIR-PIR test *: 180
Policing test ti*: 600                     Performance t*: 900
FLR result       : not-applicable          Thruput result: not-available
Latency result   : not-applicable          Jitter result : not-applicable
accounting policy: 0                       stats collect*: false
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

```
===============================================================================
Y.1564 service test 1 stream 1
===============================================================================
Stream Id        : 1                       Desc          : Stream_1
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 frame payload 1
===============================================================================
Type             : l2                      Desc          : Frame_Payload_1
Ether type       : 2048                    Ip proto      : 0
IP TOS           : 0                       Ip TTL        : 255
DSCP             : be                      Data Pattern  :
Dest IP          : 0.0.0.0                 Dest MAC      : 00:00:00:00:00:02
Src IP           : 0.0.0.0                 Src MAC       : 00:00:00:00:00:01
Dest port        : 0                       Src port      : 0
===============================================================================
```

```
===============================================================================
Y.1564 Acceptance criteria 2
===============================================================================
Desc             : Acceptance_Criteria_2
cir              : 199990                  pir           : 249750
Latency Threshold: 45                      Frame Loss Th*: 0
Jitter threshold : 0                       M-Factor      : 1000
FLR. Thr. In     : -1                      FLR. Thr. Out : -1
Lat. Thr. In     : -1                      Lat. Thr. Out : -1
Jit. Thr. In     : -1                      Jit. Thr. Out : -1
===============================================================================
```


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```
* indicates that the corresponding row element may have been truncated.
```

```
===============================================================================
Y.1564 service test 1 stream 2
===============================================================================
Stream Id        : 2                       Desc          : Stream_2
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 frame payload 1
===============================================================================
Type             : l2                      Desc          : Frame_Payload_1
Ether type       : 2048                    Ip proto      : 0
IP TOS           : 0                       Ip TTL        : 255
DSCP             : be                      Data Pattern  :
Dest IP          : 0.0.0.0                 Dest MAC      : 00:00:00:00:00:02
Src IP           : 0.0.0.0                 Src MAC       : 00:00:00:00:00:01
Dest port        : 0                       Src port      : 0
===============================================================================
```

```
===============================================================================
Y.1564 Acceptance criteria 2
===============================================================================
Desc             : Acceptance_Criteria_2
cir              : 199990                  pir           : 249750
Latency Threshold: 45                      Frame Loss Th*: 0
Jitter threshold : 0                       M-Factor      : 1000
FLR. Thr. In     : -1                      FLR. Thr. Out : -1
Lat. Thr. In     : -1                      Lat. Thr. Out : -1
Jit. Thr. In     : -1                      Jit. Thr. Out : -1
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

```
===============================================================================
Y.1564 service test 1 stream 3
===============================================================================
Stream Id        : 3                       Desc          : Stream_3
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 frame payload 1
===============================================================================
Type             : l2                      Desc          : Frame_Payload_1
Ether type       : 2048                    Ip proto      : 0
IP TOS           : 0                       Ip TTL        : 255
DSCP             : be                      Data Pattern  :
Dest IP          : 0.0.0.0                 Dest MAC      : 00:00:00:00:00:02
Src IP           : 0.0.0.0                 Src MAC       : 00:00:00:00:00:01
```


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```
Dest port        : 0                       Src port      : 0
===============================================================================
```

```
===============================================================================
Y.1564 Acceptance criteria 2
===============================================================================
Desc             : Acceptance_Criteria_2
cir              : 199990                  pir           : 249750
Latency Threshold: 45                      Frame Loss Th*: 0
Jitter threshold : 0                       M-Factor      : 1000
FLR. Thr. In     : -1                      FLR. Thr. Out : -1
Lat. Thr. In     : -1                      Lat. Thr. Out : -1
Jit. Thr. In     : -1                      Jit. Thr. Out : -1
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

```
===============================================================================
Y.1564 service test 1 stream 4
===============================================================================
Stream Id        : 4                       Desc          : Stream_4
SAP              : 1/1/2                   FC            : be
Accept. Crit.    : 2                       Frame Payload : 1
Frame size       : 512
Cir              : 200000                  adaptation    : min
Pir              : 250000                  adaptation    : closest
Tests            : cir
===============================================================================
```

```
===============================================================================
Y.1564 frame payload 1
===============================================================================
Type             : l2                      Desc          : Frame_Payload_1
Ether type       : 2048                    Ip proto      : 0
IP TOS           : 0                       Ip TTL        : 255
DSCP             : be                      Data Pattern  :
Dest IP          : 0.0.0.0                 Dest MAC      : 00:00:00:00:00:02
Src IP           : 0.0.0.0                 Src MAC       : 00:00:00:00:00:01
Dest port        : 0                       Src port      : 0
===============================================================================
```

```
===============================================================================
Y.1564 Acceptance criteria 2
===============================================================================
Desc             : Acceptance_Criteria_2
cir              : 199990                  pir           : 249750
Latency Threshold: 45                      Frame Loss Th*: 0
Jitter threshold : 0                       M-Factor      : 1000
FLR. Thr. In     : -1                      FLR. Thr. Out : -1
Lat. Thr. In     : -1                      Lat. Thr. Out : -1
Jit. Thr. In     : -1                      Jit. Thr. Out : -1
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:Dut-B#
```


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eth-cfm

Syntax

eth-cfm

Context

show

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Description

This command displays eth-cfm association information.

Parameters

ma-index

Specifies the MA index.

Values 1 to 4294967295

detail

Displays detailed information for the eth-cfm association.

Output

The following output is an example of CFM association information, and Table 33: Output fields: ETH-CFM association describes the output fields.

Sample output

```
# show eth-cfm association
```


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```
===============================================================================
CFM Association Table
===============================================================================
Md-index   Ma-index   Name                     CCM-intrvl Hold-time Bridge-id
-------------------------------------------------------------------------------
3          1          03-0000000100            1          n/a       100
10         1          FacilityPrt01            1          n/a       none
===============================================================================
ALU-IPD#

show eth-cfm association
===============================================================================
CFM Association Table
===============================================================================
Md-index   Ma-index   Name                     Int  Hold  Bridge-id  MEPS TxSid
-------------------------------------------------------------------------------
12         1          epipe01-ovcmeg-circuit0* 10   n/a   1          0    yes
12         4          vpls4-0000001            1    n/a   4          2    yes
12         16         abcdefgh                 10   n/a   none       0    no
14         1          123456789abce            1    n/a   3          3    no
14         2          epipe00000005            1    n/a   5          3    yes
14         3          ivpls-000006             10   n/a   6          1    no
14         5          service4001              10   n/a   5          0    no
15         3          12345678                 10   n/a   3          0    no
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

Table 33: 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-table [**port** [*port-id* [**vlan** *vlan-id*]] [**level 0..7**] [**direction up** | **down**]

Context

show>eth-cfm

Platforms

Supported on all 7210 SAS platforms as described in this document

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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. The various option allow the operator to be specific. If no parameters are include, the entire stack-table is displayed.

Parameters

port *port-id*

Displays the bridge port or aggregated port on which MEPs or MHFs are configured.

vlan *vlan-id*

Displays the associated VLAN ID.

Values 0 to 4094

level

Displays the MD level of the maintenance point.

