



7705 Service Aggregation Router

Release 26.10.R1

OAM and Diagnostics Guide

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1 Preface

This guide describes operations, administration, and maintenance (OAM) and diagnostic tools provided by the 7705 SAR and presents examples to configure and implement various tests.

This document is organized into functional chapters and provides concepts and descriptions of the implementation flow, as well as Command Line Interface (CLI) syntax and command usage.



Note: This manual generically covers Release 26.x content and may contain some content that will be released in later maintenance loads. See the 7705 SAR 26.x.Rx Software Release Notes, part number 3HE24971000xTQZZA, for information about features supported in each load of the Release 26.x software.



Note: As of Release 23.4, software support for the following hardware has been deprecated:

- 8-port Ethernet Adapter card, version 2 (a8-ethv2) (3HE02776)
- 12-port Serial Data Interface card, version 1 (a12-sdi) (3HE03391)
- 7705 SAR-W (3HE07349)

These components are no longer recognized in the release.

If information about any of the above components is required, please see the applicable installation guides in Release 22.10.

1.1 Audience

This guide is intended for network administrators who are responsible for configuring the 7705 SAR routers. It is assumed that the network administrators have an understanding of networking principles and configurations. Concepts described in this guide include the following:

- CLI concepts
- operations, administration, and maintenance (OAM) operations

1.2 Technical support

If you purchased a service agreement for your 7705 SAR router and related products from a distributor or authorized reseller, contact the technical support staff for that distributor or reseller for assistance. If you purchased a Nokia service agreement, follow this link to contact a Nokia support representative and to access product manuals and documentation updates:

[Product Support Portal](#)

2 7705 SAR OAM configuration process

The following table lists the tasks that are required to perform operations, administration, and maintenance (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.

Table 1: Configuration process

Area	Task/description	Reference
Diagnostics/service verification	Run OAM and SAA diagnostics	OAM and SAA
	Configure mirroring parameters	Mirroring
	Run diagnostics tools	Tools
Reference	List of security and telecom standards, supported protocols, and proprietary MIBs	Supported standards and protocols

3 OAM and SAA

This chapter provides information about the operations, administration, and maintenance (OAM) and service assurance agent (SAA) commands available in the CLI for troubleshooting services.

Topics in this chapter include:

- [OAM overview](#)
- [OAM Performance Monitoring](#)
- [Service assurance agent overview](#)
- [Configuring SAA test parameters](#)
- [Synthetic loss measurement \(SLM\)](#)
- [OAM timestamping](#)
- [OAM and SAA command reference](#)

3.1 OAM overview

Delivery of services requires that a number of operations occur properly and at different levels in the service delivery model. For example, operations—such as the association of packets to a service, VC labels to a service, and each service to a service tunnel—must be performed properly in the forwarding plane for the service to function properly. In order to verify that a service is operational, a set of in-band, packet-based OAM tools is provided, with the ability to test each of the individual packet operations.

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

The suite of OAM diagnostics supplements the basic IP ping and traceroute operations with diagnostics specialized for the different levels in the service delivery model. In addition, there are diagnostics for MPLS LSPs, SDPs, and Services within a service.

This section describes the following topics:

- [ICMP and ICMPv6 diagnostics](#)
- [IP performance monitoring](#)
- [LSP diagnostics](#)
- [MPLS OAM support in segment routing](#)
- [SDP diagnostics](#)
- [Service diagnostics](#)
- [VLL diagnostics](#)
- [ITU-T Y.1564 diagnostics](#)
- [VPLS MAC diagnostics](#)
- [Ethernet OAM capabilities](#)

- [Ethernet loopbacks](#)
- [OAM propagation to attachment circuits](#)
- [LDP status signaling](#)
- [IP multicast debugging tools](#)
- [Microwave awareness performance monitoring statistics](#)

3.1.1 ICMP and ICMPv6 diagnostics

Internet Control Message Protocol (ICMP) is part of the IP suite as defined in RFC 792, *Internet Control Message Protocol*, for IPv4 and RFC 4443, *Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*.

ICMP and ICMPv6 send and receive control and error messages used to manage the behavior of the TCP/IP stack. ICMP and ICMPv6 provide:

- debugging tools and error reporting mechanisms to assist in troubleshooting an IP network
- the ability to send and receive error and control messages to far-end IP entities

3.1.1.1 Ping

Ping is used to determine if there is IP layer connectivity between the 7705 SAR and another node in the network.

The 7705 SAR supports redirection of SGT to egress data queues instead of the default control queue. To redirect ping to a data queue, the **ping** command includes the **fc-queue** option, which specifies the queue to be used for servicing the ping packets in the egress direction. All other SGT applications are redirected using the **config>router>sgt-qos>application>fc-queue** or **config>service>vpn>sgt-qos>application>fc-queue** command. For more information about SGT redirection, see the 7705 SAR Quality of Service Guide, "SGT Redirection".

3.1.1.2 Traceroute

Traceroute is used to determine the path that an IP packet takes from the 7705 SAR to a specified router.

3.1.2 IP performance monitoring

The 7705 SAR supports IP performance measuring with Two-Way Active Measurement Protocol (TWAMP), Two-Way Active Measurement Protocol Light (TWAMP Light), and Simple Two-Way Active Measurement Protocol (STAMP)

3.1.2.1 Two-way active measurement protocol

The two-way active measurement protocol (TWAMP) provides a standards-based method to measure the round-trip performance (including the packet loss, delay, and jitter) of IP packets that are transmitted between two devices. TWAMP, which is described in RFC 5357, uses the methodology and architecture of the one-way active measurement protocol (OWAMP) to assess the two-way transmission of IP packets.

TWAMP offers advantages for performance monitoring at Layer 3/IP because it provides functions that other performance monitoring methods, such as ICMP, lack:

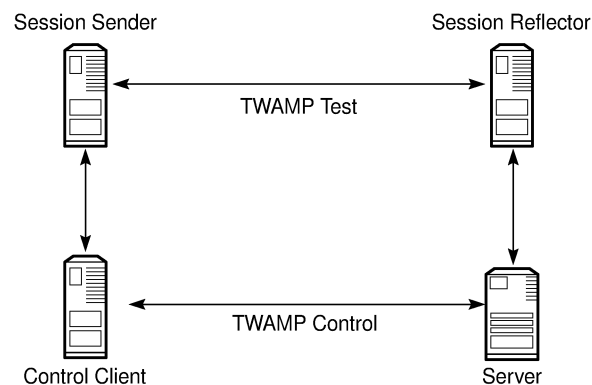
- timestamping for delay and jitter measurements
- high-accuracy timestamping at Tx and Rx on 7705 SAR nodes for error-free results
- intelligent control plane

There are four logical entities in TWAMP:

- control client – initiates the TWAMP control session and negotiates the security protocols to be used and the tests to be performed with the server
- server – negotiates with the control client request to establish the control session
- session sender – transmits test packets to the session reflector
- session reflector – transmits a packet to the session sender in response to each packet it receives

The TWAMP control and data (test) protocol operate on separate planes, as shown in the following figure. The TWAMP control protocol initiates test sessions and starts and stops the tests. The TWAMP test protocol exchanges test packets between TWAMP entities.

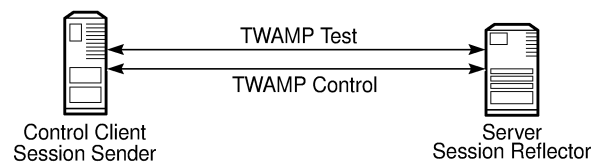
Figure 1: TWAMP logical entities (RFC 5357)



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The control client and session sender are typically implemented in one physical device (also known as the client device) and the server and session reflector are typically implemented in a second physical device (also known as the server device), as shown in the following figure.

Figure 2: Typical TWAMP implementation



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The control client and server establish a TCP connection and exchange TWAMP control messages over the connection. To start the test, the client communicates the test parameters to the server. If the server agrees to conduct the test, 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. The session

reflector responds to each received packet with a UDP-based packet response. 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.

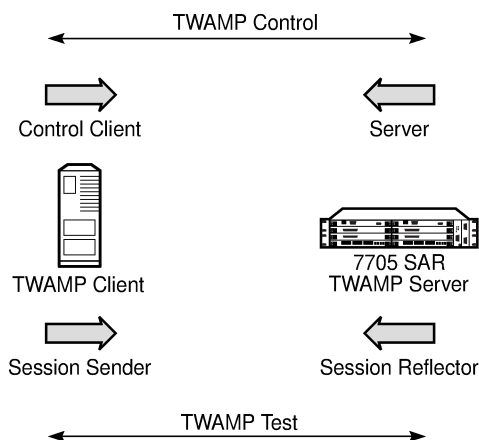
The following ports are assigned for the TWAMP control protocol, as defined in RFC 5357:

- 862/tcp
- 862/udp

3.1.2.1.1 7705 SAR support for TWAMP server

The 7705 SAR supports the TWAMP server and the session reflector functions, as shown in the following figure.

Figure 3: 7705 SAR as TWAMP server and session reflector



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The 7705 SAR plays a passive role: the TWAMP control client initiates the control session with the 7705 SAR in order to negotiate the following:

- the tests to be executed
- the security protocol to be used
- the port to be used

The 7705 SAR responds, and when the negotiation is complete, the 7705 SAR performs the following:

- timestamps the TWAMP packets upon reception
- processes the TWAMP packets and generates a response
- timestamps the packets again before transmitting the response packets

TWAMP is supported on all IPv4 interfaces and on the base router of any interface address, including the system and loopback IP addresses. Any IP address can be used to terminate TWAMP control and test packets.

Datapath timestamping in both ingress and egress directions for TWAMP frames is supported on all datapath Ethernet ports on the following adapter cards, modules, and standalone nodes:

- adapter cards

- 2-port 10GigE (Ethernet) Adapter card
- 6-port Ethernet 10Gbps Adapter card (high accuracy when using IEEE 1588v2 PTP time source)
- 8-port Gigabit Ethernet Adapter card (high accuracy when using IEEE 1588v2 PTP time source)
- 10-port 1GigE/1-port 10GigE X-Adapter card (high accuracy when using IEEE 1588v2 PTP time source)
- Packet Microwave Adapter card (high accuracy when using IEEE 1588v2 PTP time source)
- modules
 - 2-port 10GigE (Ethernet) module
 - 4-port SAR-H Fast Ethernet module
 - 6-port SAR-M Ethernet module
- standalone nodes
 - 7705 SAR-A (high accuracy when using IEEE 1588v2 PTP time source)
 - 7705 SAR-Ax (high accuracy when using IEEE 1588v2 PTP time source)
 - 7705 SAR-H (high accuracy when using IEEE 1588v2 PTP time source)
 - 7705 SAR-Hc (high accuracy when using IEEE 1588v2 PTP time source)
 - 7705 SAR-M (high accuracy when using IEEE 1588v2 PTP time source)
 - 7705 SAR-Wx (high accuracy when using IEEE 1588v2 PTP time source)
 - 7705 SAR-X (high accuracy when using IEEE 1588v2 PTP time source)



Note: A 7705 SAR node using GNSS or IEEE 1588v2 PTP for time of day/phase recovery can perform high-accuracy timestamping for TWAMP packets. See the 7705 SAR Basic System Configuration Guide for information about node timing sources.

CSM-based egress timestamping for TWAMP is supported on:

- all TDM cards
 - 2-port OC3/STM1 Channelized Adapter card
 - 4-port DS3/E3 Adapter card
 - 4-port OC3/STM1 Clear Channel Adapter card
 - 16-port T1/E1 ASAP Adapter card
 - 32-port T1/E1 ASAP Adapter card
- Ethernet ports bound to a routed VPLS interface, where the frames are processed via the VPLS instance before reaching the IP interface

For information about how to configure the TWAMP server and the TWAMP command hierarchy, see the OAM commands for [TWAMP](#).

The 7705 SAR supports a **show>test-oam>twamp>server** command that displays information about the TWAMP server configuration and statistics, and the clients associated with each server address prefix. See the [Show commands](#) for more information. The 7705 SAR also supports a dump command that displays statistics for dropped connections, dropped connection states, rejected sessions, and dropped test packets. See [Dump test OAM commands](#) for more information.

3.1.2.1.1 Interactions with Ethernet loopback

Ethernet line loopbacks, being the lower layer functionality, take precedence over TWAMP operations. If an Ethernet port loopback is enabled, all frames including TWAMP frames are looped back. TWAMP frames cannot be processed on the interface until the loopback is released.

3.1.2.1.2 Limitations

The following limitations apply:

- only the unauthenticated mode of TWAMP is supported. Authenticated and encrypted modes are excluded.
- TWAMP does not support redundant HA configurations. During a CSM activity switch, all TWAMP control sessions are dropped and all tests that are in progress are terminated.

3.1.2.2 TWAMP Light and STAMP

TWAMP Light is an optional model included in the TWAMP standard RFC 5357, *A Two-Way Active Measurement Protocol (TWAMP)*. TWAMP Light uses the standard TWAMP packet format but provides a simpler approach to gathering ongoing IP delay and synthetic loss performance data for the base router and per-VRPN statistics. Full details are described in Appendix I of RFC 5357. Following community acceptance of TWAMP Light, the IETF published RFC 7862, *Simple Two-way Active Measurement Protocol (STAMP)*, which expands and formalizes the protocol. The STAMP standard defined by RFC 8762 is backward compatible with RFC 5357 Appendix I. Unless specified otherwise, the information that refers to TWAMP light also applies to STAMP.

With TWAMP Light, the TWAMP client/server model is replaced with a session controller/responder model. The server, control-client and session-sender role is combined in one host called the controller, and the session-reflector role is in another host called the responder. In general terms, the session controller is the launch point for the TWAMP test packets and the responder reflects the packets.

TWAMP Light maintains the TWAMP test packet exchange but eliminates the TWAMP TCP control connection with local configurations; however, not all negotiated control parameters are replaced with local configurations. The DSCP value in an incoming TWAMP test packet is reflected back to the originator. The incoming TWAMP test packet is classified to a specific FC based on the ingress QoS policy and the dot1p in the reflected packet is determined by the FC to dot1p mapping in the egress QoS policy.

The test PDU format was derived from TWAMP Light based on RFC 5357, section "Informational Appendix I". As TWAMP Light gained community support and large deployment, it became in effect the standard for IP performance measurement. Following community acceptance, the IETF published RFC 7862, *Simple Two-way Active Measurement Protocol (STAMP)*.

The reflector 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-VRPN 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 to define the prefixes that the reflector will accept as valid sources for a TWAMP Light request.

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. Configured prefixes can be modified without shutting down the reflector function. An inactivity

timeout under the **config>test-oam>twamp>twamp-light** command hierarchy defines the amount of time the reflector will keep the individual reflector sessions active in the absence of test packets.

TWAMP uses a single packet to gather both delay and loss metrics. This means there is special consideration over those approaches that use a specific tool per metric type.

TWAMP Light is supported for deployments that use IPv4 or IPv6 addressing, which may each have their own hardware requirements. All IP addressing must be unicast. IPv6 addresses cannot be reserved or link local addresses. Multiple test sessions may be configured between the same source and destination IP endpoints. The 4-tuple lookup (source IP, destination IP, source UDP, destination UDP) provides a unique index for each test point.



Note: A 7705 SAR node using GNSS or IEEE 1588v2 PTP for time of day/phase recovery can perform high-accuracy timestamping for TWAMP Light packets.

3.1.2.2.1 7705 SAR support for TWAMP Light responder

TWAMP Light is supported on the same hardware as TWAMP. See [7705 SAR support for TWAMP server](#).

For information about how to configure the TWAMP Light reflector see the OAM commands for [TWAMP Light](#).

3.1.2.2.2 Interactions with Ethernet loopback

Ethernet line loopbacks, being the lower layer functionality, take precedence over TWAMP Light operations. If an Ethernet port loopback is enabled, all frames are looped back. Frames cannot be processed on the interface until the loopback is released.

3.1.2.2.3 Limitations

The 7705 SAR supports only the unauthenticated mode of TWAMP.

3.1.2.2.4 TWAMP Light configuration example

The following example shows a basic configuration using TWAMP Light to monitor two IP endpoints in a VPRN, including the default TWAMP Light values that were not overridden with configuration entries.

```
config>test-oam>twamp>twamp-light# info detail
-----
(default)      inactivity-timeout 100
-----
config>service>vprn# info
-----
route-distinguisher 65535:500
auto-bind-tunnel
resolution-filter
  ldp
exit
resolution filter
exit
vrf-target target:65535:5000
interface "to-cpe31" create
address 10.1.1.1/30
```

```

        sap 1/1/2:500 create
        exit
    exit
    static-route-entry 192.168.1.0/24
        next-hop 10.1.1.2
        no shutdown
    exit
    exit
    bgp
        no shutdown
    exit
    twamp-light
        reflector udp-port 64364 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
-----

```

3.1.3 LSP diagnostics

The 7705 SAR LSP diagnostics are implementations of LSP ping and LSP traceroute based on RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*. LSP ping and LSP traceroute are modeled after the ICMP echo request/reply used by ping and traceroute to detect and localize faults in IP networks.

The downstream mapping TLV is used in LSP ping and LSP trace to allow the sender and responder nodes to exchange and validate interface and label stack information for each downstream hop of an LDP FEC, an RSVP LSP, a BGP labeled IPv4 route, an SR-ISIS node SID, or an SR-OSPF node SID. The 7705 SAR supports two downstream mapping TLVs: the original Downstream Mapping (DSMAP) TLV defined in RFC 4379 and the Downstream Detailed Mapping (DDMAP) TLV defined in RFC 6424.

This section describes the following topics:

- [LSP ping](#)
- [LSP traceroute](#)
- [LSP ping and LSP traceroute for BGP route tunnels](#)
- [Downstream detailed mapping TLV](#)

3.1.3.1 LSP ping

LSP ping, as described in RFC 4379, provides a mechanism to detect data plane failures in MPLS LSPs. For a specified FEC, LSP ping verifies whether the packet reaches the egress label edge router (eLER).

A 7705 SAR node using GNSS or IEEE 1588v2 PTP for time of day/phase recovery can perform LSP ping tests with high-accuracy timestamping. See the 7705 SAR Basic System Configuration Guide, "Node Timing", for information about node timing sources.

3.1.3.2 LSP traceroute

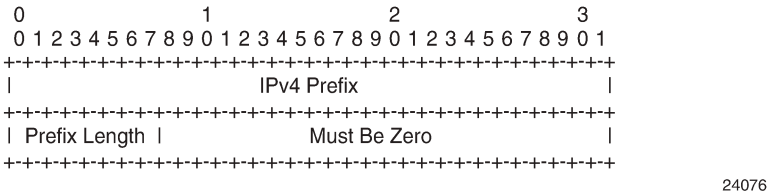
LSP traceroute sends a packet to each transit LSR along a communications path until the far-end router is reached. The path is traced one LSR at a time, where each LSR that receives a traceroute packet replies to the initiating 7705 SAR with a packet that identifies itself. When the final LSR is identified, the initiating LSR has a list of all LSRs on the path. Like IP traceroute, LSP traceroute is a hop-by-hop operation (that is, LSR by LSR).

Use LSP traceroute to determine the exact litigation of LSP failures.

3.1.3.3 LSP ping and LSP traceroute for BGP route tunnels

LSP ping and LSP traceroute are supported on BGP route tunnels using existing LSP ping and traceroute commands with the **bgp-label prefix** option. The system uses the DSMAP TLV target FEC stack TLV for BGP-labeled IPv4 /32 prefix as defined in RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*. The following figure shows the new TLV structure.

Figure 4: Target FEC stack TLV for BGP labeled IPv4 prefix



The following process is used when sending or responding to an LSP ping or LSP traceroute packet on BGP route tunnels.