Values 0 to 7

direction up | down

Displays 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 34: Output fields: CFM stack table describes the output fields.

Sample output

```
*ALU-IPD# show eth-cfm cfm-stack-table
===============================================================================
CFM SAP Stack Table
===============================================================================
Sap            Level Dir  Md-index   Ma-index   Mep-id Mac-address
-------------------------------------------------------------------------------
lag-1:1.1      0     Down 2          1          10     00:f3:f0:98:97:1b
lag-1:1.1      6     Down 1          1          1      00:f3:f0:98:97:1b
lag-1:2.2      0     Down 2          2          20     00:f3:f0:98:97:1b
lag-1:2.2      6     Down 1          2          2      00:f3:f0:98:97:1b
===============================================================================
*ALU-IPD#
```

Table 34: 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

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Label	Description
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

Description

This command displays domain information.

Parameters

md-index

Specifies the index of the MD to which the MP is associated, or 0, if none.

Values 1 to 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 CFM domain information, and Table 35: Output fields: ETH-CFM domain describes the output fields.

Sample output

```
*ALU-IPD#  show eth-cfm domain
===============================================================================
CFM Domain Table
===============================================================================
Md-index   Level Name                                        Format
-------------------------------------------------------------------------------
```


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```
1          6                                                    none
2          0                                                    none
===============================================================================
*ALU-IPD#

show eth-cfm domain 14 association 2 detail
===============================================================================
Domain 14
Md-index          : 14                       Level             : 4
                                             MHF Creation      : defMHFnone
Name Format       : none                     Next Ma Index     : 4
Name              : (Not Specified)
Creation Origin   : manual
-------------------------------------------------------------------------------
Domain 14 Associations:
Md-index          : 14                       Ma-index          : 2
Name Format       : icc-based                CCM-interval      : 1
Auto Discover     : True                     CCM-hold-time     : n/a
Name              : epipe00000005
Permission        : sendIdChassis
Bridge-id         : 5                        MHF Creation      : defMHFnone
PrimaryVlan       : 0                        Num Vids          : 0
MIP LTR Priority  : 7
Total MEP Count   : 3
Remote Mep Id     : 30   (AutoDiscovered)    Remote MAC Addr   : default
Remote Mep Id     : 32   (AutoDiscovered)    Remote MAC Addr   : default
===============================================================================
```

Table 35: 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
Next Ma Index	Displays the value of the next MA index
Domain Associations	
Md-index	Displays the MD index of the domain
Ma-index	Displays the MA index of the association
Name Format	Displays the format for the MA name
CCM-interval	Displays the CCM interval (in seconds)
Name	Displays the name of the MA

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Label	Description
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.
PrimaryVlan	Displays the VLAN ID configured under the **config>eth-cfm>domain>association>bridge-identifier>vlan** command
Num Vids	Displays the number of VLAN IDs and is always 0
Remote Mep Id	Displays the MEP identifier for the remote MEP

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**]

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

Description

This command displays Maintenance Endpoint (MEP) information.

Parameters

domain *md-index*

Specifies the index of the MD with which the MEP is associated, or 0, if none.

association *ma-index*

Specifies the index of the MA with which the MEP is associated, or 0, if none.

loopback

Specifies loopback information for the specified MEP.

linktrace

Specifies linktrace information for the specified MEP.

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

remote-mepid

Specifies remote MEP ID information for the specified MEP.

remote-peer *mac-address*

Specifies remote peer information for the specified MEP.

one-way-delay-test

Specifies one-way delay test information for the specified MEP.

two-way-delay-test

Specifies two-way delay test information for the specified MEP.

two-way-slm-test

Specifies two-way SLM test information for the specified MEP.

eth-test-results

Specifies ETH test result information for the specified MEP.

all-remote-mepids

Specifies all remote MEP ID information for the specified MEP.

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 36: Output fields: ETH-CFM MEP
- Sample output 2, Table 37: Output fields: MEP ETH-BN

Sample output 1

```
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)
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)
================================================================================
```


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```
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 36: Output fields: ETH-CFM MEP

Label	Description
Remote Mep Id	Displays the MEP identifier for the remote MEP
Auto Discovered	Displays whether the MEP is auto-discovered Auto-discovery for remote MEPs is not supported on the 7210 SAS
RDI	True — The RDI flag has been received from the remote MEP False — The RDI flag has not been received from the remote MEP
Port Status TLV	Displays the contents of the port status TLV in the CCM (Up, Blocked, or Absent), as defined in the 802.1ag specification.
I/F Status TLV	Displays the contents of the interface status TLV in the CCM (Up, Blocked, or Absent), as defined in the 802.1ag specification
MAC Address	Displays the MAC address
CCM Last Change	Displays the last CMM status change
Chass. ID Subtype	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
Chassis ID	Displays the chassis ID returned in the Sender ID TLC of the linktrace reply, if any

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Label	Description
Man Addr Domain	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

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 37: 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
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

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Label	Description
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
CcmLastFailure Frame	Displays the frame that caused the last CCM failure
XconCcmFailure Frame	Displays the frame that caused the XconCCMFailure

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mip

Syntax

mip

Context

show>eth-cfm

Platforms

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

Description

This command displays SAPs/bindings provisioned for allowing the default MIP creation.

Output

The following output is an example of CFM 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

Context

show>eth-cfm

Platforms

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

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Description

This command displays the ETH-CFM statistics counters.

Output

The following output is an example of CFM statistics.

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

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 system configuration 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)
===============================================================================

*A:cses-V28# show eth-cfm system-config
===============================================================================
```


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```
CFM System Configuration
================================================================================
Redundancy
    MC-LAG Standby MEP Shutdown: false
    MC-LAG Hold-Timer          :   1 second(s)
Synthetic Loss Measurement
    Inactivity Timer           : 100 second(s)
ETH-CCM Grace-Period
    Transmit Enabled           : true
Sender ID Information
    ChassisID Subtype          : local
    ChassisID                  : access-012-north
--------------------------------------------------------------------------------
ETH-CFM System Configuration Limits
--------------------------------------------------------------------------------
Component                                Current Usage       System Limit
--------------------------------------------------------------------------------
Maintenance Domain (MD)                                  3                 50
Maintenance Association (MA)                             8              25000
  Extended MA (up to 400 MEPs)                           0                 10
Maintenance Endpoint (MEP)                               4              25000
  One-second MEP                                         3               5000
  Sub-second MEP                                         0               5000
Alarm Indication Signal (AIS)                            0              25000
Client Signal Fail (CSF)                                 0              25000
Primary Vlan Ingress MP                                  1              19999
Primary Vlan Egress MP                                   1              19999
--------------------------------------------------------------------------------
================================================================================
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)
              access-012-west
----- -------------------- -------------------- ---------- ----------
No more responses received in the last 6 seconds.
```

twamp

Syntax

twamp

Context

show>test-oam

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

Description

Commands in this context request TWAMP information.

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twamp-light

Syntax

twamp-light

Context

show>test-oam>twamp

Platforms

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

Description

Commands in this context request TWAMP Light information.

reflectors

Syntax

reflectors

Context

show>test-oam>twamp>twamp-light

Platforms

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

Description

This command displays TWAMP Light reflector information.

Output

The following output is an example of TWAMP light reflector information, and Table 38: 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
===============================================================================
```


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Table 38: 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

server

Syntax

server

server all

server prefix *ip-prefix/mask*

Context

show>test-oam>twamp

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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

Specifies the TWAMP server IPv4 or IPv6 address prefix.