1. The next hop of a BGP labeled route for a core IPv4 /32 prefix is always resolved to an LDP FEC or an RSVP-TE LSP. The transmitting node encapsulates the packet containing the echo request message with a label stack that consists of the LDP/RSVP-TE outer label and the BGP inner label.
2. If the packet expires on an RSVP-TE or LDP LSR node that does not have context for the BGP labeled IPv4 /32 prefix, the system must validate the outer label in the stack, and if the validation is successful, it must reply with return code 8 <Label switched at stack-depth <RSC>>.
3. An LSR node that is the next hop for the BGP labeled IPv4 /32 prefix, as well as the LER node that originated the BGP labeled IPv4 prefix, have full context for the BGP IPv4 target FEC stack and can therefore perform full validation of it.

 **Note:** The 7705 SAR supports only BGP labeled IPv4 /32 prefixes in LSP ping and LSP trace.

For more information about BGP route tunnels, see the 7705 SAR Routing Protocols Guide, "BGP Route Tunnels".

3.1.3.3.1 TC handling on BGP route tunnels

A 7705 SAR that process BGP 3107 labels always re-marks the TC bits. Ingress classification is based on the received TC/DSCP bits to FC. Egress re-marking is based on the QoS queue policy.

A 7705 SAR that does not process labels on a BGP route tunnel such as a 7705 SAR acting as an LSR, does not re-mark the TC bits.

3.1.3.3.2 BGP route tunnel traceroute

Labeled BGP route tunnels pose a challenge to traceroute capability because there are two labels used in the transport layer: an inner BGP label identifying the far-end node and the regular label identifying the next hop for that far end.

Traceroute and TTL monitoring on the 7705 SAR have been enhanced to be able to identify and report every PE, ABR, ASBR, and P node along the path of a Layer 2 or Layer 3 service built partially or wholly over labeled BGP route tunnels.

Both the MPLS tunnel TTL and the labeled BGP route tunnel TTL are monitored for TTL expiry, which causes an ICMP TTL expired message to be sourced. Depending on the role of the intermediate nodes along the path, monitoring both TTL values is the most comprehensive way to ensure correct TTL handling.

3.1.3.3.3 Traceroute TTL for self-generated traffic

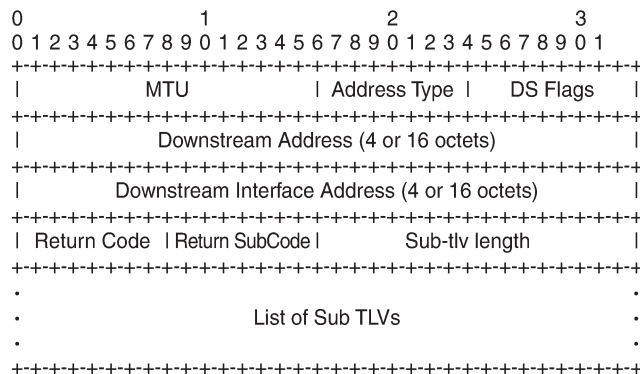
Depending on how the network is built on elements in the topology, a node along the path might be operating based on the outer MPLS tunnel label or the inner BGP label. In order to ensure that all the nodes along the path are displayed correctly, the 7705 SAR sets the TTL of the outer MPLS transport tunnel and the inner labeled BGP route tunnel to identical values. The next node is therefore identified and displayed correctly in a traceroute regardless of which label it is operating on.

For a self-generated traffic traceroute, both the MPLS and the labeled BGP TTLs are set to 1 in order to identify the first node. At the next hop, both TTL values are incremented to 2. This pattern continues at each hop in the path.

3.1.3.4 Downstream detailed mapping TLV

The DDMAP TLV, as defined in RFC 6424, provides users with the same features as the existing DSMAP TLV along with enhancements that allow LSP diagnostics to trace the details of LSP hierarchy. With the DDMAP TLV, all intermediate routers will appear in the LSP ping and traceroute lists, and intermediate nodes can append additional data with details about their relative functionality. The DDMAP TLV format is derived from the DSMAP TLV format with variable length and optional fields converted into sub-TLVs. The following figure shows the DDMAP TLV format.

Figure 5: DDMAP TLV



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The following process is used when sending or responding to an LSP ping or LSP traceroute packet using the DSMAP or 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 DSMAP or DDMAP TLV expires at a node that is not the egress for the target FEC stack, the responder node always includes the DSMAP TLV in the echo reply message. This can occur in the following cases:
 - a. The user issues an LSP trace from a sender node with a **min-ttl** value higher than 1 and a **max-ttl** value lower than the number of hops required 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 an LSP ping from a sender node with a TTL value lower than the number of hops required 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. If the global configuration or the per-test setting of the DSMAP TLV is set to DDMAP, the sender node includes 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.

The user can globally configure the downstream mapping TLV to be used for all LSP trace and LDP tree-trace packets with the **configure test-oam mpls-echo-request-downstream-map** command. The configured global value becomes the default downstream mapping TLV for all newly created LSP trace and LDP tree-trace tests. It has no effect on existing tests and can be overridden on a specific test by setting the **downstream-map-tlv** parameter in the **lsp-trace** or **ldp-tree-trace** context.

3.1.3.4.1 Using the DDMAP TLV in LSP stitching and LSP hierarchy

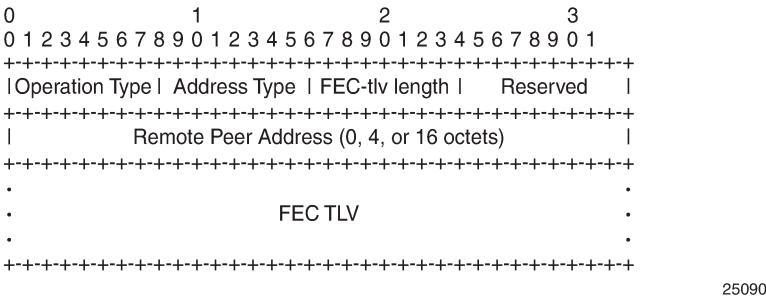
The DDMAP TLV provides full validation for a BGP IPv4 label route tunneled over an RSVP LSP or an LDP FEC.



Note: The 7705 SAR does not support LSP stitching.

In order to properly check a target FEC that is stitched to another FEC (stitching FEC) of the same or a different type, or that is tunneled over another FEC (tunneling FEC), it is necessary for the responding nodes to provide details about the FEC manipulation to the sender node. The system collects this detailed information with the DDMAP TLV FEC stack change sub-TLV, shown in the following figure. The field definitions match those of the DSMAP TLV and are described in RFC 4379.

Figure 6: FEC stack change sub-TLV



The operation type specifies the action associated with the FEC stack change. The following table defines the operation types for the FEC stack change sub-TLV.

Table 2: FEC stack change sub-TLV operation types

Type #	Operation
1	Push
2	Pop

When DDMAP TLV is configured on an LSP trace 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.

When DDMAP TLV is configured on an LSP trace that does undergo stitching or tunneling operation in the network, there are changes to the target FEC stack validation procedures at the sender and responder nodes. The following procedure represent a superset of the rules described in Section 4 of RFC 6424 to allow greater scope of interoperability with other vendor implementations.

Responder node procedures:

1. As a responder node, the 7705 SAR always inserts the global return code, **3 Replying router is an egress for the FEC at stack-depth <RSC>** or the code, **14 See DDMAP TLV for Return Code and Return Subcode**.
2. When the responder node inserts a global return code of 3, it does not include a DDMAP TLV.
3. When the responder node includes the DDMAP TLV, it inserts the global return code, **14 See DDMAP TLV for Return Code and Return Subcode**. Additionally, the responder node will:
 - a. on a success response, include a return code of 15 in the DDMAP TLV for each downstream hop that has a FEC stack change sub-TLV

- b. on a success response, include a return code, **8 Label switched at stackdepth <RSC>** in the DDMAP TLV for each downstream hop 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 hop
- 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. The echo reply message will include two or more FEC stack change sub-TLVs in the DDMAP TLV. It also includes 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.

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 explained in step 5. The responder node performs the same operation 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.

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. This results in one FEC being popped at most and one or more FECs being 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 7705 SAR 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.

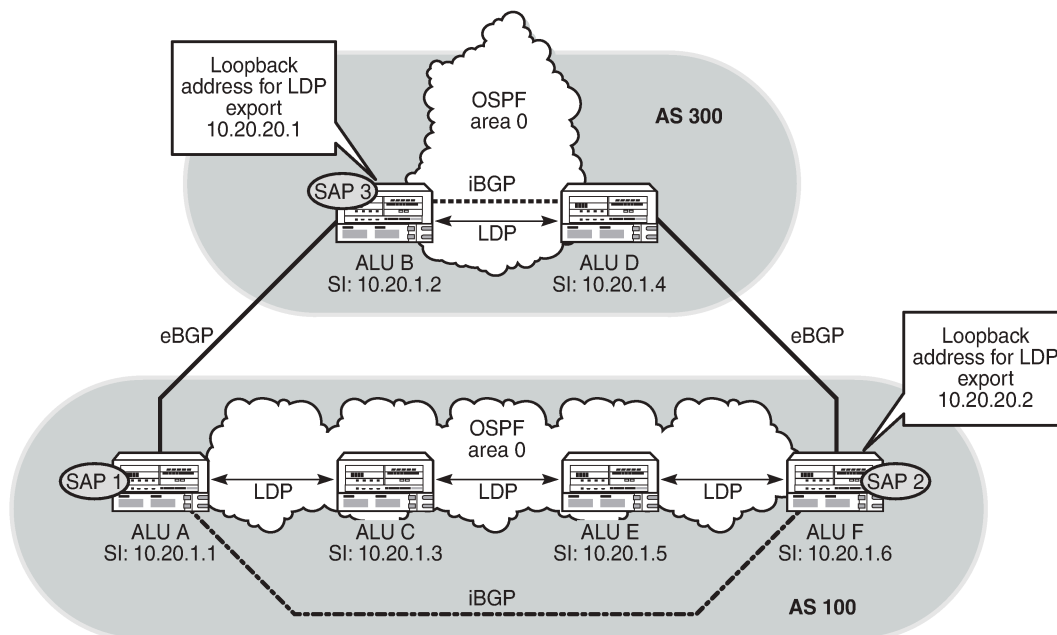
This step continues iteratively until the value for the label stack depth specified in the Return Sub Code (RSC) field is the same as the depth of current target FEC Stack TLV, at which point step a is

performed. A 7705 SAR responder node causes this case to occur as per Step 6 of the responder node procedures.

- c. If a DDMAP TLV with or without a FEC stack change sub-TLV is included, then the sender node ignores it and processing is performed as per steps (a) or (b) above. A 7705 SAR responder node does not cause this case to occur but a third party implementation may.
3. As a sender node, the 7705 SAR 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 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 the responder node, which is the egress node, still replies with return **code 4 Replying router has no mapping for the FEC at stack- depth <RSC>**. This case cannot be resolved with this feature.

The following figure and the following LSP trace examples illustrate how the 7705 SAR provides validation for a BGP IPv4 label route tunneled over an RSVP LSP or an LDP FEC.

Figure 7: BGP 3107 tunnel through LDP FEC



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LSP trace launched from ALU-A (AS 100) to ALU-D (AS 300) with the DDMAP option:

```
ALU-A# oam lsp-trace bgp-label prefix 10.20.1.4/32 downstream-map-tlv dmap src-ip-
address 10.20.1.1
lsp-trace to 10.20.1.4/32: 0 hops min, 0 hops max, 104 byte packets
1 10.20.1.3 rtt=3.63ms rc=8(DSRtrMatchLabel)
2 10.20.1.5 rtt=9.04ms rc=8(DSRtrMatchLabel)
3 10.20.1.6 rtt=7.73ms rc=8(DSRtrMatchLabel) rsc=1
4 10.20.1.4 rtt=1.62ms rc=3(EgressRtr) rsc=1
```

LSP trace launched from ALU-A (AS 100) to ALU-D (AS 300) with the DDMAP option:

```
ALU-A# oam lsp-trace bgp-label prefix 10.20.1.4/32 downstream-map-tlv ddmmap src-ip-
address 10.20.1.1
lsp-trace to 10.20.1.4/32: 0 hops min, 0 hops max, 124 byte packets
1 10.20.1.3 rtt=9.29ms rc=8(DSRtrMatchLabel) rsc=2
2 10.20.1.5 rtt=3.69ms rc=8(DSRtrMatchLabel) rsc=2
3 10.20.1.6 rtt=2.81ms rc=3(EgressRtr) rsc=2
3 10.20.1.6 rtt=11.5ms rc=8(DSRtrMatchLabel) rsc=1
4 10.20.1.4 rtt=1.68ms rc=3(EgressRtr) rsc=1
```

LSP trace launched from ALU-B (AS 300) to ALU-F (AS 100) with the DSDMAP option:

```
ALU-B# oam lsp-trace bgp-label prefix 10.20.1.6/32 downstream-map-tlv dsmmap src-ip-
address 10.20.1.2
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 104 byte packets
1 10.20.1.1 rtt=5.39ms rc=8(DSRtrMatchLabel) rsc=1
2 10.1.3.2 *
3 10.1.3.2 *
4 10.20.1.6 rtt=1.27ms rc=10(DSRtrUnmatchLabel) rsc=1
```

LSP trace launched from ALU-B (AS 300) to ALU-F (AS 100) with the DDMAP option:

```
ALU-B# oam lsp-trace bgp-label prefix 10.20.1.6/32 downstream-map-tlv ddmmap src-ip-
address 10.20.1.2
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 108 byte packets
1 10.20.1.1 rtt=10.8ms rc=15(LabelSwitchedWithFecChange) rsc=1
2 10.1.3.2 *
3 10.0.0.2 *
4 10.20.1.6 rtt=1.29ms rc=3(EgressRtr) rsc=2
4 10.20.1.6 rtt=1.23ms rc=5(DSMappingMismatched) rsc=1
```

3.1.4 MPLS OAM support in segment routing

MPLS OAM supports segment routing extensions to LSP ping and LSP traceroute as specified in *draft-ietf-mpls-spring-lsp-ping*.

Segment routing (SR) performs both shortest path and source-based routing. When the data plane uses MPLS encapsulation, the MPLS OAM and SAA **lsp-ping** and **lsp-trace** commands can be used to check connectivity and trace the path to any midpoint or endpoint of an SR-ISIS tunnel, SR-OSPF tunnel, or SR-TE LSP.

Configurable options for the **lsp-ping** and **lsp-trace** commands in the **oam** and **config>saa>test>type** contexts are available for the following types of segment routing tunnels:

- SR-ISIS and SR-OSPF node segment ID (SID) tunnels
- SR-TE LSPs

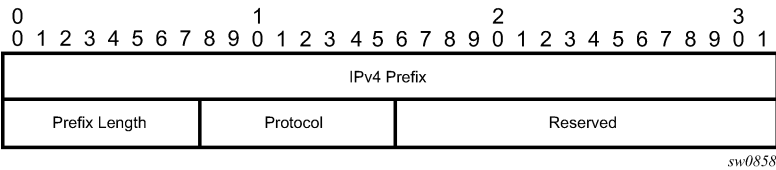
3.1.4.1 SR extensions for LSP ping and LSP traceroute

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

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

The following figure shows the format for the IPv4 IGP prefix SID.

Figure 8: IPv4 IGP prefix SID

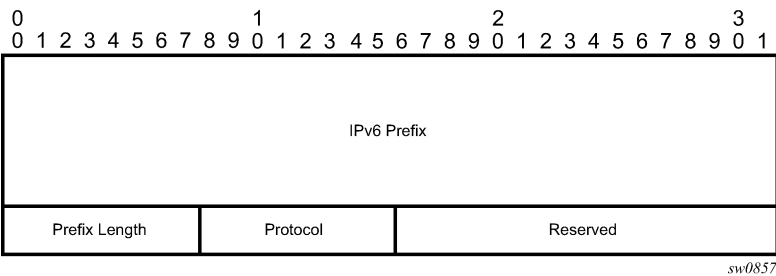


The fields are defined as follows:

- IPv4 Prefix
This field carries the IPv4 prefix to which the SID is assigned. If the prefix is shorter than 32 bits, trailing bits must be set to 0.
- Prefix Length
This field is one octet and gives the length of the prefix in bits (values can be from 1 to 32).
- Protocol
This field is set to 1 when the IGP is OSPF and set to 2 when the IGP is IS-IS.

The following figure shows the format for the IPv6 IGP prefix SID.

Figure 9: IPv6 IGP prefix SID

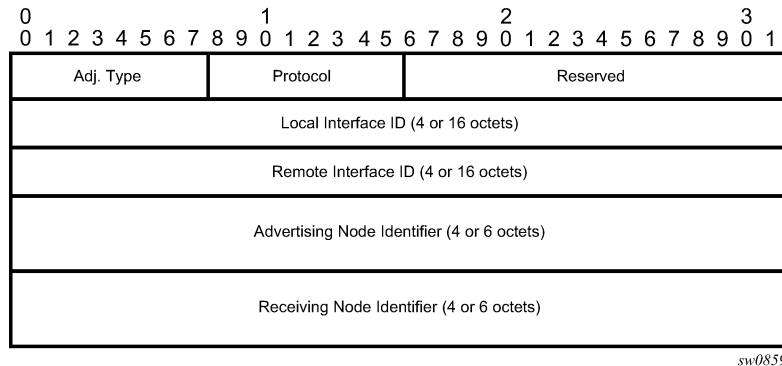


The fields are defined as follows:

- IPv6 Prefix
This field carries the IPv6 prefix to which the SID is assigned. If the prefix is shorter than 128 bits, trailing bits must be set to 0.
- Prefix Length
This field is one octet and gives the length of the prefix in bits (values can be from 1 to 128).
- Protocol
This field is set to 1 when the IGP protocol is OSPF and set to 2 when the IGP protocol is IS-IS.

As a hierarchical LSP, an SR-TE LSP uses the target FEC stack TLV, which contains a FEC element for each node SID and each adjacency SID in the path of the SR-TE LSP. Because the SR-TE LSP does not instantiate a state in the LSR other than the ingress LSR, MPLS OAM tests a hierarchy of node SID and adjacency SID segments toward the destination of the SR-TE LSP. [Figure 9: IPv6 IGP prefix SID](#) shows the format for the node SID. The following figure shows the format for the IGP Adjacency SID.

Figure 10: IGP adjacency SID



The fields are defined as follows:

- **Adj. Type (Adjacency Type)**
This field is set to 1 when the adjacency segment is a parallel adjacency as defined in *draft.ietf-spring-segment-routing*. This field is set to 4 when the adjacency segment is IPv4-based and is not a parallel adjacency. This field is set to 6 when the adjacency segment is IPv6-based and is not a parallel adjacency.
- **Protocol**
This field is set to 1 when the IGP protocol is OSPF and set to 2 when the IGP protocol is IS-IS.
- **Local Interface ID**
This field is an identifier that is assigned by the local LSR for a link on which the adjacency SID is bound. This field is set to a local link address (IPv4 or IPv6). If unnumbered, the 32-bit link identifier defined in RFC 4203 and RFC 5307 is used. If the adjacency SID represents parallel adjacencies, as described in *draft.ietf-spring-segment-routing*, this field must be set to 0.
- **Remote Interface ID**
This field is an identifier that is assigned by the remote LSR for a link on which the adjacency SID is bound. This field is set to the remote (downstream neighbor) link address (IPv4 or IPv6). If unnumbered, the 32-bit link identifier defined in RFC 4203 and RFC 5307 is used. If the adjacency SID represents parallel adjacencies, as described in *draft.ietf-spring-segment-routing*, this field must be set to 0.
- **Advertising Node Identifier**
This field specifies the advertising node identifier. When the Protocol field is set to 1, the 32 rightmost bits represent the OSPF router ID. When the Protocol field is set to 2, this field carries the 48-bit IS-IS system ID.
- **Receiving Node Identifier**
This field specifies the downstream node identifier. When the Protocol field is set to 1, the 32 rightmost bits represent the OSPF router ID. When the Protocol field is set to 2, this field carries the 48-bit IS-IS system ID.