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Values *ipv4-prefix* — a.b.c.d (host bits must be set to 0)

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 (hexadecimal)

d — 0 to 255 (decimal)

mask

Specifies the mask length.

Values *ipv4-prefix-length* — 0 to 32

ipv6-prefix-length — 0 to 128 (7210 SAS-D, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T)

0 to 64 (7210 SAS-Dxp)

Output

The following outputs are examples of TWAMP server information, and Table 39: Output fields: TWAMP server describes the output fields.

- Sample output: standard
- Sample output: server all
- Sample output: server prefix

Sample output: standard

```
*A:Dut-G>show>test-oam# twamp server

===============================================================================
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: server all

```
7210SAS# show  test-oam twamp server all
```


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

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


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Sample output: server prefix

```
*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 39: Output fields: TWAMP server

Label	Description
Admin State	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.
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	The time since the server process was started, measured in days (d), hours, minutes, and seconds.
Current Connections	The total number of currently connected clients.
Max Connections	The maximum number of connected clients.
Connections Rejected	The number of connection rejections.
Inactivity Timeout	The configured inactivity timeout for all TWAMP-control connections (**inactivity-timeout**).
Current Sessions	The number of current sessions.
Max Sessions	The maximum number of sessions.

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Label	Description
Sessions Rejected	The number of rejected sessions for the TWAMP client.
Sessions Aborted	The number of manually aborted sessions for the TWAMP client.
Sessions Completed	The number of completed sessions for the TWAMP client.
Test Packets Rx	The number of test packets received.
Test Packets Tx	The number of test packets transmitted.
Description	The configured description of the TWAMP server.
Connection information for TWAMP server prefix	The IP address prefix of a TWAMP server.
Client	The IP address of the TWAMP client.
State	The operational state of the TWAMP client.
Curr Sessions	The number of current sessions for the TWAMP client.
Idle Time (s)	The total idle time, in seconds, of the TWAMP client.
No. of Conns for Prefix	The total number of connections for the TWAMP server with the displayed IP address prefix.
No. of TWAMP Server Prefixes	The total number of displayed TWAMP server IP address prefixes.

testhead-profile

Syntax

testhead-profile *profile-id*

Context

show>test-oam

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

Description

This command specifies the testhead profile ID to use with this run/session of testhead invocation. Testhead profile must be configure beforehand using the commands under **config>test-oam>testhead-profile>**.

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Output

The following output is an example of testhead-profile information, and Table 40: Output fields: 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

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           : 20.2.2.2
L4 Dst Port        : 50                       L4 Src Port       : 40
Protocol           : 6                        Ref. Count        : 0
Data Pattern       : a1b2c3d4e5f6
===============================================================================
*A:7210SAS>config>test-oam>#
```

Table 40: Output fields: 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

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Label	Description
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
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

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Label	Description
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
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

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testhead

Syntax

testhead *test-name* **owner** *test-owner*

Context

show

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

Description

This command displays the results of the testhead test identified by test-name and owner.

Parameters

test-name

Specifies the name of the testhead. The test name must already be configured in the **oam** context.

owner *test-owner*

Specifies the owner of an testhead 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".

Output

The following output is an example of testhead information, and Table 41: 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
```


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```
         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

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
```


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```
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 41: 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
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

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Label	Description
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 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 "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. “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.

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Label	Description
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. "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 "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
OutPrf Lat Acep	Displays Pass, Fail, or Not Applicable "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 "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 "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.

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Label	Description
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 "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. "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.	Total number of packets (that is, data and marker) transmitted by the testhead session for the duration of the test
OutPrf Latency Pkt*	Total number of out-of-profile marker packets received by the testhead session for the duration of the test
Total Tx. Fail	Total number of failed transmission attempts by the testhead session for the duration of the test
Latency Pkts. Tx	Total number of marker packets transmitted by the testhead session for the duration of the test
InPrf Latency Pkt*	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

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

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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
                                             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
```


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```
                                          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

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

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 session 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
```


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```
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

Platforms

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

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 status information for an OAM-PM session.

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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
-------------------------------------------------------------------------------

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


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```
?
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
-------------------------------------------------------------------------------

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


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```
Accounting Policy : none
-------------------------------------------------------------------------------
```

sessions

Syntax

sessions [**test-family** {**ethernet** | **ip**}] [**event-mon**]

Context

show>oam-pm

Platforms

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

Description

This command displays a summary of the OAM-PM sessions.

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 information for OAM-PM sessions.

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


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```
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

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

Description

This command displays OAM-PM delay or synthetic loss statistics.

session

Syntax

session *session-name*

Context

show>oam-pm>statistics

Platforms

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

Description

This command displays OAM-PM session statistics.

Parameters

session-name

Specifies the session name. 32 characters maximum.

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dmm

Syntax

dmm

Context

show>oam-pm>statistics>session

Platforms

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

Description

This command displays DMM test statistics.

meas-interval

Syntax

meas-interval raw [{**all** | **bins** | **summary**}]

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

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

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-minute intervals.

15-mins

Specifies information for 15-minute intervals.

1-hour

Specifies information for 1-hour intervals.

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


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


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```
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
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
```


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```
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
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

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

Description

This command displays SLM test statistics.

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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

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

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.

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
-------------------------------------------------------------------------------

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


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

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


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twamp-light

Syntax

twamp-light

Context

show>oam-pm>statistics>session

Platforms

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

Description

This command displays 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**]

Context

show>oam-pm>statistics>session>twamp-light

Platforms

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

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.

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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.

3.8.2.19 Monitor commands

session

Syntax
session *session-name* [{**dmm** | **slm** | **twamp-light**}]

Context
monitor>oam-pm

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

Description
This command monitors the raw measurement interval for the specified session.

Parameters
session-name
Specifies the session name. 32 characters maximum.

dmm
Specifies monitoring information for DMM tests only.

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slm

Specifies monitoring information for SLM tests only.

twamp-light

Specifies monitoring information for TWAMP Light tests only (not applicable to the 7210 SAS-K 3SFP+ 8C).

Output

The following output is an example of session information

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
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
-----------------------------------------------------------------

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


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


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```
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)
-------------------------------------------------------------------------------

-------------------------------------------------------
                   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)
```


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

3.8.2.20 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

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.

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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

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

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

Specifies the raw measurement interval for DMM tests.

slm

Specifies the raw measurement interval for SLM tests.

twamp-light

Specifies the raw measurement interval for TWAMP Light tests (not applicable to the 7210 SAS-K 3SFP+ 8C).

mep

Syntax

mep *mep-id* **domain** *md-index* **association** *ma-index* **statistics**

Context

clear>eth-cfm

Platforms

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

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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

statistics

Clears MEP statistics for the specified MEP.

statistics

Syntax

statistics

Context

clear>eth-cfm

Platforms

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

Description

This command clears the ETH-CFM statistics counters.

test-oam

Syntax

test-oam

Context

clear

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Platforms

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

Description

This command clears the Operations, Administration, and Maintenance test parameters.

result

Syntax

result service-test *test-id* [**running-instance** *running-instance*]

Context

clear>test-oam

Platforms

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

Description

This command clears the results of all previous executions of the specified service test.

Parameters

test-id

Specifies the service test whose results are to be cleared.

Values 1 | 2 | all

running-instance

Specifies a particular instance of the service test.

Values 1 to 2147483647

twamp

Syntax

twamp

Context

clear>test-oam

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

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Description

Commands in this context clear TWAMP statistics.

server

Syntax

server

Context

clear>test-oam>twamp

Platforms

7210 SAS-D, 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, and 7210 SAS-K 2F6C4T

Description

This command clears TWAMP server statistics.

testhead

Syntax

testhead result [**test-name**] [**owner** *test-owner*]

Context

oam>clear

Platforms

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

Description

This command clears the testhead results identified by the test-name and test-owner.

Parameters

result

Specifies the test results from the latest history for the test.

test-name

Specifies the name of the test.

Values ASCII string up to 32 characters

owner test-owner

Specifies the owner of a testhead operation.

Values ASCII string up to 32 characters

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testhead

Syntax

testhead testhead-profile *profile-id*

Context

oam>clear

Platforms

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

Description

This command clears the testhead results identified by the testhead-profile.

Parameters

testhead-profile *profile-id*

Specifies 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

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

3.9.1.1 Configuration commands

3.9.1.1.1 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]
        - lag lag-id lag-id
        - persistence
```


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```
            - summary
                - mc-endpoint peer ip-address
        - router router-instance
            - dintf [ip-address]
            - filter-info [verbose]
            - l3info
            - l3-stats [clear]
            - rsvp
                - psb [endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
 [lspid lsp-id]
                - rsb [endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
 [lspid lsp-id]
            - service-name service-name
        - 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 egress-acls
        - system-resources slot-number ingress-acls
        - system-resources slot-number mcast-groups
```

3.9.1.1.2 Dump commands for 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

```
tools
    - dump
        - accounting-policy acct-policy-id flash-write-count [clear]
        - eth-ring ring-index [clear]
        - lag lag-id lag-id
        - ldp-treetrace {prefix ip-prefix/mask | manual-prefix ip-prefix/mask} [path-
destination ip-address] [trace-tree]
        - persistence
            - summary
                - mc-endpoint peer ip-address
        - router router-instance
        - router service-name service-name
            - fib slot-number [ipv4 | ipv6] summary
            - ospf
                - 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
                - abr [detail]
                - asbr [detail]
                - bad-packet interface-name
```


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```
                - leaked-routes [summary | detail]
                - memory-usage [detail]
                - request-list [detail]
                - request-list neighbor [ip-address] [router-id] [detail]
                - request-list virtual-neighbor router-id transit-area transit-area [detail]
                - retransmission-list [detail]
                - retransmission-list neighbor [ip-address] [router-id] [detail]
                - retransmission-list virtual-neighbor router-id transit-area transit-area
[detail]
                - route-summary
                - route-table [ipv6-prefix/prefix-length] [type] [detail]
            - rsvp
                - rsvp [ip-address] [detail]
                - psb [endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
[lspid lsp-id]
                - rsb [endpoint endpoint-address] [sender sender-address] [tunnelid tunnel-id]
[lspid lsp-id]
            - static-route
                - ldp-sync-status
        - service
            - id service-id
                - sap sap-id stats [clear]
                - sdp sdp-id[:vc-id] stats [clear]
        - system-resources slot-number
```

3.9.1.1.3 Perform commands for 7210 SAS-D

```
tools
    - perform
        - card slot-number
        - 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
        - eth-ring
            - clear ring-index
            - force ring-index path {a | b}
            - manual ring-index path {a | b}
        - lag
            - clear-force lag-id lag-id [sub-group sub-group-id]
            - force lag-id lag-id [sub-group sub-group-id] {active | standby}
        - log
            - test-event
```

3.9.1.1.4 Perform commands for 7210 SAS-Dxp, 7210 SAS-K 2F1C2T, 7210 SAS-K 2F6C4T, and 7210 SAS-K 3SFP+ 8C

```
tools
    - perform
        - card slot-number
        - eth-ring
            - clear ring-index
```


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```
            - force ring-index path {a | b}
            - manual ring-index path {a | b}
        - lag
            - clear-force lag-id lag-id [sub-group sub-group-id]
            - force lag-id lag-id [sub-group sub-group-id] {active | standby}
        - log
            - test-event
        - 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

3.9.2.1 Configuration commands

3.9.2.1.1 Generic commands

tools

Syntax

tools

Context

root

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context configure debugging tools.

Parameters

dump

Specifies dump tools for the various protocols.

perform

Specifies tools to perform specific tasks.

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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

This command enables context to 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

Platforms

Supported on all 7210 SAS platforms as described in this document

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 restart the counter.

Parameters

flash-write-count

Specifies the total number of flash writes up to the present for the accounting policy specified by accounting policy 'id'.

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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

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

Description

This command displays, and optionally clears, the most active MEPs on the system.

Default

sorts total in both directions

Parameters

rx-sort

Specifies to sort in the receive (Rx) direction.

tx-sort

Specifies to sorts in the transmit (Tx) direction.

clear

Clears the current counters.

eth-ring

Syntax

eth-ring *ring-index* [**clear**]

eth-ring control-sap-tag *port-id* [**list-in-use** | **next-available**]

Context

tools>dump

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Platforms

Supported on all 7210 SAS platforms as described in this document

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

Description

This command displays LAG information.

Parameters

lag-id

Specifies an existing LAG ID.

Values 1 to 12

Output

Sample output

```
*A:7210 SAS>tools>dump# lag lag-id 1
Port state      : Up
Selected subgrp : 1
NumActivePorts  : 2
ThresholdRising : 2
ThresholdFalling: 0
IOM bitmask     : 2
```


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```
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

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

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.

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 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
```


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```
    ===  ================  ================  ================  ==================
    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#
```

persistence

Syntax

persistence

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display persistence information for debugging.

summary

Syntax

summary

Context

tools>dump>persistence

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays persistence summary information for debugging.

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Output

Sample output

```
A:ALA-B# tools dump persistence summary
===============================================================================
Persistence Summary on Slot A
===============================================================================
Client             Location            Entries in use    Status
-------------------------------------------------------------------------------
xxxxxx            cf1:\l2_dhcp.pst    200              ACTIVE
-------------------------------------------------------------------------------
Persistence Summary on Slot B
===============================================================================
Client             Location            Entries in use    Status
-------------------------------------------------------------------------------
xxxxxx              cf1:\l2_dhcp.pst    200               ACTIVE
-------------------------------------------------------------------------------
A:ALA-B#
```

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 *slot-number* **egress-acls**

system-resources *slot-number* **ingress-acls**

system-resources mcast-groups

Context

tools>dump

Platforms

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

Description

This command displays system resource information.

Parameters

slot-number

Specifies a slot to view system resources information.

Values 1

sap-ingress-qos

Specifies details about usage of resources allocated for QoS classification and different match criteria under QoS classification.

associations

Specifies all SAPs that use each chunk ID.

egress-acls

Specifies details on usage of resources allocated for egress filter resource consumption.

ingress-acls

Specifies details on usage of resources allocated for ingress filter resource consumption.

mcast-groups

Specifies details on usage of resources allocated for multicast group resource consumption.

Output

The following outputs are examples of system resources information:

- Sample output: SAP ingress QoS
- Sample output: SAP ingress QoS and SAP egress aggregate meter for 7210 SAS-D
- Sample output: SAP ingress QoS policy associations

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- Sample output: tools dump system-resources for 7210 SAS-K 2F1C2T
- Sample output: multicast groups

The following table describes tools>dump>system-resource SAP ingress QoS output fields.

Table 42: Output fields: tools 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 for by SAP that use 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 for by SAP that use 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 for by SAP that use MAC classification 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 in use for by SAP that use 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 in use for by SAP that use IPv6 classification match criteria in the SAP ingress QoS policy

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Labels	Descriptions
	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 in use for by SAP that use MAC classification match criteria in the SAP ingress QoS policy This assumes all of the free chunks are alloted to MAC classification match criteria.

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
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#
```