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

- SR-ISIS or SR-OSPF shortest path IPv4 tunnel
- SR-ISIS shortest path IPv6 tunnel
- IS-IS SR-TE IPv4 LSP or OSPF SR-TE IPv4 LSP

- BGP IPv4 LSP resolved over an SR-ISIS IPv4 tunnel, an SR-OSPF IPv4 tunnel, or an SR-TE IPv4 LSP, including support for BGP LSP across AS boundaries and for ECMP next hops at the transport tunnel level

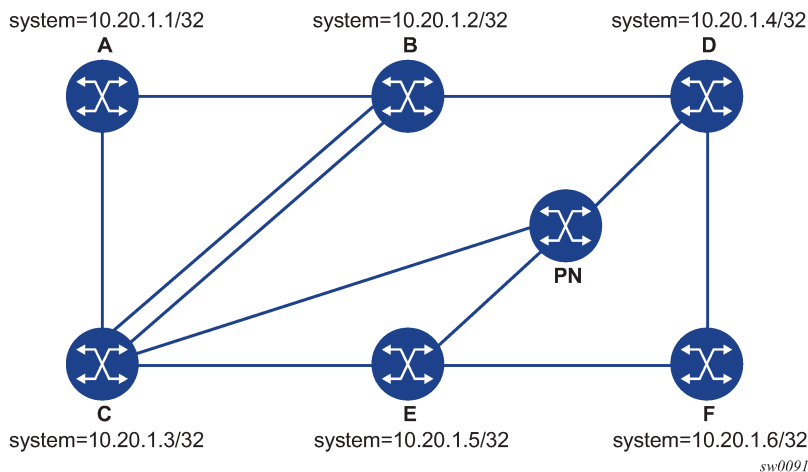
3.1.4.2 LSP ping and LSP traceroute on SR-ISIS or SR-OSPF tunnels

The following operations apply to **lsp-ping** and **lsp-trace** commands on SR-ISIS tunnels or SR-OSPF tunnels:

- The sender node builds the target FEC stack TLV with a single FEC element corresponding to the node SID of the destination of the SR-ISIS or SR-OSPF tunnel.
- A node SID label that is swapped at an LSR results in a return code of 8, "Label switched at stack-depth <RSC>", per RFC 8029.
- A node SID label that is popped at an LSR results in a return code of 3, "Replying router is an egress for the FEC at stack-depth <RSC>".
- The **lsp-trace** command supports the following downstream mapping TLV parameters: **ddmap**, **dsmap**, or **none**. When the downstream mapping TLV is configured as **none**, 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 an example of the topology used for LSP ping and LSP trace for an SR-ISIS node SID tunnel.

Figure 11: Testing MPLS OAM with SR tunnels



Based on this topology, the following is an output example for LSP ping on DUT-A for target node SID of 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 intf to_B, reply from 10.20.1.6
  udp-data-len=32 ttl=255 rtt=1220324ms rc=3 (EgressRtr)
---- LSP 10.20.1.6/32 PING Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min = 1220324ms, avg = 1220324ms, max = 1220324ms, stddev = 0.000ms
```

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

```
*A:Dut-A# oam lsp-trace sr-isis prefix 10.20.1.6/32 igp-instance 0 downstream-map-
tlv dsmap detail
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 108 byte packets
1 10.20.1.2 rtt=1220323ms 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=1220323ms 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=1220324ms rc=3(EgressRtr) rsc=1
```

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

```
*A:Dut-A# oam lsp-trace sr-isis prefix 10.20.1.6/32 igp-instance 0 downstream-map-
tlv ddmmap detail
lsp-trace to 10.20.1.6/32: 0 hops min, 0 hops max, 108 byte packets
1 10.20.1.2 rtt=1220323ms 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=1220324ms 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=1220324ms rc=3(EgressRtr) rsc=1
```

3.1.4.3 LSP ping and LSP traceroute on SR-TE LSPs

The following operations apply to **lsp-ping** and **lsp-trace** commands on SR-TE LSPs:

- The sender node builds a target FEC stack TLV that contains FEC elements.
For **lsp-ping**, the target FEC stack TLV contains a single FEC element that corresponds to the last segment, that is, a node SID or an adjacency SID of the destination of the SR-TE LSP.
For **lsp-trace**, the target FEC stack TLV contains a FEC element for each node SID and for each adjacency SID in the path of the SR-TE LSP, including the SID of the destination of the SR-TE LSP.
- A node SID label that is popped at an LSR results in a return code of 3, "Replying router is an egress for the FEC at stack-depth <RSC>".
- An adjacency SID label that is popped at an LSR results in a return code of 3, "Replying router is an egress for the FEC at stack-depth <RSC>".
- A node SID label that is swapped at an LSR results in a return code of 8, "Label switched at stack-depth <RSC>", per RFC 8029.
- An adjacency SID label that is swapped at an LSR results in a return code of 8, "Label switched at stack-depth <RSC>", per RFC 8029.
- The **lsp-trace** command includes the option to specify the downstream mapping TLV format to use in the LSP trace packet: **ddmap**, **dsmmap**, or **none**. When **none** is configured, no map TLV is sent. The downstream interface information is returned along with the egress label for the node SID tunnel or the adjacency SID tunnel of the current segment as well as the protocol that resolved the tunnel at the responder node.
- If the target FEC stack TLV contains more than one FEC element, the responder node that is the termination of one node SID or adjacency SID segment pops its own SID in the first operation. When the sender node receives this reply, it adjusts the target FEC stack TLV by stripping the top FEC before

sending the probe for the next TTL value. When the responder node receives the next echo request message with the same TTL value from the sender node for the next node SID or adjacency SID segment in the stack, it performs a swap operation to that next segment.

- When the path of the SR-TE LSP is computed by the sender node, the hop-to-label translation tool returns the IGP instance that was used to determine the labels for each hop in the path. When the path of the SR-TE LSP is computed by a PCE, the protocol ID is not returned by the PCEP. In this case, the sender node performs a lookup in the SR module for the IGP instance that resolved the first segment of the path. In both cases, the IGP is used to encode the protocol ID field of the node SID or adjacency SID in each of the FEC elements of the target FEC stack TLV.
- The responder node validates the top FEC in the target FEC stack TLV, provided that the depth of the incoming label stack in the packet header is greater than the depth of the target FEC stack TLV.
- TTL values can be changed.

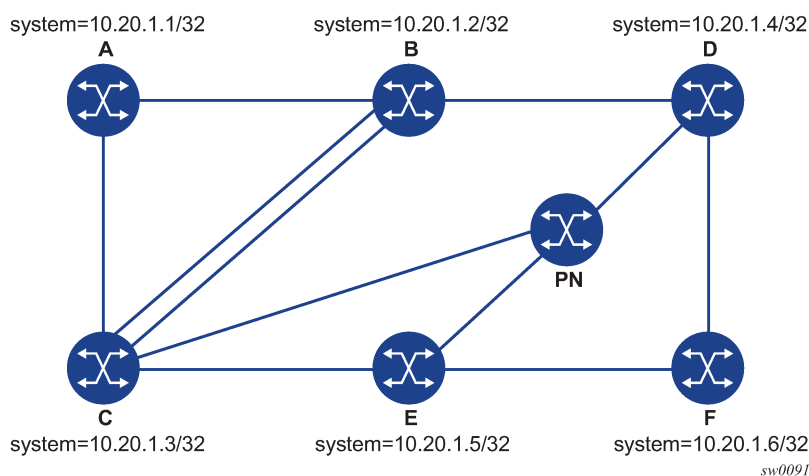
The **ttl** parameter in the **lsp-ping** command can be set to a value lower than 255 and the responder node replies if the FEC element in the target FEC stack TLV corresponds to a node SID resolved at that node. The responder node, however, fails the validation if the FEC element in the target FEC stack TLV is the adjacency of a remote node. The return code in the echo reply message is either "rc=4(NoFECMapping)" or "rc=10(DSRtrUnmatchLabel)".

The **min-ttl** and **max-ttl** parameters in the **lsp-trace** command can be set to values other than the default. However, **lsp-trace** can only properly trace the partial path of an SR-TE LSP if there is no segment termination before the node that corresponds to the minimum TTL value. Otherwise, it fails validation and returns an error because the responder node receives a target FEC stack depth that is greater than the incoming label stack size. The return code in the echo reply message is "rc=4(NoFECMapping)", "rc=5(DSMappingMismatched)", or "rc=10(DSRtrUnmatchLabel)".

This scenario is true whether the **downstream-map-tlv** option is set to **ddmap**, **dsmmap**, or **none**.

The following are output examples for LSP ping and LSP trace on SR-TE LSPs. The first example uses a path with strict hops, each corresponding to an adjacency SID, while the second example uses a path with loose hops, each corresponding to a node SID. The topology for the examples is shown in the following figure.

Figure 12: Testing MPLS OAM with SR-TE LSPs



Example 1

The following output is an example of LSP ping and LSP trace on DUT-A for a strict-hop adjacency SID SR-TE LSP, where:

- the source is DUT-A
- the destination is DUT-F
- the path is as follows: A to B, B to C, C to E, E to D, D to F

```
*A:Dut-A# oam lsp-ping sr-te "srteABCEDF" detail
LSP-PING srteABCEDF: 96 bytes MPLS payload
Seq=1, send from intf int_to_B, reply from 10.20.1.6
  udp-data-len=32 ttl=255 rtt=1220325ms rc=3 (EgressRtr)
---- LSP srteABCEDF PING Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min = 1220325ms, avg = 1220325ms, max = 1220325ms, stddev = 0.000ms
*A:Dut-A# oam lsp-trace sr-te "srteABCEDF" downstream-map-tlv ddmap detail
lsp-trace to srteABCEDF: 0 hops min, 0 hops max, 252 byte packets
1 10.20.1.2 rtt=1220323ms rc=3(EgressRtr) rsc=5
1 10.20.1.2 rtt=1220322ms rc=8(DSRtrMatchLabel) rsc=4
  DS 1: ipaddr=10.10.33.3 ifaddr=10.10.33.3 iftype=ipv4Numbered MRU=1520
    label[1]=3 protocol=6(ISIS)
    label[2]=262135 protocol=6(ISIS)
    label[3]=262134 protocol=6(ISIS)
    label[4]=262137 protocol=6(ISIS)
2 10.20.1.3 rtt=1220323ms rc=3(EgressRtr) rsc=4
2 10.20.1.3 rtt=1220323ms rc=8(DSRtrMatchLabel) rsc=3
  DS 1: ipaddr=10.10.5.5 ifaddr=10.10.5.5 iftype=ipv4Numbered MRU=1496
    label[1]=3 protocol=6(ISIS)
    label[2]=262134 protocol=6(ISIS)
    label[3]=262137 protocol=6(ISIS)
3 10.20.1.5 rtt=1220325ms rc=3(EgressRtr) rsc=3
3 10.20.1.5 rtt=1220325ms rc=8(DSRtrMatchLabel) rsc=2
  DS 1: ipaddr=10.10.11.4 ifaddr=10.10.11.4 iftype=ipv4Numbered MRU=1496
    label[1]=3 protocol=6(ISIS)
    label[2]=262137 protocol=6(ISIS)
4 10.20.1.4 rtt=1220324ms rc=3(EgressRtr) rsc=2
4 10.20.1.4 rtt=1220325ms rc=8(DSRtrMatchLabel) rsc=1
  DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1496
    label[1]=3 protocol=6(ISIS)
5 10.20.1.6 rtt=1220325ms rc=3(EgressRtr) rsc=1
```

Example 2

The following output is an example of LSP ping and LSP trace on DUT-A for a loose-hop node SID SR-TE LSP, where:

- the source is DUT-A
- the destination is DUT-F
- the path is A, B, C, E

```
*A:Dut-A# oam lsp-ping sr-te "srteABCE_loose" detail
LSP-PING srteABCE_loose: 80 bytes MPLS payload
Seq=1, send from intf int_to_B, reply from 10.20.1.5
  udp-data-len=32 ttl=255 rtt=1220324ms rc=3 (EgressRtr)
---- LSP srteABCE_loose PING Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min = 1220324ms, avg = 1220324ms, max = 1220324ms, stddev = 0.000ms
*A:Dut-A# oam lsp-trace sr-te "srteABCE_loose" downstream-map-tlv ddmap detail
lsp-trace to srteABCE_loose: 0 hops min, 0 hops max, 140 byte packets
1 10.20.1.2 rtt=1220323ms rc=3(EgressRtr) rsc=3
1 10.20.1.2 rtt=1220322ms rc=8(DSRtrMatchLabel) rsc=2
```

```

DS 1: ipaddr=10.10.3.3 ifaddr=10.10.3.3 iftype=ipv4Numbered MRU=1496
      label[1]=26303 protocol=6(ISIS)
      label[2]=26305 protocol=6(ISIS)
DS 2: ipaddr=10.10.12.3 ifaddr=10.10.12.3 iftype=ipv4Numbered MRU=1496
      label[1]=26303 protocol=6(ISIS)
      label[2]=26305 protocol=6(ISIS)
DS 3: ipaddr=10.10.33.3 ifaddr=10.10.33.3 iftype=ipv4Numbered MRU=1496
      label[1]=26303 protocol=6(ISIS)
      label[2]=26305 protocol=6(ISIS)
2 10.20.1.3 rtt=1220323ms rc=3(EgressRtr) rsc=2
2 10.20.1.3 rtt=1220323ms rc=8(DSRtrMatchLabel) rsc=1
  DS 1: ipaddr=10.10.5.5 ifaddr=10.10.5.5 iftype=ipv4Numbered MRU=1496
        label[1]=26505 protocol=6(ISIS)
  DS 2: ipaddr=10.10.11.5 ifaddr=10.10.11.5 iftype=ipv4Numbered MRU=1496
        label[1]=26505 protocol=6(ISIS)
3 10.20.1.5 rtt=1220324ms rc=3(EgressRtr) rsc=1

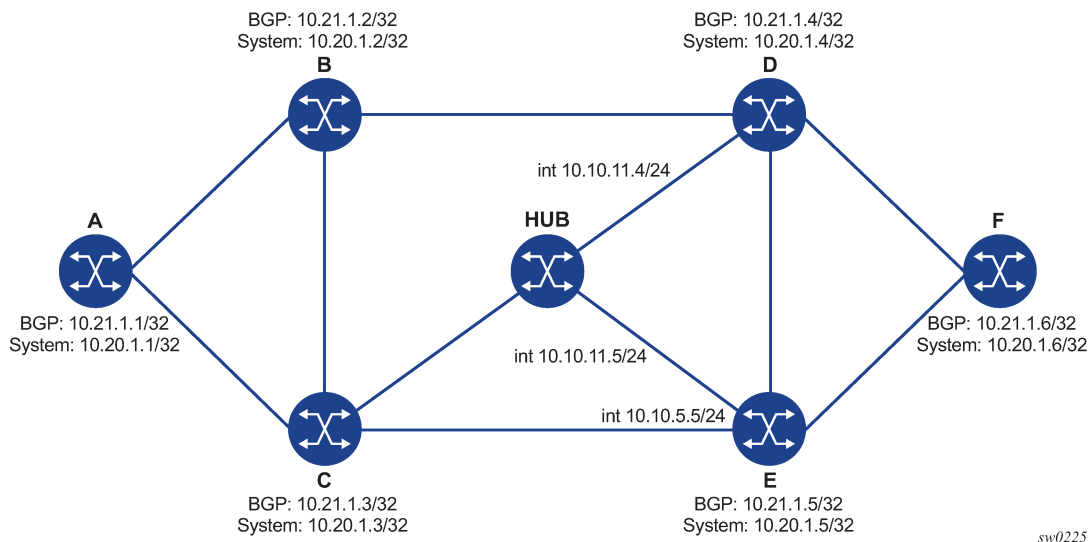
```

3.1.4.4 LSP ping and LSP trace for BGP IPv4 LSPs

The 7705 SAR supports LSP ping and LSP trace on a BGP IPv4 LSP resolved over an SR-OSPF IPv4 tunnel, an SR-ISIS IPv4 tunnel, or an SR-TE IPv4 LSP.

The following are output examples of LSP trace for a hierarchical tunnel consisting of a BGP IPv4 LSP resolved over an SR-OSPF IPv4 tunnel, an SR-ISIS IPv4 tunnel, or an SR-TE IPv4 LSP (OSPF or IS-IS). The topology for the examples is shown in the following figure.

Figure 13: Testing MPLS OAM for BGP over SR-OSPF, SR-TE (OSPF), SR-ISIS, and SR-TE (ISIS)



Output example for BGP over SR-OSPF:

```

*A:Dut-A# oam lsp-trace bgp-label prefix 11.21.1.6/32 detail downstream-map-tlv ddmap path-
destination 127.1.1.
lsp-trace to 11.21.1.6/32: 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]=13199 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#

```

Output example for BGP over SR-TE (OSPF):

```

*A:Dut-A# oam lsp-trace bgp-label prefix 11.21.1.6/32 detail downstream-map-tlv dmap path-
destination 127.1.1.1
lsp-trace to 11.21.1.6/32: 0 hops min, 0 hops max, 236 byte packets
1  10.20.1.2  rtt=2.13ms rc=3(EgressRtr) rsc=4
1  10.20.1.2  rtt=1.79ms rc=8(DSRtrMatchLabel) rsc=3
    DS 1: ipaddr=10.10.4.4 ifaddr=10.10.4.4 iftype=ipv4Numbered MRU=1492
        label[1]=3 protocol=5(OSPF)
        label[2]=262104 protocol=5(OSPF)
        label[3]=262139 protocol=2(BGP)
2  10.20.1.4  rtt=3.24ms rc=3(EgressRtr) rsc=3
2  10.20.1.4  rtt=4.46ms rc=8(DSRtrMatchLabel) rsc=2
    DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1492
        label[1]=3 protocol=5(OSPF)
        label[2]=262139 protocol=2(BGP)
3  10.20.1.6  rtt=6.24ms rc=3(EgressRtr) rsc=2
3  10.20.1.6  rtt=6.18ms rc=3(EgressRtr) rsc=1
*A:Dut-A#

```

Output example for BGP over SR-ISIS:

```

A:Dut-A# oam lsp-trace bgp-label prefix 11.21.1.6/32 detail downstream-map-tlv dmap path-
destination 127.1.1.1
lsp-trace to 11.21.1.6/32: 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

```

Output example for BGP over SR-TE (ISIS):