Sample output: SAP ingress QoS and SAP egress aggregate meter for 7210 SAS-D
The following example displays the resource utilization for SAP ingress QoS and SAP egress aggregate meter for the 7210 SAS-D, and Table 42: Output fields: tools dump system-resource SAP ingress QoS and Table 43: Output fields: tools dump system-resource describe the output fields.

```
*A:7210SAS>tools>dump# system-resources sap-ingress-qos
Sap Resource Manager info at 007 h 01/01/70 07:18:39.032:

Sap Ingress Resource Usage for Slot #1, Cmplx #0:

Total Chunks Configured : 1
Total Chunks Available  : 1
Number of Chunks in Use : 0
Number of Free Chunks   : 1
Number of Fixed Chunks  : 1

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      : 0
```


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```
Number of pre-allocated Chunks with MAC match# :1

                |  Classification Entries   |           Meters
    Chunk | Type | Total  |Allocated|  Free  | Total  |Allocated|  Free
  --------+------+--------+---------+--------+--------+---------+---------
         1|   Mac|     128|        2|     126|      64|        1|      63

Number of Chunks available for use with IP match*        : 1
Number of Chunks available for use with IPv6 match*      : 0
Number of Chunks available for use with Ip + Mac match*  : 1
Number of Chunks available for use with MAC match*       : 1

# - Chunk 1 with 128 entries is statically assigned to SAP ingress QoS MAC criteria.
* - Assumes all remaining chunks are used


*A:7210SAS>tools>dump#*A:NS1050C0070>tools>dump# system-resources
Resource Manager info at 007 h 01/01/70 07:17:52.952:

Hardware Resource Usage per Node:

                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------

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 |        128|          0|        128
      Shared Qos Ingress Meters |        128|          0|        128
  Shared Qos Ingress CAM Entries |        256|          0|        256
        Mac Qos Ingress Meters |         64|          1|         63
    Mac Qos Ingress CAM Entries |        128|          2|        126
       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 |        256|          0|        256
         Network Ingress Meters |         90|          0|         90
         Network Ing CAM Entries |        180|          0|        180
         Port Scheduler Policies |          0|          0|          0
      Ingress Shared ACL Entries |        512|          0|        512
         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 |          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 |        240|          0|        240
      Egress Sap Counter Entries |          0|          0|          0
Num VLAN-ID/Range in Con Profile |       4096|          0|       4096

*A:7210SAS>tools>dump#
```


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Table 43: Output fields: tools dump system-resource

Labels	Descriptions
SAP Ingress QoS Policies	Number of SAP ingress policies that are allowed to be configured (software-limit)
Access Egr. QoS Policies	Number of Access egress policies that are allowed to be configured (software-limit)
SAP Egress QoS Policies	Number of SAP egress policies that are allowed to be configured (software-limit)
SAP Ingress Aggregate-Meter	Number of SAP ingress aggregate meter (that is, per SAP aggregate meter) allowed (hardware limit)
Shared Qos Ingress Meters	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	Number of SAP ingress classification CAM entries across all match-criteria (hardware limit)
Mac Qos Ingress Meters	Number of SAP ingress meter (that is, per FC meter) for MAC match-criteria (hardware limit)
Mac Qos Ingress CAM Entries	Number of SAP ingress classification CAM entries for MAC match-criteria (hardware limit)
IPv4 Qos Ingress Meters	Number of SAP ingress meter (that is, per FC meter) for IPv4 match-criteria (hardware limit)
IPv4 Qos Ingress CAM Entries	Number of SAP ingress classification CAM entries for IPv4 match-criteria (hardware limit)
IPv6 Qos Ingress Meters	Number of SAP ingress meter (that is, per FC meter) for IPv6 match-criteria (hardware limit)
IPv6 Qos Ingress CAM Entries	Number of SAP ingress classification CAM entries for IPv6 match-criteria (hardware limit)
IP + Mac Qos Ingress Meters	Number of SAP ingress meter (that is, per FC meter) for IP+MAC match-criteria (hardware limit)
IP + Mac Qos Ingress CAM Entries	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	Number of SAP ingress meter (that is, per FC meter) when using IP DSCP table-based classification (hardware limit)

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Labels	Descriptions
DSCP CAM Entries	Number of CAM entries for IP DSCP table-based classification. (hardware limit)
DSCP Profile	Number of IP DSCP table-based classification resources (hardware limit)
Network Ing Port Meters	Number of Network Port Ingress Meters (hardware limit)
Network Ing Port CAM Entries	Number of Network port ingress classification CAM entries used for FC classification. (hardware limit)
Network Ing IpIntf Meters	Number of Network IP interface meters (hardware limit)
Network Ing IpIntf CAM Entries	Number of Network IP interface ingress classification CAM entries used for FC classification. (hardware limit)
Network MPLS Exp Profile Table	Number of MPLS EXP to FC mapping table resources (hardware limit)
Port Scheduler Policies	Number of Port Scheduler policies that can be configured (software limit)
Queue Management Policies	Number of Queue Management policies that can be configured (software limit)
Remark Policies	Number of Remark policies that can be configured (software limit)
Shared Egr QOS MAP Entries	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	Number of resources used for access SAP egress queuing (hardware limit) These resources are taken from the ingress-internal-tcam pool.
Dscp Classification policies	Number of IP DSCP table-based classification policy templates (software limit)
Ingress Shared ACL Entries	Number of CAM entries for ingress ACLs across all match-criteria (some of these are shared with SAP aggregate meter) See the system resource profile command description for more information.
Ingress Mac ACL Entries	Ingress ACL CAM entries for MAC match criteria
Ingress IPv4 ACL Entries	Ingress ACL CAM entries for IPv4 match criteria

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Labels	Descriptions
Ing IPv6 128 bit ACL Entries	Ingress ACL CAM entries for IPv6 with 128-bit addresses match criteria
Ing IPv6 64 bit ACL Entries	Ingress ACL CAM entries for IPv6 with 64-bit addresses match criteria
Egress Shared ACL Entries	Number of CAM entries for egress ACLs across all match-criteria
Egress Mac only ACL Entries	Egress ACL CAM entries for MAC match criteria
Egress Mac+IPv4 ACL Entries	Egress ACL CAM entries for MAC and IPv4 match criteria
Egr IPv6 128 bit ACL Entries	Egress ACL CAM entries for IPv6 128-bit match criteria
Egr Mac+IPv6 64 bit ACL Entries	Egress ACL CAM entries for MAC + IPv6 64-bit match criteria
Ingress SAP Lookup Entries	Number of entries used to identify the SAP on port ingress (hardware limit)
Egress Aggregate Meter	Resources used for egress aggregate meter configured for access SAP (hardware limit)
TWAMP/LT Entries	Number of CAM entries used for TWAMP/TWAMP light (hardware limit)
MEP Lookup CAM Entries	The number of CAM entries (pre-ingress resource pool) used for CFM/Y.1731 Down MEP processing (hardware limit)
DN MEP Entries	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	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	The number of egress multicast entries (software limit)

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
  1/1/1:200                    506       1           0        2        Mac
```


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```
  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
-------------------------------------------------------------------------------
===============================================================================
```

Sample output: tools dump system-resources for 7210 SAS-K 2F1C2T

The following example displays the resource utilization for the 7210 SAS-K 2F1C2T, and Table 44: Output fields: discard statistics describes the output fields. The display for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C is similar.

```
*A:Dut-A>tools>dump# system-resources
Resource Manager info at 014 h 05/03/17 12:24:09.828:

Hardware Resource Usage per Node:

                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------


Hardware Resource Usage for Slot #1, CardType iom-sas, Cmplx #0:
                                |   Total   | Allocated |    Free
  ------------------------------+-----------+-----------+------------
       SAP Ingress QoS Policies |        255|          1|        254
        SAP Egress QoS Policies |        255|          1|        254
           Network QoS Policies |         32|          1|         31
     Network Queue QoS Policies |         32|          1|         31
                 Ingress Queues |        400|          2|        398
                  Egress Queues |        400|          2|        398
            WRED Slope Profiles |        255|          1|        254
                 Ingress Meters |        511|          0|        511
              Ingress CAM Entries |          0|          0|          0
        Port Scheduler Policies |          0|          0|          0
                Remark Policies |         63|          1|         62
   Dot1p Classification policies |         63|          1|         62
    Dscp Classification policies |         31|          0|         31
      Ingress Shared ACL Entries |        510|          0|        510
         Ingress Mac ACL Entries |           |          0|
        Ingress IPv4 ACL Entries |           |          0|
    Ing IPv6 128 bit ACL Entries |           |          0|
     Ing IPv6 64 bit ACL Entries |           |          0|
       Egress Shared ACL Entries |       1020|        128|        892
Egress ETH-CFM PVLAN ACL Entries |           |        128|
          Egress Mac ACL Entries |           |          0|
         Egress IPv4 ACL Entries |           |          0|
    Egr IPv6 128 bit ACL Entries |           |          0|
     Egr IPv6 64 bit ACL Entries |           |          0|
      Ingress Shared QoS Entries |          0|          0|          0
         Ingress Mac QoS Entries |           |          0|
        Ingress IPv4 QoS Entries |           |          0|
```


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```
    Ing IPv6 128 bit QoS Entries |           |          0|
     Ing IPv6 64 bit QoS Entries |           |          0|
      Ingress SAP Lookup Entries |         8|          0|         8
Num VLAN-ID/Range in Con Profile |      4096|          0|      4096
        Egress TLS Mcast Entries |    147455|          1|    147454

*A:Dut-A>tools>dump#
```

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#
```

3.9.2.1.3 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

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays internal service statistics.

Parameters

clear

Clears the statistics.

dpipe

Syntax

dpipe *service-id*

Context

tools>dump>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays debug information for specified service.

Parameters

service-id

Specifies the service ID.

dtls

Syntax

dtls *service-id*

Context

tools>dump>service

Platforms

Supported on all 7210 SAS platforms as described in this document

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.

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

Description

This command displays L2pt diagnostics.

Parameters

clear

Clears the diagnostics.

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detail

Displays detailed information.

Output

Sample output

```
A:ALA-48>tools>dump>service# l2pt-diags
[ l2pt/bpdu error diagnostics ]
 Error Name       | Occurrence   | 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       | Occurrence   | 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

Description

This command displays VPLS FDB statistics.

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Parameters

clear

Clears the statistics.

vpls-mfib-stats

Syntax

vpls-mfib-stats [**clear**]

Context

tools>dump>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays VPLS MFIB statistics.

Parameters

clear

Clears the statistics.

3.9.2.1.4 Router commands

router

Syntax

router *router-instance*

Context

tools>dump

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.

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Values

router-name: Base

service-id: 1 to 2147483647

Default Base

dintf

Syntax

dintf [*ip-address*]

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays the internal IP interface details.

This command dumps hardware-specific information related to the active IP interfaces configured. By default, hardware information for all active IP interfaces is dumped.

Default

Dumps hardware-specific information for all the active IP interfaces present within the system.

Parameters

ip-address

Only displays the hardware information associated with the specified IPaddress.

Output

Sample output

```
A:STU# /tools dump router dintf 5.1.1.2
[************ SLOT 1 ****************]
[IP interfaces]
    Table Usage:           5/263
    [L3 SAP interface 1/1/7:360137680]
        Interface index                          54  (Svc)
        cpmtag                                   2
        primary IPv4                             10.1.1.2/24
        VRF                                      0
        primary MAC                              00:14:25:36:f7:f0
        no VRRP MAC addresses
        Local Subnet 0                           10.1.1.2/24  index=62
        admin ip_mtu                             1500
        Intf Port                                1/1/7
```


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```
        No agg port
        uRPF mode                                 None
        Ingress uRPF stats                        Drop=0/0
        [Host IP Map 1 entries]
            [IP Entry v4 10.1.1.1  interface=54 L3 Egress HDL=100003 Ref Cnt=0]
                [Nexthop 10.1.1.1  idx=7]
                    ref count                     1
                    # mpls nhlfes                 0
                    # nexthop groups              1
                    # SDP bindings                0
                    p2mp_arp_index                0
        Subscriber ifIndex                        0
        Subscriber red ifIndex                    0
        [Subscriber Red Group 54]
            Subscriber red ifIndex                0
            Subscriber use SRRP src mac           no
            Use inter-dest Id                     no
            SRRP                                  Disabled
            ref count                             1
            [Inter-dest group 0]
                Locally reachable                 no
                Subscriber red ifIndex            In-use=no
                Subscriber hosts unreachable      no
                cpmtag                            15
            cpmtag                                15
        L3 SAP                                    idx=1 1/1/7:0.*
      SVLAN                                       54
      svlan_interface_index                       54
      Encap Type                                  q-in-q
      HW IF Index                                 1024
      L2 USER ENTRY cindex                        1
      VFP EID                                     181
      L3  BCAST EID                               182
      ARP REPLY EID                               183
      ARP REQST EID                               184
      VFP0 EID                                    185
      L3  BCAST0 EID                              186
      ARP REPLY0 EID                              187
      ARP REQST0 EID                              188
      L3  BCAST IFP                               189
      ARP IFP                                     190
      IP EXT MtcH IFP                             288
      HW Port Number                              17
A:STU#
A:ALA-A#
```

filter-info

Syntax

filter-info [**verbose**]

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

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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 L3 information.

l3-stats

Syntax

l3-stats [**clear**]

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command dumps the hardware-specific L3 statistics.

Parameters

clear

Clears the hardware information of the filter.

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rsvp

Syntax

rsvp

Context

tools>dump>router

Platforms

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

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

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

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

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

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#
```

3.9.2.1.5 Perform 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.

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.