```

*A:Dut-A# oam lsp-trace bgp-label prefix 11.21.1.6/32 detail downstream-map-tlv dmap path-
destination 127.1.1.1
lsp-trace to 11.21.1.6/32: 0 hops min, 0 hops max, 248 byte packets
1  10.20.1.2  rtt=2.60ms rc=3(EgressRtr) rsc=4
1  10.20.1.2  rtt=2.29ms rc=8(DSRtrMatchLabel) rsc=3

```



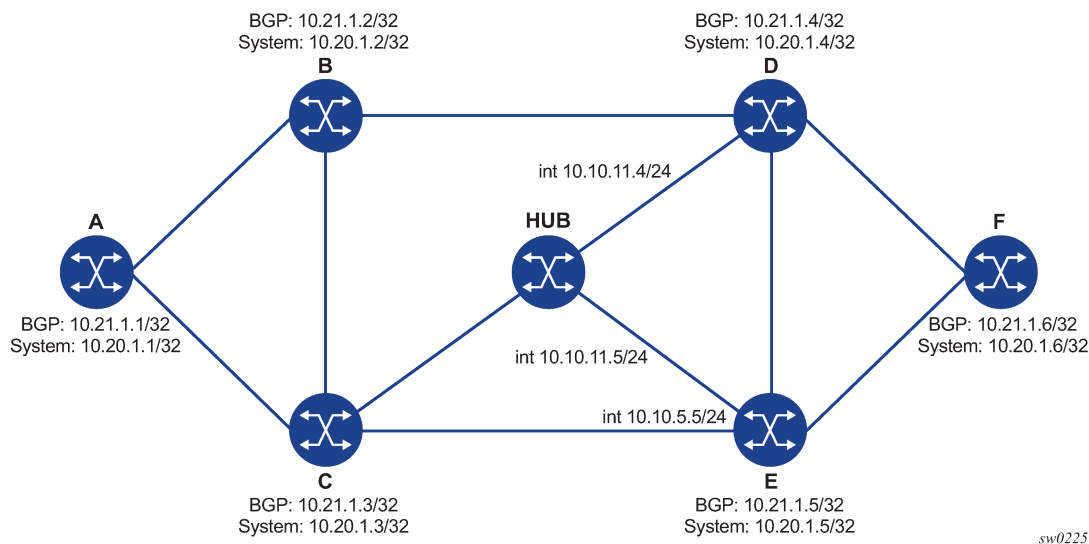
```

DS 1: ipaddr=10.10.4.4 ifaddr=10.10.4.4 iftype=ipv4Numbered MRU=1492
      label[1]=3 protocol=6(ISIS)
      label[2]=262094 protocol=6(ISIS)
      label[3]=262139 protocol=2(BGP)
2 10.20.1.4 rtt=4.04ms rc=3(EgressRtr) rsc=3
2 10.20.1.4 rtt=4.38ms rc=8(DSRtrMatchLabel) rsc=2
  DS 1: ipaddr=10.10.9.6 ifaddr=10.10.9.6 iftype=ipv4Numbered MRU=1492
        label[1]=3 protocol=6(ISIS)
        label[2]=262139 protocol=2(BGP)
3 10.20.1.6 rtt=6.64ms rc=3(EgressRtr) rsc=2
3 10.20.1.6 rtt=5.94ms rc=3(EgressRtr) rsc=1

```

Assuming the topology in the following figure has the addition of an EBGP peering between nodes B and C, the BGP IPv4 LSP spans the AS boundary and resolves to an SR-ISIS tunnel or an SR-TE LSP within each AS.

Figure 14: Topology example for BGP over SR-ISIS in inter-AS option C and BGP over SR-TE (ISIS) in inter-AS option C



Output example for BGP over SR-ISIS in inter-AS option C:

```

*A:Dut-A# oam lsp-trace bgp-label prefix 11.20.1.6/32 src-ip-
address 11.20.1.1 detail downstream-map-tlv dmap path-destination 127.1.1.1
lsp-trace to 11.20.1.6/32: 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)
        fecchange[1]=PUSH fectype=SR Ipv4 Prefix prefix=10.20.1.6
remotepeer=10.10.5.5
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
```

Output example for BGP over SR-TE (ISIS) in inter-AS option C:

```
*A:Dut-A# oam lsp-trace bgp-label prefix 11.20.1.6/32 src-ip-
address 11.20.1.1 detail downstream-map-tlv dmap path-destination 127.1.1.1
lsp-trace to 11.20.1.6/32: 0 hops min, 0 hops max, 168 byte packets
1 10.20.1.2 rtt=2.77ms rc=3(EgressRtr) rsc=2
1 10.20.1.2 rtt=2.92ms 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=4.82ms rc=15(LabelSwitchedWithFecChange) rsc=1
    DS 1: ipaddr=10.10.5.5 ifaddr=10.10.5.5 iftype=ipv4Numbered MRU=1496
        label[1]=26505 protocol=6(ISIS)
        label[2]=26506 protocol=6(ISIS)
        label[3]=262139 protocol=2(BGP)
        fecchange[1]=PUSH fectype=SR Ipv4 Prefix prefix=10.20.1.6
remotepeer=0.0.0.0 (Unknown)
        fecchange[2]=PUSH fectype=SR Ipv4 Prefix prefix=10.20.1.5
remotepeer=10.10.5.5
3 10.20.1.5 rtt=7.10ms rc=3(EgressRtr) rsc=3
3 10.20.1.5 rtt=7.45ms 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=9.23ms rc=3(EgressRtr) rsc=2
4 10.20.1.6 rtt=9.46ms rc=3(EgressRtr) rsc=1
*A:Dut-A
```

3.1.5 SDP diagnostics

The 7705 SAR SDP diagnostics include:

- [SDP ping](#)
- [SDP MTU path discovery](#)

3.1.5.1 SDP ping

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

For a unidirectional test, SDP ping tests:

- the egress SDP ID encapsulation
- the ability to reach the far-end IP address of the SDP ID within the SDP encapsulation
- the path MTU to the far-end IP address over the SDP ID
- the 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 7705 SAR.

SDP round-trip testing is an extension of SDP connectivity testing with the additional ability to test:

- the remote SDP ID encapsulation
- the potential service round-trip time
- the round-trip path MTU
- the round-trip forwarding class mapping

3.1.5.2 SDP MTU path discovery

In a large network, network devices can support a variety of packet sizes that are transmitted across their interfaces. The largest packet (including headers) can be as large as the maximum transmission unit (MTU). An MTU specifies the largest packet size, measured in octets, that can be transmitted through a network entity. It is important to understand the MTU of the entire path (end-to-end) when provisioning services, especially for VLL services where the service must support the ability to transmit the extra large customer packets.

The MTU path discovery tool is a powerful tool that enables service providers to get the exact MTU supported between the service ingress and service termination points, accurate to 1 byte.



Note: The **sdp-mtu** command probes the far-end port using the configured MTU of the near-end port, not the configured MTU of the far-end port. For example, a far-end port that is physically capable of receiving jumbo frames would respond to **sdp-mtu** probes up to the jumbo frame size, regardless of the configured MTU of the far-end port. This assumes that the intermediate transport network can switch frames of this size.

3.1.6 Service diagnostics

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

3.1.6.1 Service ping

Service (SVC) ping is initiated from a 7705 SAR router to verify round-trip connectivity and delay to the far end of the service. Service ping applies to GRE, IP, and 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



Note: By default, service ping uses GRE encapsulation.

3.1.7 VLL diagnostics

This section describes virtual circuit connectivity verification (VCCV) ping and VCCV trace, the VLL diagnostic capabilities for the 7705 SAR.

3.1.7.1 VCCV ping

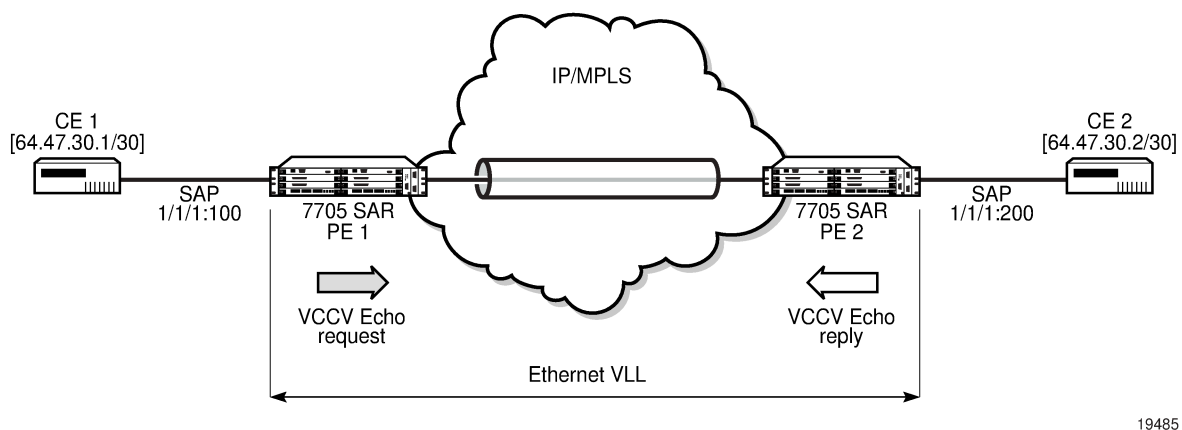
VCCV ping is used to check the connectivity (in-band) of a VLL. It checks that the destination (target) PE is the egress point for the Layer 2 FEC. It provides a cross-check between the data plane and the control plane. It is in-band, meaning that the VCCV ping message is sent using the same encapsulation 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, GRE, or IP SDP.

A 7705 SAR node using GNSS or IEEE 1588v2 PTP for time of day/phase recovery can perform VCCV ping tests with high-accuracy timestamping. See the 7705 SAR Basic System Configuration Guide, "Node Timing", for information about node timing sources.

3.1.7.1.1 VCCV ping application

VCCV creates an IP control channel within the pseudowire between PE1 and PE2 as shown in the following figure. PE2 should be able to distinguish, on the receive side, VCCV control messages from user packets on that VLL.

Figure 15: VCCV ping application



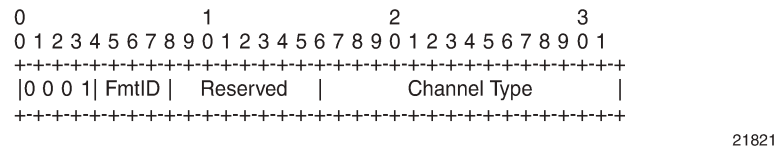
VCCV-based pseudowire (PW) tests are only supported on dynamically signaled PWs (not on statically signaled PWs).

There are three methods of encapsulating a VCCV message in a VLL, which translates into three types of control channels, as follows:

- Type 1— in-band VCCV (special control word)

Type 1 uses the OAM control word, which is shown in the following figure.

Figure 16: OAM control word format



In the figure, 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 for the user packets. This means that if the control word is optional for a VLL and is not configured, the 7705 SAR PE node will only advertise the router alert label as the CC capability in the Label Mapping message.

This method is supported by the 7705 SAR.

- Type 2 – out-of-band VCCV (router alert above the service label)

The 7705 SAR uses the router alert label immediately above the VC label to identify the VCCV ping message. This method has a drawback in that if ECMP is applied to the outer LSP label, such as the 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 7705 SAR when a 7750 SR node acts as an LSR in the core of the network. If a 7705 SAR acts as an LSR in the core of the network, the VCCV type 2 message will instead follow the data path.

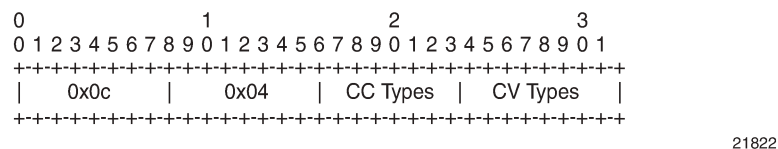
- Type 3 – TTL expiry VCCV (service label TTL = 1 and special control word)

This method is not supported by the 7705 SAR.

When sending the label mapping message for the VLL, PE1 and PE2 must indicate which of the above OAM packet encapsulation methods (that is, which control channel type) they support. This is accomplished by including an optional VCCV TLV in the PW FEC interface parameter field. The format of the VCCV TLV is shown in the following figure.

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

Figure 17: VCCV TLV



In the figure, the Control Channel (CC) Type field is a bit mask used to indicate if the PE supports none, one, or many control channel types:

- 0x00 – none of the following VCCV control channel types (Type 1, Type 2, or Type 3) are supported
- 0x01 – (Type 1, in-band) PWE3 OAM control word (see [Figure 16: OAM control word format](#))
- 0x02 – (Type 2, out-of-band) MPLS router alert label

- 0x04 – (Type 3, not supported on the 7705 SAR) MPLS inner label TTL = 1

If both PE nodes support more than one of the CC types, a 7705 SAR PE will make use of the CC type with the lowest type value. For instance, OAM control word (0x01) will be used in preference to the MPLS router alert label (0x02).

The Connectivity Verification (CV) Type field is a bit mask used to indicate the specific type of VCCV packets to be sent over the VCCV control channel. The possible values supported on the 7705 SAR are:

- 0x00 – none of the following VCCV packet types are supported
- 0x02 – LSP ping

This value (0x02) is used in the VCCV ping application and applies to a VLL over an MPLS, GRE, or IP SDP.

A VCCV ping is an LSP echo request message as defined in RFC 4379. It contains a Layer 2 FEC stack TLV in which it must include the sub-TLV type 10 FEC 128 pseudowire. It also contains a field that indicates to the destination PE which reply mode to use:

- **do not reply**
This mode is supported by the 7705 SAR.
- **reply by an IPv4 UDP packet**
This mode is supported by the 7705 SAR.
- **reply via an IPv4 UDP packet with router alert**
This mode is not supported by the 7705 SAR.



Note: This mode, which sets the router alert bit in the IP header, should not be confused with the CC type that makes use of the router alert label.

- **reply by application-level control channel**
This mode sends the reply message in-band over the pseudowire from PE2 to PE1. PE2 will encapsulate the echo reply message using the CC type negotiated with PE1.
This mode is supported by the 7705 SAR.

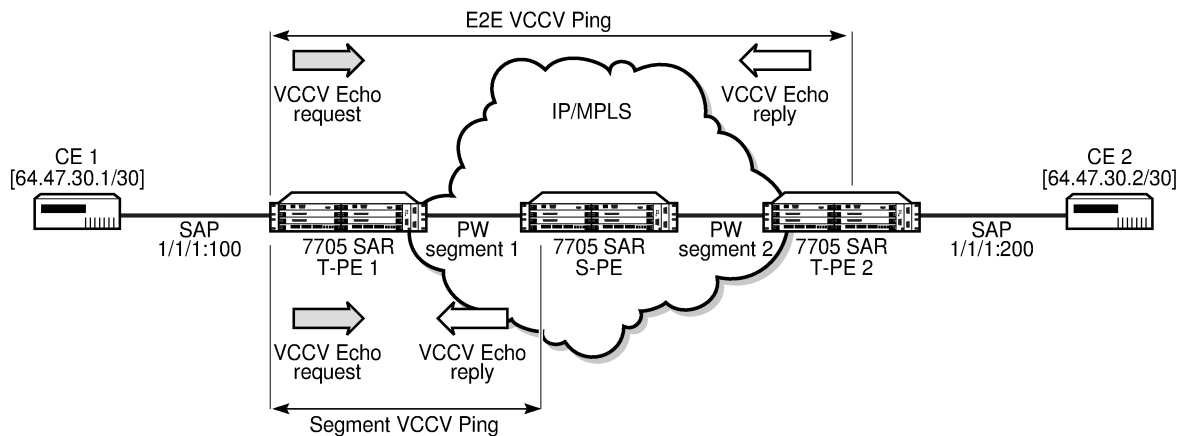
The VCCV ping reply has the same format as an LSP echo reply message as defined in RFC 4379. The message is sent via the reply mode requested by PE1. The return codes supported are the same as those currently supported in the 7705 SAR LSP ping capability.

The VCCV ping feature is in addition to the service ping OAM feature that can be used to test a service between 7705 SAR nodes. The VCCV ping feature can test connectivity of a VLL with any third-party node that is compliant with RFC 5085.

3.1.7.1.2 VCCV ping over a multi-segment pseudowire

The following figure displays an example of an application of VCCV ping over a multi-segment pseudowire (MS-PW). Pseudowire switching provides the user with the ability to create a VLL service by cross-connecting two spoke SDPs.

Figure 18: VCCV ping over a multi-segment pseudowire



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In the network, a termination PE (T-PE) is where the pseudowire originates and terminates. The switching PE (S-PE) is the node that performs pseudowire switching by cross-connecting two spoke SDPs.

VCCV ping on the 7705 SAR is capable of performing 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 7705 SAR 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 7705 SAR S-PE1 node does not process the VCCV OAM control word unless the VC label TTL expires. If the VC label TTL expires, the message is sent to the CSM for further validation and processing. This is the method described in *draft-hart-pwe3-segmented-pw-vccv*.

The originator of the VCCV ping message does not need to be a T-PE node; it can be an S-PE node. The destination of the VCCV ping message can also be an S-PE node. When an S-PE node receives a VCCV ping echo request destined for itself, it sends an IP-routed reply. VCCV trace can trace the entire path of a pseudowire with a single command issued at the T-PE. This is equivalent to LSP trace and is an iterative process, where T-PE1 sends successive VCCV ping messages while incrementing the TTL value, starting from TTL=1.

The procedure for each iteration is the same. Each node in which the VC label TTL expires checks the FEC and replies with the FEC to the downstream S-PE or T-PE node. The process is terminated when the reply is sent from the T-PE2 node or when a timeout occurs.

3.1.7.1.3 Automated VCCV trace capability for multi-segment pseudowire

Although tracing of the MS-PW path is possible using the methods described in the [VCCV ping](#) section, these require multiple manual iterations and that require the FEC of the last pseudowire segment to the target T-PE/S-PE already be known 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 TTL values, starting from TTL=1.

The method is described in *draft-hart-pwe3-segmented-pw-vccv*, *VCCV Extensions for Segmented Pseudo-Wire*, and is pending acceptance by the PWE3 working group. In each iteration, the source T-PE

or S-PE builds the MPLS echo request message in a way similar to [VCCV ping](#). The first message with TTL=1 will have the next-hop S-PE T-LDP session source address in the Remote PE Address field in the pseudowire FEC TLV. Each S-PE that terminates and processes the message will include the FEC 128 TLV corresponding to the pseudowire segment to its downstream node, in the MPLS echo reply message. The inclusion of the FEC TLV in the echo reply message is allowed according to *RFC 4379, Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*.

The source T-PE or S-PE then sends 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 sent from the egress T-PE node 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 of VCCV trace can be displayed for fewer pseudowire 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 will still probe all hops up to the **min-ttl** value in order to correctly build the FEC of the required subset of segments.

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

3.1.7.1.4 VCCV for static pseudowire segments

MS-PW is supported with a mix of static and signaled pseudowire segments. However, VCCV ping and VCCV trace are not allowed if any segment of the MS-PW is static. Users cannot test a static segment or contiguous signaled segments of the MS-PW. VCCV ping and VCCV trace are not supported in static-to-dynamic configurations.

3.1.7.1.5 VCCV for MS-PW and pseudowire redundancy

VCCV is supported on S-PE nodes configured for MS-PW and PW redundancy. In this case, S-PE terminates the in-band or out-of-band (IP-routed) VCCV ping (echo reply) and can generate VCCV ping (echo request) toward the dynamic section of the PW segment.

To configure an S-PE for MS-PW and pseudowire redundancy, an explicit endpoint is required to configure the service. Only one explicit endpoint is supported. The first PW segment must be configured with a static inner label under an implicit endpoint. The second PW segment can be created as either a redundant or non-redundant PW using the explicit endpoint.



Note: A VLL service is in MS-PW and PW redundancy mode as long as there is one PW segment with an explicit endpoint configured.

On S-PE nodes configured for MS-PW and PW redundancy, each segment of the PW can be configured with its own independent control word. The control word of the dynamic segment does not have to match the control word of the static segment for traffic to flow. The control word is automatically inserted or removed from the packets as they are switched from one segment to the other based on the control word configuration for each segment.

From an OAM diagnostic perspective, only Type-1 VCCV is supported for the dynamic MS-PW segment, which means that the PW segment must be configured with the control word option. In this mode, the ability to support VCCVs is signaled through the label message and the optional VCCV TLV toward the dynamic segment on the S-PE. The S-PE terminates all VCCV packets arriving on the dynamic segment, then extracts them toward the CSM.

3.1.7.1.6 Detailed VCCV trace operation

In [Figure 18: VCCV ping over a multi-segment pseudowire](#), a trace can be performed on the MS-PW originating from T-PE1 by a single operational command. The following process occurs:

1. T-PE 1 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-PE 1 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-PE 2) and sends the echo reply back to T-PE 1.
3. T-PE 1 builds a second VCCV echo request based on the FEC 128 in the echo reply from the S-PE. It increments the TTL and sends the next echo request out to T-PE 2. 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-PE 2 receives and validates the echo request with the FEC 128 of the pseudowire2 from TPE 1. Since T-PE 2 is the destination node or the egress node of the MS-PW, 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-PE 1 receives the echo reply from T-PE 2. T-PE 1 is made aware that T-PE 2 is the destination of the MS-PW 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 VCCV trace

VCCV trace is similar to LSP trace. VCCV trace is used to trace the entire path of a pseudowire (PW) with a single command.

VCCV trace is useful in multi-segment PW (MS-PW) applications where a single PW traverses one or more switched PEs (S-PEs). VCCV trace is an iterative process by which the initiating terminating PE (T-PE) sends successive VCCV ping messages, each message having an incrementing TTL value, starting from TTL=1. The procedure for each iteration is the same as that for VCCV-ping, where each node in which the VC label TTL expires will check the FEC and reply with the FEC to the downstream S-PE or far-end T-PE. The process is terminated when the reply is from the far-end T-PE or when a timeout occurs.

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

3.1.8 ITU-T Y.1564 diagnostics

The 7705 SAR supports the ITU-T Y.1564 feature for throughput and bandwidth testing of Ethernet point-to-point virtual circuits. ITU-T Y.1564 includes, but also improves and standardizes, the RFC 2544 testing process.

ITU-T Y.1564 is supported on second-generation Ethernet ports in access mode in conjunction with 16-priority scheduling, on the following:

- 7705 SAR-A
- 7705 SAR-Ax

- 7705 SAR-H (not supported on the 4-port SAR-H Fast Ethernet module)
- 7705 SAR-Hc
- 7705 SAR-M
- 7705 SAR-Wx
- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE X-Adapter card (in 10-port 1GigE mode)
- Packet Microwave Adapter card

ITU-T Y.1564 is supported on third-generation Ethernet ports in access mode in conjunction with 4-priority scheduling, on the following:

- 7705 SAR-X
- 6-port Ethernet 10Gbps Adapter card

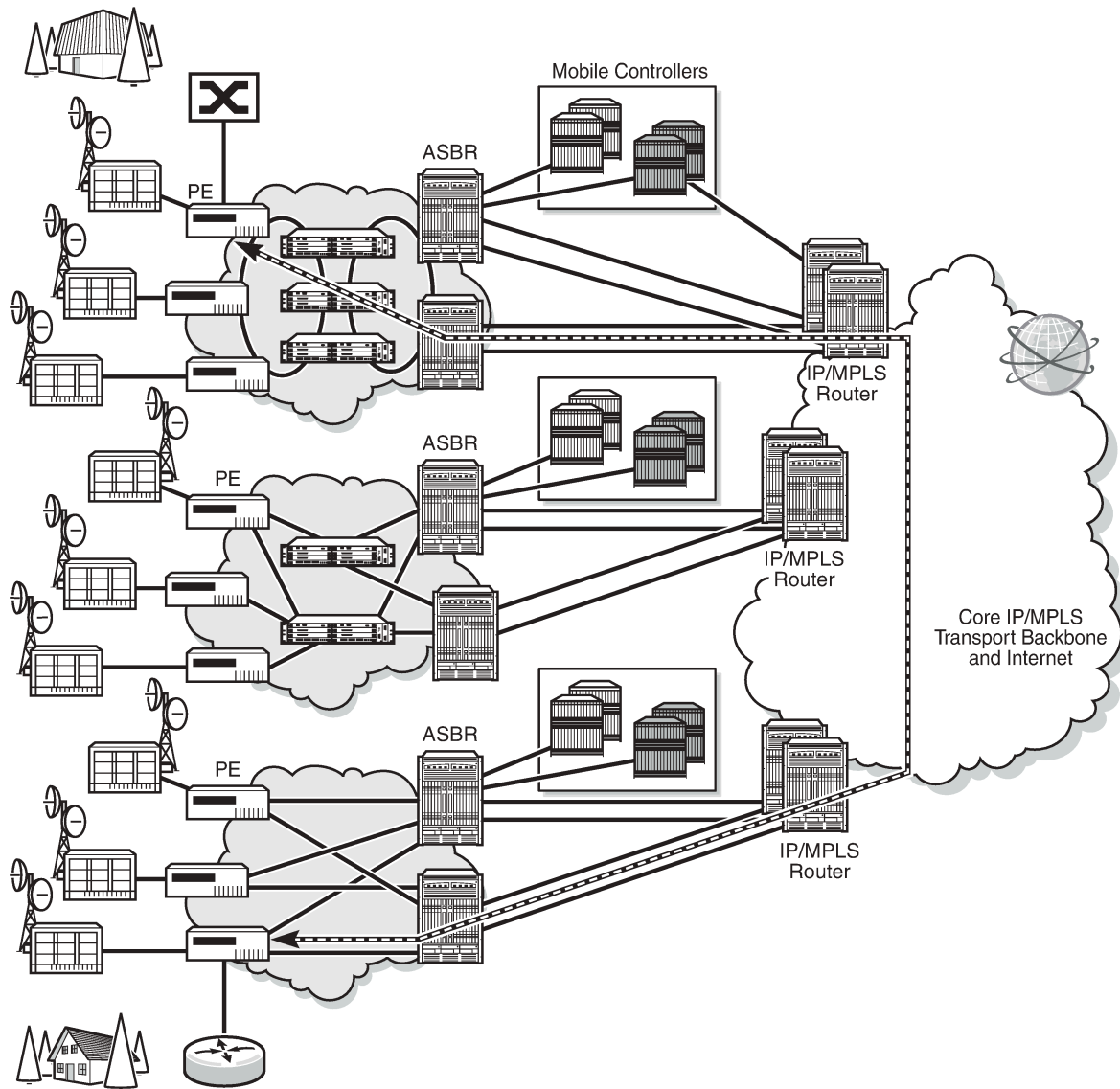
For information about card and platform generations, see the 7705 SAR Interface Configuration Guide, "Evolution of Ethernet Adapter Cards, Modules, and Platforms".

In a traditional hub and spoke network model, traffic is terminated on edge routers and aggregation hubs, which also perform bandwidth and throughput tests. In a flat, seamless, MPLS network, edge routers and aggregation hubs provide only forwarding and switching and cannot be used for service testing as they do not terminate traffic.

ITU-T Y.1564 is crucial in these types of networks because it provides the 7705 SAR edge nodes with the ability to run a complete validation of Ethernet SLAs. The 7705 SAR generates RFC 2544 test frames, up to the required rate, and sends them through the SAP of the service to test its performance. The far-end nodes must also offer per-service loopback capabilities, with the **epipe>sap>loopback** command, to return the traffic to the source node for test analysis and reporting.

The following figure shows a network with service endpoints where throughput tests are required.

Figure 19: ITU-T Y.1564 end-to-end throughput test



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During an ITU-T Y.1564 test, marker frames are used to measure delay and jitter. Packet loss is reported directly by counting transmitted and received frames. Delay, jitter, and loss support two profile states: conforming traffic (configured as in-profile) and non-conforming traffic (configured as out-of-profile).

The 7705 SAR relies on the SAP ingress and SAP egress QoS profile queuing points for generated test traffic bandwidth. The assigned CIR and PIR dictate the potential test frame coloring when a Y.1564 test is run with **color-aware** enabled.

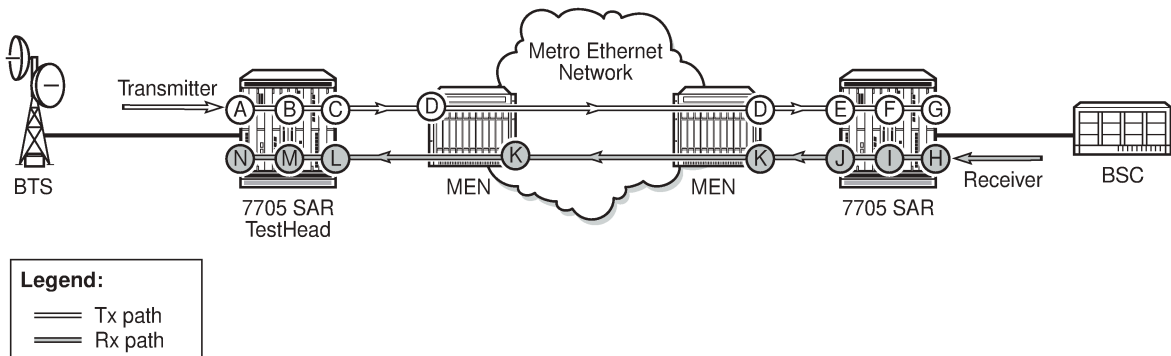
The following colors are assigned to packets:

- green – traffic is equivalent to the CIR
- yellow – traffic received, up to the SAP PIR provisioned value

- red – traffic exceeding the PIR provisioned value

The following figure shows all of the queuing and policing points, in addition to the SAP ingress QoS profile, that can have an effect on the throughput test results. Each of these queuing points can contribute to traffic policing or shaping, which can impact delay, jitter, and loss measurements.

Figure 20: Queuing and policing points that impact throughput



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Table 3: Description of queueing and policing points

Point	Description	Point	Description
A	Test head access/SAP ingress QoS profile	H	Far-end/responder access/SAP ingress QoS profile
B	Test head access ingress fabric shaper	I	Far-end/responder access ingress fabric shaper
C	Test head network egress QoS profile	J	Far-end/responder network egress QoS profile
D	Any QoS enforcement via intermediate LSR nodes	K	Any QoS enforcement via intermediate LSR nodes
E	Far-end/responder network ingress QoS profile	L	Test head network ingress QoS profile
F	Far-end/responder network ingress fabric shaper	M	Test head network ingress fabric shaper
G	Far-end/responder access/SAP egress QoS profile	N	Test head access/SAP egress QoS profile

3.1.8.1 ITU-T Y.1564 functionality

The 7705 SAR supports the test heads, as defined in RFC 2544, for ITU-T Y.1564. Test heads allow users to configure a set of trusted procedures to use during testing.

An ITU-T Y.1564 test head cannot survive activity switches (on platforms supporting HA) or any maintenance operation at the port, SAP, service level. The user must restart the test from the newly active CSM. If an activity switch occurs during an active test, all statistics and measurement data are lost.

An Ethernet SAP loopback can survive a CSM activity switch if it is enabled with the **persistent** keyword. Otherwise, the loopback is also reset during an activity switch. Ethernet SAP loopbacks are supported on LAG and MC-LAG ports on second-generation and third-generation Ethernet cards.

ITU-T Y.1564 test heads rely on delay and delay variation when calculating jitter. For more details, see RFC 3550, section A.8.

Users can configure the following frame type using the **frame-payload** command: Layer 2 payload, IPv4 payload, and IP/TCP/UDP payload. The test head uses the configured values for the IP header fields and TCP header fields based on the payload type configured.

The test head implementation on the 7705 SAR allows users to run tests with up to four parallel flows by specifying up to four frame payload IDs in the **oam>testhead** command. This allows users to test a service with IMIX-type traffic patterns.