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clear-force

Syntax

clear-force lag-id *lag-id* [**sub-group** *sub-group-id*]

Context

tools>perform>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command clears forced status.

Parameters

lag-id

Specifies the LAG ID.

Values 1 to 800

sub-group-id

Specifies the subscriber group ID.

Values 1 to 16

force

Syntax

force lag-id *lag-id* [**sub-group** *sub-group-id*] {**active** | **standby**}

Context

tools>perform>lag

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command allows forcing the specified LAG, subgroup, all MC-LAGs, or remote peer for MC-LAGs to become active or standby when LAG runs in Active/Standby mode. To remove the forced condition, execute the **tools perform lag clear-force** command.

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Parameters

active

Specifies to become active.

standby

Specifies to become standby.

lag-id

Specifies the LAG ID.

Values 1 to 800

sub-group-id

Specifies the subscriber group ID.

Values 1 to 16

log

Syntax

log

Context

tools>perform

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command configures tools for event logging.

test-event

Syntax

test-event

Context

tools>perform>log

Platforms

Supported on all 7210 SAS platforms as described in this document

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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.

script-control

Syntax

script-control

Context

tools>perform>system

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs script-control operations.

script-policy

Syntax

script-policy

Context

tools>perform>system>script-control

Platforms

Supported on all 7210 SAS platforms as described in this document

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

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command stops the execution of scripts.

Parameters

script-policy-name

Specifies to only stop scripts with the specified policy name.

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.

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.

cron

Syntax

cron

Context

tools>perform>system

Platforms

Supported on all 7210 SAS platforms as described in this document

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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

Description
Commands in this context perform operations for tools that control 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

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

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Description

This command reevaluates the time-of-day state of a site.

Parameters

customer-id

Specifies an existing customer ID.

Values 1 to 2147483647

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

Description

This command reevaluates the time-of-day state of a filter entry.

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*]

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Context

tools>perform>system>cron>tod>re-eval

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command reevaluates the time-of-day state of a SAP.

Parameters

service-id

Specifies existing service ID.

Values 1 to 2147483647

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

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command reevaluates the time-of-day state for the objects associated with a TOD suite.

Parameters

tod-suite-name

Specifies an existing TOD suite name.

eth-ring

Syntax

eth-ring

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Context

tools>perform

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command performs Ethernet ring operations.

clear

Syntax

clear *ring-index*

Context

tools>perform>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command, at the Ethernet Ring Node, is used for the following operations:

1. Clearing an active local administrative command (for example, Forced Switch or Manual Switch).
2. Triggering reversion before the WTR or WTB timer expires in case of revertive operation.
3. Triggering reversion in case of non-revertive operation.

Parameters

ring-index

Specifies the Ethernet ring index to clear.

Values 1 to 128

force

Syntax

force *ring-index* **path** {**1** | **2**}

Context

tools>perform>eth-ring

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Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command forces a block on the ring port where the command is issued.

Parameters

ring-index

Specifies the ring index.

Values 1 to 128

path

Specifies the path.

Values 1, 2

manual

Syntax

manual *ring-index* **path** {**1** | **2**}

Context

tools>perform>eth-ring

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

In the absence of a failure or FS, this command forces a block on the ring port where the command is issued.

Parameters

ring-index

Specifies the ring index.

Values 1 to 128

path

Specifies the path.

Values 1, 2

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3.9.2.2 Tools dump command descriptions for the 7210 SAS-K 2F6C4T and 7210 SAS-K 3SFP+ 8C

accounting-policy

Syntax

accounting-policy *acct-policy-id* **flash-write-count** [**clear**]

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

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

Specifies to dump 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 the statistics.

eth-ring

Syntax

eth-ring *ring-index* [**clear**]

eth-ring control-sap-tag *port-id* [**list-in-use** | **next-available**]

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

This command displays Ethernet-ring information.

Parameters

ring-index

Specifies the ring index.

Values 1 to 128

clear

Clears the statistics.

lag

Syntax

lag lag-id *lag-id*

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays LAG information.

Parameters

lag-id

Specifies an existing LAG id.

Values 1 to 12

Output

Sample output

```
*A:7210 SAS>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
```


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

persistence

Syntax

persistence

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display persistence information for debugging purposes.

summary

Syntax

summary

Context

tools>dump>persistence

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display persistence summary information for debugging purposes.

Output

Sample output

```
*A:7210 SAS>tools>dump# persistence summary
===============================================================
Persistence Summary on Slot A
===============================================================
```


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```
Client             Location            Entries in use    Status
-------------------------------------------------------------------
xxxxxx            cf1:\l2_dhcp.pst    200               ACTIVE
-------------------------------------------------------------------
Persistence Summary on Slot B
===================================================================
Client             Location            Entries in use    Status
-------------------------------------------------------------------
xxxxxx              cf1:\l2_dhcp.pst    200               ACTIVE
-------------------------------------------------------------------
A:7210#
```

service

Syntax

service

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display service information.

id

Syntax

id *service-id*

Context

tools>dump>service

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

Commands in this context display information for a specific service.

Parameters

service-id

Specifies an existing service ID.

Values 1 to 2147483647or a name string up to 64 characters

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sap

Syntax

sap *sap-id* **stats** [**clear**]

Context

tools>dump>service>id

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays SAP information for this service.

Parameters

sap-id

Specifies the SDP binding identifier

Values

null	[*port-id* | *lag-id*]
dot1q	[*port-id* | *lag-id* | *pw-id*]:*qtag1*
qinq	[*port-id* | *lag-id* | *pw-id*]:*qtag1.qtag2*
dot1q	[*port-id* | *lag-id*]:*cp-id*
port-id	*slot/mda/port*
lag-id	lag-*id* lag keyword *id* 1 to 6
pw-id	pw-*id* pw keyword *id* 1 to 10239
cp-id	cp-*id* cp keyword *id* 1 to 1000
qtag1	*, 0 to 4094
qtag2	*, 0 to 4094

clear

Clears the statistics.

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stats

Displays statistics associated with this SAP.

Output

The following output is an example of the discard statistics, and Table 44: Output fields: discard statistics describes the fields.

Sample output