3.1.8.2 ITU-T Y.1564 protocol interaction

CFM OAM must be explicitly disabled in order for an ITU-T Y.1564 test or Ethernet SAP loopback to be operational. You can enable a Y.1564 test head or Ethernet SAP loopback, or enable CFM OAM, but not both simultaneously (see the following table).

Table 4: ITU-T Y.1564 protocol interaction

Feature	Y.1564 test head		Ethernet SAP loopback	
	Line	Internal	Line	Internal
All Layer 1 peering functionality (EFM (excluding tunneling), LLDP, SSM, EAP, and down-when-looped)	Maintained	—	Maintained	—
EFM tunneling	Dropped	—	Dropped	—
802.1ag Y.1731 CFM	—	Must be explicitly disabled	—	Must be explicitly disabled
BFD	—	—	—	—

3.1.9 VPLS MAC diagnostics

Although the LSP ping, SDP ping, and service ping tools enable transport tunnel testing and verify that 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 possible that even though 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. The 7705 SAR provides 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** – 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** – 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 a successful OAM and SAA test when there is a reply from a far-end node indicating the destination MAC address on an egress SAP or the CSM.
- **CPE ping** – 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 from 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

3.1.9.1 MAC ping

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

A 7705 SAR node using GNSS or IEEE 1588v2 PTP for time of day/phase recovery can perform MAC ping tests with high-accuracy timestamping. See the 7705 SAR Basic System Configuration Guide, "Node Timing", for information about node timing sources.

3.1.9.2 MAC trace

A MAC trace operates like an LSP trace with 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.

When a MAC trace request is 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 as a unicast transmission 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 assigned by the system, where the source UDP port is really the demultiplexer that identifies the particular instance that sent the request, when that demultiplexer correlates the reply. The source IP address is the system IP address 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 address of the sender.

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

3.1.9.3 CPE ping

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

The **cpe-ping** command extends this capability and can detect 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 7705 SAR. Operators are encouraged to use the source IP address of 0.0.0.0 in order to prevent the provider's IP address from being learned by the CE.

3.1.9.4 MAC populate

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

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

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

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 as an OAM-induced learning with some other binding), to prevent new dynamic learning to over-write the existing OAM MAC entry, or 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, to populate the local FIB with an OAM MAC entry, and to flood the request along the data plane using the flooding domain.

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

3.1.9.5 MAC purge

MAC purge is used to clear the FIBs of any learned information for a particular MAC address. This allows an operator to perform 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 request.

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 rather the control plane behavior of it.

3.1.10 Ethernet OAM capabilities

The 7705 SAR supports Ethernet OAM capabilities, as described in the following sections:

- [Ethernet OAM overview](#)
- [802.1ag and Y.1731 functional comparison](#)
- [ETH-CFM Ethernet OAM tests \(802.1ag and Y.1731\)](#)
- [ITU-T Y.1731 performance monitoring \(PM\)](#)
- [ITU-T Y.1731 Ethernet bandwidth notification \(ETH-BN\)](#)
- [CFM OAM QoS](#)
- [EFM OAM \(802.3ah\)](#)

3.1.10.1 Ethernet OAM overview

The 7705 SAR supports the following Ethernet OAM capabilities:

- Ethernet connectivity fault management (ETH-CFM) – for network layer OAM according to IEEE 802.1ag (dot1ag) and ITU Y.1731 standards, including loopback (LB), linktrace (LT), continuity check (CC), and remote defect indication (RDI). "Network layer" refers to an end-to-end context across a network.

ITU-T Y.1731 provides functional enhancements to 802.1ag ETH-CFM, including alarm indication signals (AIS) and Ethernet signal tests (ETH-Test).

See [ETH-CFM Ethernet OAM tests \(802.1ag and Y.1731\)](#).

- performance monitoring (PM) – PM according to the ITU-T Y.1731 standard, including delay measurements (DM), delay variation measurements (DV), and loss measurements (LM)

See [ITU-T Y.1731 performance monitoring \(PM\)](#).

- Ethernet bandwidth notification (ETH-BN) – when enabled on a port, the egress rate may be dynamically altered based on the available bandwidth indicated by the ETH-BN server.

See [ITU-T Y.1731 Ethernet bandwidth notification \(ETH-BN\)](#).

- Ethernet first mile (EFM) OAM – for the transport layer OAM according to IEEE 802.3ah (dot3ah) standards. "Transport layer" refers to a point-to-point link context or transport hop.

See [EFM OAM \(802.3ah\)](#).

Ethernet OAM capabilities on the 7705 SAR are similar to the OAM capabilities offered in SONET/SDH networks and include loopback tests to verify end-to-end connectivity, test pattern generation (and response) to verify error-free operation, and alarm message generation in case of fault conditions to ensure that the far end is notified of the failure.

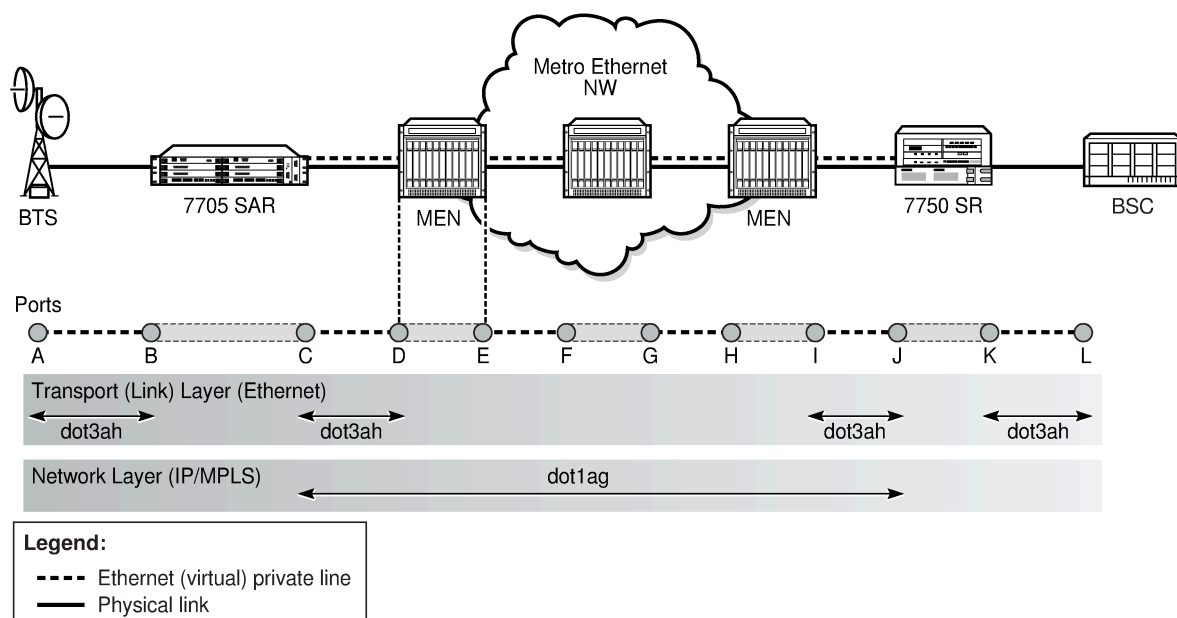
Ethernet OAM configurations are maintained across CSM switchovers.

3.1.10.1.1 Ethernet OAM usage examples

The following figure illustrates the complementary use of dot3ah and dot1ag to locate points of failure along a route from BTS to BSC. Because dot1ag and Y.1731 have similar functions, only dot1ag is discussed in order to simplify the explanation.

In the figure, from the IP/MPLS (network) layer perspective, the 7705 SAR looks as though it is connected directly to the 7750 SR. From the Ethernet (transport) layer perspective, the route passes through many ports and nodes, where each port or node is a potential point of failure. These failure points cannot be detected using IP/MPLS OAM capabilities (that is, using ETH-CFM (dot1ag)). However, they can be detected using EFM OAM (dot3ah) capabilities.

Figure 21: 7705 SAR Ethernet OAM endpoints



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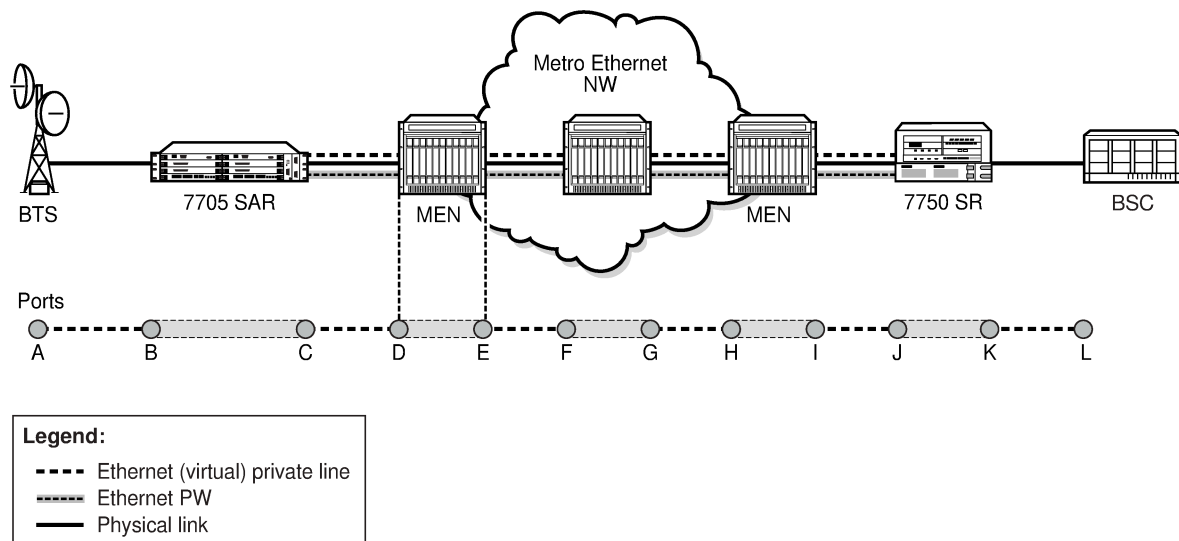
Dot3ah uses port-level loopbacks to check and verify last-mile Ethernet frame integrity, connectivity verification between ports and nodes, and so on. As shown in the figure, dot3ah provides transport (link) layer OAM between the BTS and the 7705 SAR access port facing the BTS (ports A and B), or between the 7705 SAR network port and the MEN switch (ports C and D). Ethernet first mile (EFM) OAM allows users to test frame integrity and detect Ethernet layer failures faster than using associated heartbeat messages.

Dot1ag checks end-to-end connectivity across an Ethernet PW (across a network). Because end-to-end connectivity differs depending on the service provided and the span of the network, dot1ag can operate at several MD levels (as defined in the IEEE 802.1ag standard). For example, in the figure, ETH-CFM (dot1ag) could be used by a MEN provider at one MD level to ensure connectivity between ports D and I (or possibly all the way to their customer's Ethernet ports, C and J). Similarly, a mobile backhaul service provider (MBSP) can use dot1ag at another MD level to ensure connectivity between ports B and K (and possibly between ports A and L).

[Figure 22: ETH-CFM \(dot1ag\) capabilities on the 7705 SAR](#) and [Figure 23: EFM OAM \(dot3ah\) capabilities on the 7705 SAR](#) illustrate the use of ETH-CFM to verify connectivity across an Ethernet PW and EFM OAM to verify transport layer connectivity between two directly connected nodes.

For example, in the following figure, an MBSP can use dot1ag between the two Ethernet spoke SDP endpoints (ports C and J, which define the Ethernet PW) to ensure connectivity. Similarly, a MEP can use dot1ag between ports D and I to ensure the health status of the Ethernet (virtual) private line.

Figure 22: ETH-CFM (dot1ag) capabilities on the 7705 SAR



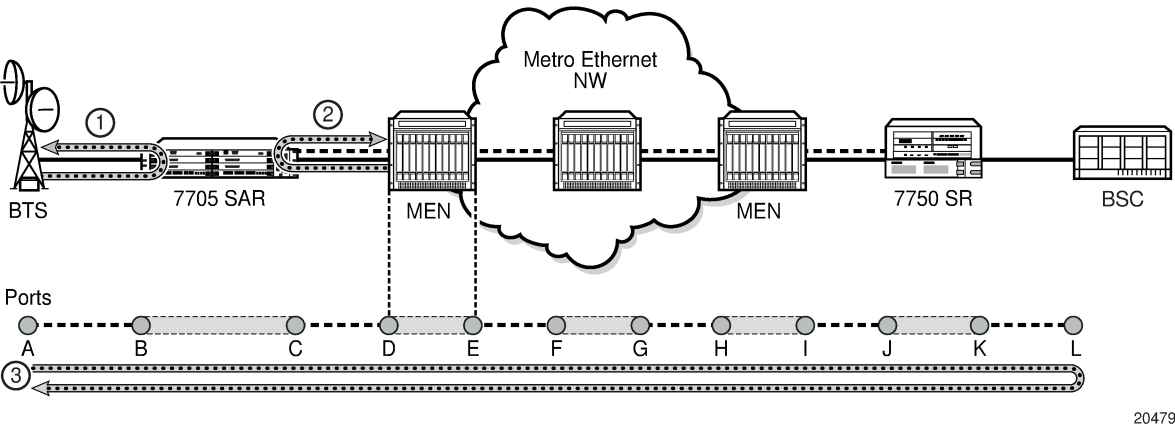
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In [Figure 23: EFM OAM \(dot3ah\) capabilities on the 7705 SAR](#), EFM OAM ensures transport layer connectivity between two directly connected nodes. The figure illustrates three scenarios in which EFM can be used by the MEN provider to ensure error-free connectivity to the 7705 SAR (the cell site) via loopback tests, including:

- scenario 1 – EFM termination at the Ethernet access port, which includes loopback tests, heartbeat messages at the Ethernet layer with dying gasp, and termination of customer device-initiated EFM packets at the access port
- scenario 2 – EFM termination at the Ethernet network port, which includes network-side loopbacks

- scenario 3 – EFM tunneling through an Epipe service

Figure 23: EFM OAM (dot3ah) capabilities on the 7705 SAR



3.1.10.2 802.1ag and Y.1731 functional comparison

The following table lists the 802.1ag and Y.1731 OAM functions supported on the 7705 SAR. For each function and test, the table identifies the PDU that carries the test data, the test’s target entity, and the standards that the 7705 SAR supports for the test.

For example, the 7705 SAR can run an Ethernet continuity check using an ETH-CC test according to the dot1ag and the Y.1731 standards. For either standard, the test data is carried in a continuity check message (CCM) and the test target is a MEP.

The Fault Management (FM) capabilities of ITU-T Y.1731 extend the functionality of dot1ag (ETH-CFM) with additional FM functions as well as performance monitoring (PM) capabilities. The generation of AIS and RDI messages are defined under the FM section of the Y.1731 specification, whereas Ethernet layer, delay, jitter, loss, and throughput tests are part of Y.1731 PM capabilities.

Table 5: 802.1ag and Y.1731 OAM functionality overview

Test	OAM function	PDU	Target	Standard
ETH-LB	Loopback	LBM, LBR	MEP	dot1ag, Y.1731
ETH-LT	Linktrace	LTM, LTR	MEP	dot1ag, Y.1731
ETH-CC	Continuity check	CCM	MEP	dot1ag, Y.1731
ETH-RDI	Remote defect indication	CCM	MEP	dot1ag, Y.1731
ETH-AIS	Alarm indication signal	AIS	MEP	Y.1731
ETH-LM	Frame loss measurement (dual-ended)	CCM	MEP	Y.1731
ETH-LM	Frame loss measurement (single-ended)	LMM, LMR	MEP	Y.1731
ETH-DM	Frame delay measurement (two-way)	DMM, DMR	MEP	Y.1731

Test	OAM function	PDU	Target	Standard
ETH-DM	Frame delay measurement (one-way)	1DM	MEP	Y.1731
ETH-DV	Frame delay variation (one-way)	DMM, DMR	MEP	Y.1731
ETH-Test	Test error measurements	TST	MEP	Y.1731
ETH-SL	Synthetic loss measurement	SLM	MEP	dot1ag, Y.1731

The following table lists the MEPs that support each test.

Table 6: Supported OAM tests per MEP type

OAM test	Epipe SAP Up/Down MEP	Epipe spoke SDP Up/Down MEP	VPLS SAP Up/Down MEP	VPLS spoke/mesh SDP Up/Down MEP	Ethernet network interface Down MEP (facility)
Loopback	✓	✓	✓	✓	✓
Linktrace	✓	✓	✓	✓	✓
Throughput measurement	✓	✓	✓	✓	✓
Continuity check	✓	✓	✓	✓	✓
Remote defect indication	✓	✓	✓	✓	✓
Alarm indication signal	✓		✓		
Test error measurements	✓		✓		✓
Frame delay measurement (two-way)	✓	✓	✓	✓	✓
Frame delay measurement (one-way)	✓	✓	✓	✓	✓
Frame delay variation (one-way)	✓		✓		✓
Frame loss measurement (dual-ended)	✓				✓
Frame loss measurement (single-ended)	✓		✓		✓
Synthetic loss measurement	✓	✓	✓	✓	✓

3.1.10.3 ETH-CFM Ethernet OAM tests (802.1ag and Y.1731)

Ethernet Connectivity Fault Management (ETH-CFM) is defined in the IEEE 802.1ag and ITU Y.1731 standards. ETH-CFM specifies protocols, procedures, and managed objects to support fault management (including discovery and verification of the path), detection, and isolation of a connectivity fault in an Ethernet network.

IEEE 802.1ag and Y.1731 can detect:

- loss of connectivity
- unidirectional loss
- loops
- merging of services

The implementation of Y.1731 on the 7705 SAR also provides the following enhancements:

- Ethernet alarm indication signal (ETH-AIS)
- Ethernet test function (ETH-Test)

ETH-CFM uses Ethernet frames and can be distinguished by its Ethertype value (8902). With ETH-CFM, interoperability can be achieved between different vendor equipment in the service provider network, up to and including customer premises bridges.

ETH-CFM is configured at the global level and at the Ethernet service level (Epipes and VPLS) or network interface level. The following entities and their configuration levels are listed below:

- global level
 - MA and MEG
 - MD
 - MD level and MEG level
- Ethernet service level
 - MEP
- Ethernet network interface level
 - facility MEP

For information about configuring ETH-CFM to set up an Ethernet OAM architecture, see the 7705 SAR Services Guide, "ETH-CFM (802.1ag and Y.1731)". Most of the configuration information applies to Ethernet network interfaces as well; for information about ETH-CFM support specific to network interfaces, see the 7705 SAR Router Configuration Guide, "ETH-CFM Support".

3.1.10.3.1 Hold MEP up on failure

The hold MEP up on failure function allows MEP operation that is independent of SAP status. To report service-level agreement (SLA) metrics, transport providers run Y.1731 performance monitoring tests periodically. At preset times, transport providers initiate various tests to measure and record one or all required SLA components: jitter, delay, loss, and throughput. The ability to hold MEP up allows the MEP to be kept in operation even if the SAP is down or non-operational.

The hold MEP up on failure function applies only to Ethernet pseudowire services (Epipes) operating between SAPs or between SAPs and SDPs. The SAP connecting the provider equipment to the customer can be configured to hold the MEP in operation when the customer-facing SAP enters any failed state. Only one SAP per Epipe can be configured in this manner. Pseudowire status will indicate a failed SAP in the LDP status message, but as long as the pseudowire is in an operationally up state, it supports receiving frames from the network's far-end side. Counters are also incremented to accurately represent the number of received packets.

ETH-CFM PM measurements, ETH-CFM troubleshooting tools and connectivity, and ETH-CFM CCM processing and fault propagation are not impacted by this feature and continue to function normally.

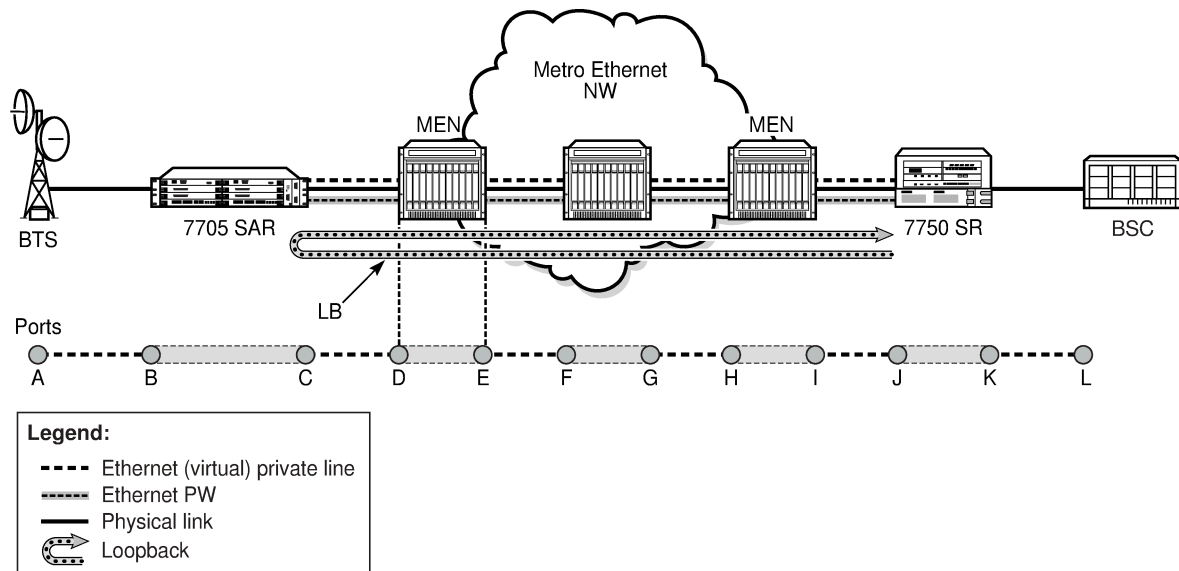
3.1.10.3.2 Loopback (ETH-LB)

The loopback function is supported by 802.1ag and Y.1731 on the 7705 SAR. A loopback message (LBM) is generated by a MEP to its peer MEP. Both dot1ag and dot3ah loopbacks are supported. The loopback function is similar to IP or MPLS ping in that it verifies Ethernet connectivity between the nodes on a per-request basis. That is, it is non-periodic and is only initiated by a user request.

In the following figure, the line labeled LB represents the dot1ag loopback message between the 7750 SR (source) and 7705 SAR (target) over an Ethernet PW (Epipe). The 7750 SR-generated LBM is switched to the 7705 SAR, where the LBM is processed. After the 7705 SAR generates the loopback reply message (LBR), the LBR is switched over the Epipe to the 7750 SR.

ETH-LB tests are run using the **oam>eth-cfm>loopback** command.

Figure 24: Dot1ag loopback test



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3.1.10.3.3 Linktrace (ETH-LT)

The linktrace function is supported by 802.1ag and Y.1731 on the 7705 SAR. A linktrace message (LTM) is originated by a MEP and targeted to a peer MEP in the same MA and within the same MD level. Its function is similar to IP traceroute. The peer MEP responds with a linktrace reply message (LTR) after successful inspection of the LTM.

ETH-LT tests are run using the **oam>eth-cfm>linktrace** command.

3.1.10.3.4 Throughput measurement

Throughput measurement is performed by sending frames to the far end at an increasing rate (up to wire speed) and measuring the percentage of frames received back. In general, the rate is dependent on frame size; the larger the frame size, the lower the rate.

The Y.1731 specification recommends the use of unicast ETH-LB and ETH-Test frames to measure throughput.

On the 7705 SAR, LBM processing and LBR generation is enhanced and occurs on the datapath, allowing the node to respond to loopback messages at wire speed and making in-service throughput tests possible. Therefore, if the 7705 SAR receives LBMs at up to wire speed, it can generate up to an equal number of LBRs. In order to process LBMs at wire speed, there must be either no TLVs or a single TLV (which is a data TLV) in the LBM frame. The End TLV field (0) must be present and the frame can be padded with data after the End TLV field in order to increase the size of the frame. The MAC address cannot be a multicast MAC address; it must be the MEP MAC destination address (DA).

Datapath processing of LBMs is supported with dot1ag and Y.1731 for the following MEPs:

- SAP Up and Down MEPs
- spoke SDP Up and Down MEPs
- mesh SDP Up and Down MEPs (VPLS only)

For spoke or mesh SDP Up and Down MEPs, fastpath (datapath) LBM processing requires that both interfaces—the LBM receiver and the LBR transmitter—reside on the same adapter card. For example, if the 7705 SAR must perform a reroute operation and needs to move the next hop interface to another adapter card (that is, LBMs are received on one card and LBRs are transmitted on another), the fastpath processing of LBMs is terminated and LBM processing continues via the CSM.

3.1.10.3.5 Continuity check (ETH-CC)

The continuity check function is supported by 802.1ag and Y.1731 on the 7705 SAR. A continuity check Message (CCM) is a multicast frame that is generated by a MEP and sent to its remote MEPs in the same MA. The CCM does not require a reply message. To identify faults, the receiving MEP maintains a MEP database with the MAC addresses of the remote MEPs with which it expects to maintain connectivity checking. The MEP database can be provisioned manually. If there is no CCM from a monitored remote MEP in a preconfigured period, the local MEP raises an alarm.

Continuity checks are enabled using the **eth-cfm>mep>ccm-enable** command for Epipe and VPLS services and for router network interfaces.

The following CC capabilities are supported:

- enable and disable CC for a MEP
- automatically put local MEPs into the database when they are created
- manually configure and delete the MEP entries in the CC MEP monitoring database. The only local provisioning required to identify a remote MEP is the remote MEP identifier (using the **remote-mepid mep-id** command).
- CCM transmit interval: 10ms, 100ms, 1s, 10s, 1m, 10m (default: 10s)
- transmit interval: 10ms, 100ms, 1s, 10s, 1m, 10m (default: 10s)
- CCM declares a fault when it:
 - stops hearing from one of the remote MEPs for a period of 3.5 times the CC interval
 - hears from a MEP with a lower MD level
 - hears from a MEP that is not in the same MA
 - hears from a MEP that is in the same MA but is not in the configured MEP list
 - hears from a MEP that is in the same MA with the same MEP ID as the receiving MEP

- recognizes that the CC interval of the remote MEP does not match the local configured CC interval
- recognizes that the remote MEP declares 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.

- CC must be enabled in order for RDI information to be carried in the CCM OAMPDU

The optional **ccm-tlv-ignore** command can be used to ignore the receipt of interface-status and port-status TLVs in the ETH-CCM PDU on a facility MEP. No processing is performed on ignored ETH-CCM TLV values.

Any TLV that is ignored is reported as absent to the relevant remote peer, and the values in the TLV do not have any effect. This is the same behavior as if the received ETH-CCM PDU never included these TLVs in the first place. If the TLV is not properly formed, the ETH-CCM PDU will fail the packet parsing process, which will cause it to be discarded and an alarm to be raised.

3.1.10.3.6 Remote defect indication (ETH-RDI)

The Ethernet remote defect indication function (ETH-RDI) is used by a MEP to communicate to its peer MEPs that a defect condition has been encountered. Defect conditions such as signal failure and AIS may result in the transmission of frames with ETH-RDI information. ETH-RDI is used only when ETH-CC transmission is enabled and it is enabled automatically.

ETH-RDI has the following applications:

- single-ended fault management – the receiving MEP detects an RDI defect condition, which gets correlated with other defect conditions in this MEP. The absence of received ETH-RDI information in a single MEP indicates the absence of defects in the entire MEG.
- contribution to far-end performance monitoring – the transmitting MEP reflects that there was a defect at the far end, which is used as an input to the performance monitoring process

A MEP that is in a defect condition transmits frames with ETH-RDI information. A MEP, upon receiving frames with ETH-RDI information, determines that its peer MEP has encountered a defect condition.

The specific configuration information required by a MEP to support the ETH-RDI function is as follows:

- MEG level – the MEG level at which the MEP exists
- ETH-RDI transmission period – application-dependent and is the same value as the ETH-CC transmission period
- priority – the priority of frames containing ETH-RDI information and is the same value as the ETH-CC priority

The PDU used to carry ETH-RDI information is the CCM.



Note: When a port or interface experiences a failure, the Up MEP on the port or interface transmits a Port or Interface Status TLV (or both).

- if the **hold-mep-up-on-failure** command is enabled:
 - the Up MEP indicates ETH-RDI
 - the remote MEP indicates a DefMACstatus
- if the **hold-mep-up-on-failure** command is disabled:
 - the Up MEP indicates a DefRemoteCCM defect
 - the remote MEP indicates both a DefMACstatus and a DefRDICCM defect

The **hold-mep-up-on-failure** command is not supported for VPLS SAPs.

3.1.10.3.7 Alarm indication signal (ETH-AIS)

The Ethernet alarm indication signal function (ETH-AIS) is a Y.1731 CFM enhancement used to suppress alarms at the client (sub) layer following detection of defect conditions at the server (sub) layer.

Transmission of frames with ETH-AIS information can be enabled or disabled on a Y.1731 SAP MEP.

ETH-AIS is enabled using the **eth-cfm>mep>ais-enable** command for Epipe and VPLS services.



Note: ETH-AIS is not supported on network interface facility MEPs.

Frames with ETH-AIS information can be issued at the client MEG level by a MEP, including a server MEP, upon detecting the following conditions:

- signal failure conditions in the case where ETH-CC is enabled
- AIS condition in the case where ETH-CC is disabled

For a point-to-point Ethernet connection at the client (sub) layer, a client layer MEP can determine that the server (sub) layer entity providing connectivity to its peer MEP has encountered a defect condition upon receiving a frame with ETH-AIS information. Alarm suppression is simplified by the fact that a MEP is expected to suppress only those defect conditions associated with its peer MEP.

Only a MEP, including a server MEP, is configured to issue frames with ETH-AIS information. Upon detecting a defect condition, the MEP can immediately start transmitting periodic frames with ETH-AIS information at a configured client MEG level. A MEP continues to transmit periodic frames with ETH-AIS information until the defect condition is removed. Upon receiving a frame with ETH-AIS information from its server (sub) layer, a client (sub) layer MEP detects the AIS condition and suppresses alarms associated with all its peer MEPs. After the AIS condition is cleared, a MEP resumes alarm generation upon detecting defect conditions.

The following specific configuration information is required by a SAP MEP to support ETH-AIS:

- client MEG level – the MEG level at which the most immediate client layer MEPs exist
- ETH-AIS transmission period – the transmission period of frames with ETH-AIS information
- priority – the priority of frames with ETH-AIS information

3.1.10.3.8 Test error (ETH-Test)

The Ethernet test (signal) function (ETH-Test) is a Y.1731 CFM enhancement used to perform one-way, on-demand, in-service diagnostics tests, which include verifying frame loss and bit errors. ETH-Test is supported on Y.1731 SAP MEPs and facility MEPs on network interfaces.

ETH-Test is enabled using the **eth-cfm>mep>eth-test-enable** command for Epipe and VPLS services and for router network interfaces and is run using the **oam>eth-cfm>eth-test** command.



Note: The out-of-service diagnostics test is not supported on the 7705 SAR.

When configured to perform such tests, a MEP inserts frames with ETH-Test information such as frame size and transmission patterns.

When an in-service ETH-Test function is performed, data traffic is not disrupted and the frames with ETH-Test information are transmitted.

To support ETH-Test, a Y.1731 SAP or facility MEP requires the following configuration information:

- MEG level – the MEG level at which the MEP exists
- unicast MAC address – the unicast MAC address of the peer MEP for which the ETH-Test is intended
- data – an optional element with which to configure data length and contents for the MEP. The contents can be a test pattern and an optional checksum.

Examples of test patterns include all 0s or all 1s. At the transmitting MEP, this configuration information is required for a test signal generator that is associated with the MEP. At the receiving MEP, this configuration is required for a test signal detector that is associated with the MEP.

- priority – the priority of frames with ETH-Test information

A MEP inserts frames with ETH-Test information toward a targeted peer MEP. The receiving MEP detects the frames with ETH-Test information and performs the requested measurements.

3.1.10.4 ITU-T Y.1731 performance monitoring (PM)

The Y.1731 performance monitoring (PM) functions can be used to measure Ethernet frame delay, delay variation, throughput (including throughput at queue-rates), and frame loss. These performance parameters are defined for point-to-point Ethernet connections.

3.1.10.4.1 Frame delay and delay variation measurements (ETH-DM and ETH-DV)

The Y.1731 recommendation covers the following performance parameters, which are based on Metro Ethernet Forum (MEF) 10:

- frame delay – specified as one-way or round-trip delay for a frame, where frame delay is defined as the time elapsed since the start of transmission of the first bit of the frame by a source node until the reception of the frame by the destination node or the same source node
- frame delay variation – a measure of the variations in the frame delay between a pair of service frames, where the service frames belong to the same CoS instance on a point-to-point Ethernet connection

The performance parameters listed above are applicable to Ethernet services frames. Services frames are those frames that conform to an agreed-upon level of bandwidth profile conformance and are associated

with a particular CoS identifier. Services frames are admitted at the ingress Ethernet flow point of a point-to-point Ethernet connection and should be delivered to the egress Ethernet flow point.

The 7705 SAR supports one-way and two-way Ethernet delay measurement (ETH-DM) tests (section 8.2 of the Y.1731 standard). The tests are run using the **oam>eth-cfm>one-way-delay-test** and **oam>eth-cfm>two-way-delay-test** commands. Ethernet delay variation (ETH-DV) tests are run concurrently with the one-way and two-way ETH-DM tests.

For ETH-DM, the accuracy of the measurement is in the microseconds range.

3.1.10.4.2 Y.1731 delay measurement (DM)

Y.1731 delay measurement implementation ensures the most accurate results under all circumstances. The implementation ensures that there is minimal delay measurement error between packet generation and packet play-out over the Ethernet link.

In order to isolate delay measurement results from the effects of any queuing, scheduling, and shaping procedures, timestamping of source one-way and two-way delay measurement (1DM and DMM) frames in the transmit direction occurs when the first byte of the DM frame is put on the wire (that is, once the actual serialization starts). Last-minute timestamping ensures that DM tests truly measure the delay between two SAP, spoke SDP, mesh SDP, or port endpoints, and not the delay imposed by the routers. Using these accurate measurements, a network operator can separate the delay introduced by the routers from the transmission delay introduced by the transmission network, such as a Metro Ethernet network (MEN) or Generic Framing Procedure (GFP) over SONET links.

Timestamping of received 1DM and DMM frames is similar to transmitted source 1DM and DMM frames. When a Y.1731 delay measurement frame is identified internally, it is immediately timestamped to ensure reporting of only the network-induced delay and jitter.

With two-way delay measurement, delay measurement reply (DMR) timestamping occurs at the entry point to the egress datapath. DMR frames are then classified according to their configured dot1p setting and experience any scheduling delays experienced by the queue and scheduling priorities that the frames are associated with. Performing DMR timestamping at the entry point to the egress datapath provides the most accurate end-to-end measurement of delay and jitter, as it takes into account the internal delay of the responding node due to other higher-priority packets.

In summary, one-way delay measurement performs timestamping in the transmit direction only when the frame is about to be sent on the wire and in the receive direction when the frame is received, before any queuing at the far end. This provides true transport network-induced delay and jitter measurements. Two-way delay measurement takes into account the delay introduced by queuing and scheduling of the far-end node for true end-to-end measurements.

3.1.10.4.3 Frame loss measurement (ETH-LM)

The 7705 SAR supports single-ended and dual-ended Ethernet loss measurement (ETH-LM) tests. Single-ended LM tests are run using the **oam>eth-cfm>single-ended-loss-test** command and are considered on-demand tests. Dual-ended LM tests are enabled using the **eth-cfm>mep>dual-ended-loss-test-enable** command for Epipe services and network router interfaces. When enabled, dual-ended LM tests run continuously in the background.



Note: Dual-ended LM tests are not supported for VPLS.

Y.1731 loss measurement functionality is implemented to ensure the most accurate results under all circumstances. Each adapter card has a network processor (NP). LM counters are maintained at the NP. The NP is responsible for incrementing and resetting these counters. These counters are accessed by the CSM CPU in order to calculate and display the loss (percentage) to the user.

LM/CCM frames follow the associated QoS path and therefore might inadvertently report loss due to local congestion even before the frame is switched onto the link. In order to reflect the true experience of a particular QoS setting, generated LM/CCM frames follow the egress QoS path. Once generated, these frames are classified in the same manner as the applicable dot1p-to-FC mapping, associated queuing, and scheduling rules. Following the proper path ensures that loss measurements reflect the experience of a given FC all the way through the network, including within the 7705 SAR platform. As is the case for any other frame of the same FC (that is, user or control frame), the LM/CCM frame follows the associated QoS path to reflect the real experience.

For example, newly generated LM/CCM frames that have a higher counter value can be forwarded sooner than LM/CCM frames with a lower counter value that have been generated but are waiting to be serviced (that is, frames with a lower queue, a queue in the out-of-profile state; or a single SAP with multiple FCs). As a result, when under congestion, the LM ratio would increase to reflect local loss if lower-priority frames cannot be serviced in a timely manner.

In addition, congestion (and therefore prioritization) can occur anywhere in the transport network, which means that a reordering could take place not only on the ingress point, but anywhere in the network along the entire path.

The loss ratio is calculated based on the aggregate frames being transmitted and received. In an uncongested network, the loss ratio would be 0%. With congestion, not all frames may be sent out to the network (that is, higher priority traffic, and so on) or any one of the transit nodes or the endpoint node might drop the packet, which would end up with loss.

The above-described behavior for following the QoS path equally applies to both Up and Down MEPs. Loss measurements in both up and down directions for the same MEP can be performed simultaneously.

The counters used for loss measurement in LM and CCM frames are appended as late as possible in the datapath. Appending the counters at the last minute to the LM or CCM frames ensures that a scheduling priority issue or some other queue-delaying event does not delay the OAM frame in a queue. If the counters are updated or generated earlier in the datapath, then the OAM frames could be affected by queuing or scheduling delays, which could cause the frames to be counted as lost frames when the far-end receive timer expires.

The following notes apply to Y.1731 LM tests:

- Single-ended and dual-ended LM tests cannot be enabled on a MEP simultaneously. That is, either a single-ended or a dual-ended LM test can be enabled on a specific MEP at any one time.
- The behavior and the interaction between single- and dual-ended LM tests are described in the following list. Error conditions, such as correct domain level and valid destination address (DA) MAC, are not covered in the list:
 - if dual-ended LM test is disabled:
 - CCM frames are transmitted with LM counters set to 0
 - CCM frames being received are not processed for LM
 - LMM and LMR frames being received are processed
 - single-ended tests can be enabled (not blocked by CLI)
 - if dual-ended LM test is enabled:
 - single-ended tests cannot be enabled (blocked by CLI)

- LMM and LMR frames being received will be dropped
- Multiple MEPs bound to the same Epipe SAP but belonging to different MEG levels can perform LM tests simultaneously.
- CCM must be enabled before a dual-ended LM test can be enabled.
- When a dual-ended LM test is enabled, the user cannot disable CCM. The dual-ended LM test needs to be disabled before the CCM can be disabled.
- For dual-ended LM tests, an alarm is declared when frame losses are greater than an alarm threshold configured for the MEP. The granularity of the alarm threshold (declaring or clearing) is 0.01%. The default threshold is set to 0.25%.
- On a per-SAP or per-network interface basis, there is one set of Rx and Tx Local LM counters and one set of Rx and Tx Remote LM counters. LM counters are not separated on a per-MAC source address (SA) basis. All MEPs, regardless of their MD or MEG level, share the same set of Rx and Tx LM counters.
- On the CLI, there are interval counters and accumulated counters. The CCM counters are referred to as Local and FarEnd counters and the accumulated counters are referred to as Near-End and Far-End counters.
- The LM counters are incremented when a user data frame reaches a SAP. Because there is only one set of Tx and Rx Local counters per SAP, each user data frame received by all the MEPs configured on that SAP is counted.
- OAM frames with MEP levels matching or lower than the locally configured MEP level are not counted. They are treated and processed as OAM frames. This functionality applies to both received and transmitted OAM frames. CFM OAM frames at higher MEP levels are counted as user data frames.
 - For example, assume a SAP with two MEPs configured on it; one MEP at level 5 and the other at level 6.
 - When a level 6 OAM frame is received, it is extracted to the CSM for processing and is not counted by LM counters. It is treated as an OAM frame.
 - The same behavior applies in the transmit direction. In the above example, any level 5 or level 6 OAM frames generated by the local SAR would not be counted by the far-end LM counters.
- For dual-ended LM tests, any received CCMs with all LM counters being 0s (zeros) are treated as invalid. In this case, the 7705 SAR resets the LM counters for the current and previous CCMs to 0s (zeros). Accumulated counters are not reset.
- Except for a valid counter rollover scenario, if the value of any CCM/LMR counter is less than the value of the same counter in the previous CCM/LMR frame, then the accumulated values of all counters are not increased; they are kept at the same values as before the last CCM/LMR frame is processed.
- When the first valid CCM/LMR frame—that is, a frame with at least one non-zero LM counter—is received after a dual-ended loss test is enabled or a single-ended loss test is launched, the accumulated values cannot be calculated. In this case, the counters are resaved as current counters. When the next received CCM/LMR frame with valid LM counts is received, it will trigger the update of accumulated counts.

Accumulated counts always start at 0 for each launch of a single-ended test. However, the accumulated counts do not change nor do they get reset to all 0s when dual-ended loss tests become disabled. For dual-ended loss tests, accumulated counts can be restarted at 0 by removing the existing LM result of a particular MEP with the CLI command **clear>eth-cfm>dual-ended-loss-test>mep mep-id domain md-index association ma-index**, or the equivalent SNMP command.

3.1.10.5 ITU-T Y.1731 Ethernet bandwidth notification (ETH-BN)

The Ethernet bandwidth notification (ETH-BN) function, as defined in ITU-T Rec. G.8013/Y.1731, is used by a server MEP to signal changes in link bandwidth to a client MEP.

One of the best applications of 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) in order 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 router responds to this information by adjusting the rate of traffic being sent to the radio. The server MEP continues to transmit periodic frames with ETH-BN information with the currently available bandwidth. When full bandwidth is restored, the ETH-BNM will start indicating the full bandwidth.

When the 7705 SAR is interoperating with 9500 MPR-e radios, ETH-BN functionality is supported with 9500 MPR-e radios in standalone mode or in MWA mode.

The 7705 SAR supports the client side of ETH-BN, receiving and acting on the ETH-BN information sent by the server MEP.

ETH-BN is supported on Ethernet ports on the following adapter cards, modules, and platforms:

- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card
- Packet Microwave Adapter card
- 6-port Ethernet 10Gbps Adapter card
- 2-port 10GigE (Ethernet) Adapter card (v-port)
- 2-port 10GigE (Ethernet) module (v-port)
- 6-port SAR-M Ethernet module
- all fixed platforms, with the exception of Fast Ethernet ports on the 7705 SAR-A (ports 9 to 12)

The ports can be configured for network, access, or hybrid mode. When ETH-BN is enabled on a port with the **egress-rate** sub-rate **allow-eth-bn-rate-changes** command, the egress rate, which was configured as a fixed bandwidth, can be dynamically changed based on the available bandwidth indicated by the ETH-BN server.

The maximum egress rate that the port can be set to is the native port rate (for example, 1 Gb/s), and the minimum egress rate is 1 kb/s. If a rate request is outside that range, including 0, it cannot be implemented, and the egress rate is set as close as possible to the requested rate. Any request for a change less than 1% is ignored.

To reduce the number of bandwidth changes (each change incurs a small data hit), a hold timer can be configured. The range is 1 to 600 s with a default of 5 s. Any ETH-BN message received before the hold timer expires, after the last bandwidth change, is ignored.

The bandwidth indicated by the ETH-BN server includes the FCS; therefore, the **include-fcs** option must also be selected in the **egress-rate** command or the bandwidth will not match the intended rate.

For information about the **egress-rate** command, see the "Ethernet commands" section in the 7705 SAR Interface Configuration Guide, "Configuration Command Reference" chapter.

3.1.10.5.1 Bandwidth notification message (BNM)

The PDU used for ETH-BN information is called the bandwidth notification message (BNM).

The BNM PDU format consists of the following fields:

- MEG level – carries the MEG level of the client MEP (0 to 7); this field can be any value
- Version – current version is 0
- OpCode – value for this PDU type is GMN (32)
- Flags – contains one information element:
 - period – bits 3 to 1 indicate how often BN messages are transmitted; currently, the only valid values are 100 (1 frame/s), 101 (1 frame/10 s), and 110 (1 frame/min)
- TLV Offset – set to 13
- Sub-OpCode – value for this PDU type is BNM (1)
- Nominal Bandwidth – the nominal full bandwidth of the link, in Mb/s; this information is ignored by the 7705 SAR
- Current Bandwidth – the current bandwidth of the link, in Mb/s
- Port ID – a non-zero unique identifier for the port associated with the ETH-BN information, or zero if not used; this information is ignored by the 7705 SAR
- End TLV – all zeros octet value

Typical behavior for ETH-BN is that if no BNM frames are received within an interval of 3.5 times the BNM transmission period indicated in the last BNM frame received, the MEP signals to the management system that it no longer has any bandwidth information (for example, because the full bandwidth has been restored). For the 7705 SAR implementation, no action is taken if no BNM frame arrives within 3.5 periods.

Upon startup or restart of the system, the configured egress rate is used until a BNM arrives on the port with a new bandwidth request from the ETH-BN server MEP.

Event logs are generated each time the egress bandwidth 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.

BN messages are transmitted with a source MAC address that cannot be a multicast address or have a value of 0. The destination MAC address can be a Class 1 multicast address (that is, 01-80-C2-00-00-3x) or the MAC address of the configured port. If these conditions are not satisfied, the message is discarded. The packets are rate-limited to the CSM as are all OAM packets.