```
A:7210# tools dump service id 200 sap 1/X3/6:100 stats
=============================================================
Service Id 200 SAP 1/X3/6:100 VPLS Ingress Debug Stats
=============================================================
total number of discarded packets                    | 1
total number of discarded bytes                      | 996
number of discards due to source suppression         | 0
number of discards due to split horizon              | 0
number of discards due to mesh to mesh               | n/a
number of discards due to unknown DA                 | 0
number of discards due to unknown SA                 | 0
number of discards due to service MTU                | 0
number of discards due to STP not in fwding state    | 1
number of other discards                             | 0
=============================================================
Service Id 200 SAP 1/X3/6:100 VPLS Egress Debug Stats
=============================================================
total number of discarded packets                    | 0
number of unicast discards due to pool exhaustion    | 0
number of multicast discards due to pool exhaustion  | 0
number of unicast discards due to queue overflow     | 0
number of multicast discards due to queue overflow   | 0
number of other discards                             | 0
```

Table 44: Output fields: discard statistics

Label	Description
total number of discarded packets	The total number of discarded ingress or egress packets for the specified SAP or SDP binding
total number of discarded bytes	The total number of discarded ingress bytes for the specified SAP or SDP binding
number of discards due to source suppression	The total number of ingress discards due to source suppression for the specified SAP or SDP binding
number of discards due to split horizon	The total number of ingress discards due to split horizon for the specified SAP or SDP binding
number of discards due to mesh to mesh	The total number of ingress discards due to mesh-to-mesh forwarding for the specified mesh SDP
number of discards due to unknown DA	The total number of ingress discards due to an unknown destination address for the specified SAP or SDP binding

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Label	Description
number of discards due to unknown SA	The total number of ingress discards due to an unknown source address for the specified SAP or SDP binding
number of discards due to service MTU	The total number of ingress discards due to the packet size exceeding the configured maximum transmission unit for the specified SAP or SDP binding
number of discards due to STP not in fwding state	The total number of ingress discards due to an inactive VPLS endpoint determined by the Spanning Tree Protocol for the specified SAP
number of other discards	The total number of ingress or egress discards that do not match a listed category
number of unicast discards due to pool exhaustion	The total number of egress unicast discards due to pool exhaustion for the specified SAP or SDP binding
number of multicast discards due to pool exhaustion	The total number of egress multicast discards due to pool exhaustion for the specified SAP or SDP binding
number of unicast discards due to queue overflow	The total number of egress unicast discards due to queue overflow for the specified SAP or SDP binding
number of multicast discards due to queue overflow	The total number of egress multicast discards due to queue overflow for the specified SAP or SDP binding

sdp

Syntax

sap *sdpid*[**:***vc-id*] **stats** [**clear**]

Context

tools>dump>service>id

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays SDP bind information for this service.

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Parameters

sdp-id

Specifies the SDP binding identifier.

Values 1 to 17407

vc-id

Specifies the virtual circuit identifier.

Values 1 to 4294967295

clear

Clears the statistics.

stats

Displays statistics associated with this SDP.

3.9.2.3 Dump router commands

router

Syntax

router *router-instance*

router service-name *service-name*

Context

tools>dump

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command enables tools for the router instance.

Parameters

router-instance

specifies the router name and service ID

Values *router-name*: Base, management

service-id: 1 to 2147483647

Default Base

service-name

Specifies the service name.

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fib

Syntax

fib *slot-number* [**ipv4** | **ipv6**] **summary**

Context

tools>dump>router

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information for the FIB.

Parameters

slot-number

Specifies the slot number, always "1".

ipv4 | ipv6

Specifies the IP family.

summary

Displays summary information.

ospf

Syntax

ospf

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.

ospf3

Syntax

ospf

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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 OSPFv3.

abr

Syntax

abr [**detail**]

Context

tools>dump>router>ospf

tools>dump>router>ospf3

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

tools>dump>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

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Description

This command displays autonomous system boundary router (ASBR) information for OSPF.

Parameters

detail

Displays detailed information about the ASBR.

bad-packet

Syntax

bad-packet *interface-name*

Context

tools>dump>router>ospf

tools>dump>router>ospf3

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

tools>dump>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays information about leaked routes for OSPF.

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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**]

Context

tools>dump>router>ospf

tools>dump>router>ospf3

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**]

request-list [**detail**]

request-list neighbor [*interface-name*] [*router-id*] [**detail**]

request-list virtual-neighbor *router-id* **transit-area** *transit-area* [**detail**]

Context

tools>dump>router>ospf

tools>dump>router>ospf3

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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*

Displays OSPF neighbor information only for the neighbor identified by the IP address.

neighbor *interface-name*

Displays OSPFv3 neighbor information only for the neighbor identified by the IP interface name.

detail

Displays detailed information about the neighbor or virtual neighbor.

virtual-neighbor *ip-address*

Displays OSPF information about the virtual neighbor identified by the IP address.

virtual-neighbor *router-id*

Displays OSPFv3 information about the virtual neighbor identified by the IP router identifier.

area-id *area-id*

Displays OSPF information about the area identified by the area ID, expressed in dotted-decimal notation or as a 32-bit decimal integer.

transit-area *transit-area*

Displays OSPFv3 information about the transit area identified by the router ID, expressed in dotted-decimal notation or as a 32-bit decimal integer.

retransmission-list

Syntax

retransmission-list [**neighbor** *ip-address*] [**detail**]

retransmission-list virtual-neighbor *ip-address* **area-id** *area-id* [**detail**]

retransmission-list [**detail**]

retransmission-list neighbor [*ip-int-name*] [*router-id*] [**detail**]

retransmission-list virtual-neighbor *router-id* **transit-area** *transit-area* [**detail**]

Context

tools>dump>router>ospf

tools>dump>router>ospf3

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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*

Displays OSPF neighbor information only for the neighbor identified by the IP address.

neighbor *ip-int-name*

Displays OSPFv3 neighbor information only for the neighbor identified by the IP interface name.

detail

Displays detailed information about the neighbor or virtual neighbor.

virtual-neighbor *ip-address*

Displays OSPF information about the virtual neighbor identified by the IP address.

virtual-neighbor *router-id*

Displays OSPFv3 information about the virtual neighbor identified by the router identifier.

area-id *area-id*

Displays the OSPF information about the area ID, expressed in dotted-decimal notation or as a 32-bit decimal integer.

transit-area *transit-area*

Displays the OSPFv3 information about the transit area ID, expressed in dotted-decimal notation or as a 32-bit decimal integer.

route-summary

Syntax

route-summary

Context

tools>dump>router>ospf

tools>dump>router>ospf3

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**] [**alternative**]

route-table [*ipv6-prefix/prefix-length*] [*type*] [**detail**] [**alternative**]

Context

tools>dump>router>ospf

tools>dump>router>ospf3

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays dump information about routes learned through OSPF.

Parameters

ip-prefix/mask

Specifies the IPv4 prefix and mask for routes learned through OSPF.

Values *ip-prefix* a.b.c.d (host bits must be 0)
mask 0 to 32

ipv6-prefix/prefix-length

the IPv6 prefix and prefix length for routes learned through OSPFv3

Values *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..FFFF]H
d: [0..255]D
prefix-length 0 to 128

type

Specifies the type of route table to display information about.

Values intra-area, inter-area, external-1, external-2, nssa-1, nssa-2

detail

Displays detailed information about learned routes.

alternative

Displays LFA details.

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static-route

Syntax

static-route

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 static routes.

ldp-sync-status

Syntax

ldp-sync-status

Context

tools>dump>router>static-route

Platforms

Supported on all 7210 SAS platforms as described in this document

Description

This command displays the status of the LDP synchronization timers for static routes.

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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 following table shows the formats in which the SAP ID can be configured.

Table 45: 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"

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Type	Syntax	Example
		lag-*id*:*qtag1*.*qtag2* — "lag-10:100.10"

4.1.2 Port syntax

port

Syntax

port *port-id*

Context

(multiple)

Description

This command specifies a port identifier.

Parameters

port-id

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

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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.

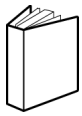
RFC 4762, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling is supported on K12, K30, T(N), Mxp, Sx/S-1/10GE, Sx-10/100GE, Sx/S-1/10GE-VC, R6, and R12

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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