BN messages with zero, one, or two VLAN tags are supported.

3.1.10.6 CFM OAM QoS

It is important that CFM OAM tools use the relevant FC and the associated queue to report traffic performance issues such as delay, jitter, and loss. When user traffic is mapped to one FC/queue and the OAM traffic is mapped to another FC/queue, data reported by the OAM tools might not be a true reflection of the performance metrics that the user traffic is experiencing, due mainly to different queue depths and scheduling priorities.

To ensure that CFM OAM traffic experiences the same treatment as user traffic, the 7705 SAR supports a configurable priority to specify the FC, and therefore the queue, to be used for a specified OAM test. The **priority** keyword in the **eth-cfm loopback**, **one-way-delay-test**, **single-ended-loss-test**, **two-way-delay-**

test and **two-way-slm-test** commands is used to configure the FC mapping as per the configured priority. The priority value maps to a specific FC; therefore, selecting a priority selects the FC. The following table lists the priority-to-FC mapping. This mapping of priority to FC cannot be changed by the user.

Table 7: Y.1731 priority-to-FC mapping

Priority	FC-ID	FC name
0	0	BE
1	1	L2
2	2	AF
3	3	L1
4	4	H2
5	5	EF
6	6	H1
7	7	NC

The priority-to-FC mapping does change depending on the message type and direction of the MEP. The following table summarizes the FC and dot1p priority mappings based on this criteria.

Table 8: Priority mapping based on message type and MEP direction

MEP type	Message type	FC	Dot1p
SAP Down MEP	CCM	Dictated via ccm-ltm-priority value	Dictated via ccm-ltm-priority value
	LMM, DMM, 1DM, LBM	User-defined priority value copied	User-defined priority value copied
	LMR, DMR, LBR	ccm-ltm-priority value	Incoming dot1p priority preserved
SAP Up MEP	CCM	User-defined priority value copied to dot1p and FC as per sap-ingress classification	Dictated via ccm-ltm-priority value
	LMM, DMM, 1DM, LBM	User-defined priority value copied to dot1p and FC as per sap-ingress classification	User-defined priority value copied
	LMR, DMR, LBR	User-defined priority value copied to dot1p and FC as per sap-ingress classification	Incoming dot1p priority preserved

For more information, see the 7705 SAR Services Guide, "Priority Mapping (802.1ag and Y.1731)".

3.1.10.7 EFM OAM (802.3ah)

802.3ah Clause 57 defines the Ethernet in the first mile (EFM) OAM sublayer, which is a link-level Ethernet OAM that is supported on 7705 SAR Ethernet ports configured as network or access ports. It provides mechanisms for monitoring link operations such as remote fault indication and remote loopback control. Ethernet OAM gives network operators the ability to monitor the health of Ethernet links and quickly determine the location of failing CFM links or fault conditions.

Because some of the sites where the 7705 SAR is deployed have only Ethernet uplinks, this OAM functionality is mandatory. For example, mobile operators must be able to request remote loopbacks from the peer router at the Ethernet layer in order to debug any connectivity issues. EFM OAM provides this capability.

EFM OAM defines a set of events that may impact link operation. The following critical link events (defined in 802.3ah clause 57.2.10.1) are supported:

- link fault – the PHY has determined that a fault has occurred in the receive direction of the local DTE
- dying gasp – an unrecoverable local failure condition has occurred
- critical event – an unspecified critical event has occurred

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

EFM OAM is supported on network and access Ethernet ports, and is configured at the Ethernet port level. The access ports can be configured to tunnel the OAM traffic originated by the far-end devices.

EFM OAM has the following characteristics.

- All EFM OAM, including loopbacks, operate on point-to-point links only.
- EFM loopbacks are always line loopbacks (line Rx to line Tx).
- When a port is in loopback, all frames (except EFM frames) are discarded. If dynamic signaling and routing is used (dynamic LSPs, OSPF, IS-IS, or BGP routing), all services also go down. If all signaling and routing protocols are static (static routes, LSPs, and service labels), the frames are discarded but services stay up.

The following EFM OAM functions are supported:

- OAM capability discovery
- configurable transmit interval with an Information OAMPDU
- active or passive mode
- OAM loopback
- OAMPDU tunneling and termination (for Epipe service)
- dying gasp at network and access ports

For information about Epipe service, see the 7705 SAR Services Guide, "Ethernet VLL (Epipe) Services".

3.1.10.7.1 Unidirectional OAM operation

Some physical layer devices support unidirectional OAM operation. When a link is operating in unidirectional OAM mode, the OAM sublayer ensures that only information OAMPDUs with the Link Fault critical link event indication set and no Information TLVs are sent across the link.

3.1.10.7.2 Remote loopback

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

To initiate a remote loopback, the local EFM OAM client enables the OAM remote loopback command to send a loopback control OAMPDU. After receiving the loopback control OAMPDU, the remote OAM client puts the remote port into local loopback mode.

OAMPDUs are slow protocol frames that contain appropriate control and status information used to monitor, test, and troubleshoot OAM-enabled links.

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

When a port is in local loopback mode (the far end requested an Ethernet OAM loopback), any packets received on the port will be looped back, except for EFM OAMPDUs. No data will be transmitted from the node; only data that is received on the node will be sent back out.

When the node is in remote loopback mode, local data from the CSM is transmitted, but any data received on the node is dropped, except for EFM OAMPDUs.

Remote loopbacks should be used with caution; if dynamic signaling and routing protocols are used, all services go down when a remote loopback is initiated. If only static signaling and routing is used, the services stay up. On the 7705 SAR, the Ethernet port can be configured to accept or reject the remote-loopback command.

3.1.10.7.3 802.3ah OAMPDU tunneling and termination for Epipe services

Customers who subscribe to Epipe service may have customer equipment running 802.3ah at both ends. The 7705 SAR can be configured to tunnel EFM OAMPDUs received from a customer device to the other end through the existing network using MPLS or GRE, or to terminate received OAMPDUs at a network or an access Ethernet port.



Note: This feature applies only to port-based Epipe SAPs because 802.3ah runs at port level, not at VLAN level.

While tunneling offers the ability to terminate and process the OAM messages at the head-end, termination on the first access port at the cell site can be used to detect immediate failures or can be used to detect port failures in a timelier manner.

The user can choose either tunneling or termination, but not both at the same time.

In [Figure 23: EFM OAM \(dot3ah\) capabilities on the 7705 SAR](#), scenario 1 shows the termination of received EFM OAMPDUs from a customer device on an access port, while scenario 2 shows the same thing except for a network port. Scenario 3 shows tunneling of EFM OAMPDUs through the associated Ethernet PW. To configure termination (scenario 1), use the **config>port>ethernet>efm-oam>no shutdown** command.

3.1.10.7.4 Dying gasp

Dying gasp is used to notify the far end that EFM-OAM is disabled or shut down on the local port. The dying gasp flag is set on the OAMPDUs that are sent to the peer. The far end can then take immediate action and inform upper layers that EFM-OAM is down on the port.

When a dying gasp is received from a peer, the node logs the event and generates an SNMP trap to notify the operator.

3.1.11 Ethernet loopbacks

The following loopbacks are supported on Ethernet ports:

- timed network line loopback
- timed and untimed access line loopbacks
- timed and untimed access internal loopbacks
- persistent access line loopback
- persistent access internal loopback
- MAC address swapping
- CFM loopback on network and access ports
- CFM loopback on ring ports and v-port

3.1.11.1 Line and internal Ethernet loopbacks

A line loopback loops frames received on the corresponding port back toward the transmit direction. Line loopbacks are supported on ports configured for access or network mode.

Similarly, a line loopback with MAC addressing loops frames received on the corresponding port back toward the transmit direction, and swaps the source and destination MAC addresses before transmission. See [MAC swapping](#) for more information.

An internal loopback loops frames from the local router back to the framer. This is usually referred to as an equipment loopback. The transmit signal is looped back and received by the interface. Internal loopbacks are supported on ports configured in access mode.

If a loopback is enabled on a port, the port mode cannot be changed until the loopback has been disabled.

A port can support only one loopback at a time. If a loopback exists on a port, it must be disabled or the timer must expire before another loopback can be configured on the same port. EFM-OAM cannot be enabled on a port that has an Ethernet loopback enabled on it. Similarly, an Ethernet loopback cannot be enabled on a port that has EFM-OAM enabled on it.

When an internal loopback is enabled on an Ethernet port, autonegotiation is turned off silently. This is to allow an internal loopback when the operational status of a port is down. Any user modification to autonegotiation on a port configured with an internal Ethernet loopback will not take effect until the loopback is disabled.

The loopback timer can be configured from 30 s to 86400 s. All non-zero timed loopbacks are turned off automatically under the following conditions: an adapter card reset, activity switch, or timer expiry. Line or internal loopback timers can also be configured as a latched loopback by setting the timer to 0 s, or as a persistent loopback with the **persistent** keyword. Latched and persistent loopbacks are enabled indefinitely until turned off by the user. Latched loopbacks survive adapter card resets and activity switches, but are lost if there is a system restart. Persistent loopbacks survive adapter card resets and activity switches and can survive a system restart if the **admin>save** or **admin>save>detail** command was executed before the restart. Latched loopbacks (untimed) and persistent loopbacks can be enabled only on Ethernet access ports.

Persistent loopbacks are the only Ethernet loopbacks saved to the database by the **admin>save** and **admin>save>detail** commands.

3.1.11.1.1 MAC swapping

Typically, an Ethernet port loopback only echoes back received frames. That is, the received source and destination MAC addresses are not swapped. However, not all Ethernet equipment supports echo mode, where the original sender of the frame must support receiving its own port MAC address as the destination MAC address.

The MAC swapping feature on the 7705 SAR is an optional feature that swaps the received destination MAC address with the source MAC address when an Ethernet port is in loopback mode. After the swap, the FCS is recalculated to ensure the validity of the Ethernet frame and to ensure that the frame is not dropped by the original sender because of a CRC error.

3.1.11.1.2 Interaction of Ethernet port loopback with other features

EFM OAM and line loopbacks are mutually exclusive. If one of these functions is enabled, it must be disabled before the other can be used.

However, a line loopback precedes the dot1x behavior. That is, if the port is already dot1x-authenticated it will remain so. If it is not, EAP authentication will fail.

Ethernet port-layer line loopback and Ethernet port-layer internal loopback can be enabled on the same port with the down-when-looped feature. EFM OAM cannot be enabled on the same port with the down-when-looped feature. For more information, see the 7705 SAR Interface Configuration Guide, "Ethernet Port Down-When-Looped".

3.1.11.2 CFM loopbacks for OAM on Ethernet ports

Connectivity fault management (CFM) loopback support for loopback messages (LBMs) on Ethernet ports allows operators to run standards-based Layer 1 and Layer 2 OAM tests on ports receiving unlabeled packets.

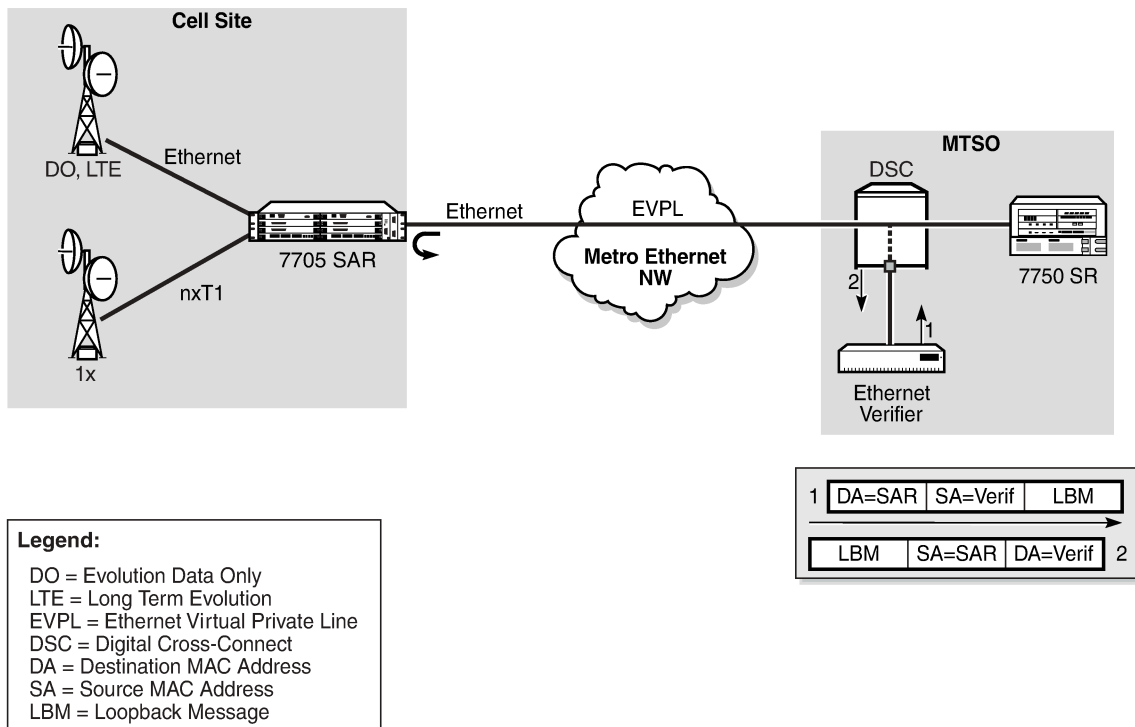
The 7705 SAR supports CFM MEPs associated with different endpoints (that is, Up and Down SAP MEPs, Up and Down spoke SDP MEPs, Up and Down mesh SDP MEPs, and network interface facility Down MEPs). In addition, for traffic received from an uplink (network ingress), the 7705 SAR supports CFM LBM for both labeled and unlabeled packets. CFM loopbacks are applied to the Ethernet port.

See [Ethernet OAM capabilities](#) for information about CFM MEPs.

The following figure shows an application where an operator leases facilities from a transport network provider in order to transport traffic from a cell site to their MTSO. The operator leases a certain amount of bandwidth between the two endpoints (the cell site and the MTSO) from the transport provider, who offers Ethernet Virtual Private Line (EVPL) or Ethernet Private Line (EPL) PTP service.

Before the operator offers services on the leased bandwidth, the operator runs OAM tests to verify the SLA. Typically, the transport provider (MEN provider) requires that the OAM tests be run in the direction of (toward) the first Ethernet port that is connected to the transport network. This is done in order to eliminate the potential effect of queuing, delay, and jitter that may be introduced by an SDP or SAP.

Figure 25: CFM loopback on Ethernet ports



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The figure shows an Ethernet verifier at the MTSO that is directly connected to the transport network (in front of the 7750 SR). Therefore, the Ethernet OAM frames are not label- encapsulated. Because Ethernet verifiers do not support label operations and the transport provider mandates that OAM tests be run between the two hand-off Ethernet ports, the verifier cannot be relocated behind the 7750 SR node at the MTSO. Therefore, CFM loopback frames received are not MPLS-encapsulated, but are simple Ethernet frames where the **type** is set to CFM (dot1ag or Y.1731).

3.1.11.2.1 CFM loopback mechanics

The following list contains important facts to consider when working with CFM loopbacks:

- CFM loopbacks can be enabled on a per-port basis, and:
 - the port can be in access or network mode
 - when enabled on a port, all received LBM frames are processed, regardless of the VLAN and the service that the VLAN or SAP is bound to
 - there is no associated MEP creation involved with this feature; therefore, no domain, association, or similar checks are performed on the received frame
 - upon finding a destination address MAC match, the LBM frame is sent to the CFM process
- CFM loopback support on a physical ring port on the 2-port 10GigE (Ethernet) Adapter card/module differs from other Ethernet ports. For these ports, **cfm-loopback** is configured, optionally, using **dot1p** and **match-vlan** to create a list of up to 16 VLANs. The null VLAN is always applied. The CFM loopback

message will be processed if it does not contain a VLAN header, or if it contains a VLAN header with a VLAN ID that matches one in the configured **match-vlan** list.

- received LBM frames undergo no queuing or scheduling in the ingress direction
- at egress, loopback reply (LBR) frames are stored in their own queue; that is, a separate new queue is added exclusively for LBR frames
- users can configure the way a response frame is treated among other user traffic stored in network queues; the configuration options are high priority, low priority, or dot1p, where dot1p applies only to physical ring ports
- for network egress or access egress, where 4-priority scheduling is enabled:
 - high priority: either cir = port_speed, which applies to all frames that are scheduled via an expedited in-profile scheduler, or RR for all other (network egress queue) frames that reside in expedited queues and are in an in-profile state
 - low priority: either cir = 0, pir = port_speed, which applies to all frames that are scheduled via a best effort out-of-profile scheduler, or RR for all other frames that reside in best-effort queues and are in an out-of-profile state
- for the 8-port Gigabit Ethernet Adapter card, 10-port 1GigE/1-port 10GigE X-Adapter card, and the v-port on the 2-port 10GigE (Ethernet) Adapter card/module, for network egress, where 16-priority scheduling is enabled:
 - high priority: has higher priority than any user frames
 - low priority: has lower priority than any user frames
- for the physical ring ports on the 2-port 10GigE (Ethernet) Adapter card/module, which can only operate as network egress, the priority of the LBR frame is derived from the dot1p setting of the received LBM frame. Based on the assigned ring-type network queue policy, dot1p-to-queue mapping is handled using the same mapping rule that applies to all other user frames.
- the above queue parameters and scheduler mappings are all preconfigured and cannot be altered. The required QoS treatment is selected by enabling the CFM loopback and specifying **high-priority**, **low-priority**, or **dot1p**.

3.1.12 OAM propagation to attachment circuits

Typically, T1/E1 equipment at a site relies on the physical availability of the T1/E1 ports to determine the uplink capacity (that is, for ATM IMA or MLPPP groups). When a failure in the access link between the 7705 SAR and the associated T1/E1 equipment is detected, notification of the failure is propagated by the PW status signaling using one of two methods: label withdrawal or TLV (see [LDP status signaling](#)). In addition, the PW failure must also be propagated to the devices attached to the T1/E1 equipment. The propagation method depends on the type of port used by the access circuit (ATM, T1/E1 TDM, or Ethernet) and is described in the following sections.

3.1.12.1 ATM ports

Propagation of ATM PW failures to the ATM port is achieved through the generation of AIS and RDI alarms.

3.1.12.2 T1/E1 TDM ports

If a port on a 16-port T1/E1 ASAP Adapter card, 32-port T1/E1 ASAP Adapter card, or 2-port OC3/STM1 Channelized Adapter card is configured for CESoPSN VLL service, failure of the VLL forces a failure of the associated DS0s (timeslots). Because there can be $n \times$ DS0s bound to a CESoPSN VLL service as the attachment circuit, an alarm is propagated to the bound DS0s only. To emulate the failure, an "all 1s" or an "all 0s" signal is sent through the DS0s. The bit pattern can be configured to be either all 1s or all 0s. This is sometimes called "trunk conditioning".

3.1.12.3 Ethernet ports

For an Ethernet port-based Ethernet VLL, failure of the VLL forces a failure of the local Ethernet port. That is, the local attachment port is taken out of service at the physical layer and the Tx is turned off on the associated Ethernet port.

3.1.12.4 Pseudowire status signaling OAM propagation

See the 7705 SAR Services Guide for more information about frame relay and HDLC PW status signaling and OAM propagation.

3.1.13 LDP status signaling

The failure of a local circuit needs to be propagated to the far-end PE, which then propagates the failure to its attached circuits. The 7705 SAR can propagate failures over the PW using one of the following methods:

- LDP status via label withdrawal
- LDP status via TLV

3.1.13.1 LDP status via label withdrawal

Label withdrawal is negotiated during the PW status negotiation phase and must be supported by both the near-end and the far-end points. If the far end does not support label withdrawal, the 7705 SAR still withdraws the label in case the local attachment circuit is removed or shut down.

Label withdrawal occurs only when the attachment circuit is administratively shut down or deleted. If there is a failure of the attached circuit, the label withdrawal message is not generated.

When the local circuit is re-enabled after shutdown, the VLL must be re-established, which causes some delays and signaling overhead.

3.1.13.2 LDP status via TLV

Signaling PW status via TLV is supported as per RFC 4447. Signaling PW status via TLV is advertised during the PW capabilities negotiation phase. It is more efficient and is preferred over the label withdrawal method.

For cell mode ATM PWs, when an AIS message is received from the local attachment circuit, the AIS message is propagated to the far-end PE unaltered and PW status TLV is not initiated.

3.1.14 IP multicast debugging tools

This section describes multicast debugging tools for the 7705 SAR.

The debugging tools for multicast consist of three elements, which are accessed from the CLI <global> level:

- [Mtrace](#)
- [Mstat](#)
- [Mrinfo](#)

3.1.14.1 Mtrace

Assessing problems in the distribution of IP multicast traffic can be difficult. The multicast traceroute (mtrace) feature uses a tracing feature implemented in multicast routers that is accessed via an extension to the IGMP protocol. The mtrace feature is used to print the path from the source to a receiver; it does this by passing a trace query hop-by-hop along the reverse path from the receiver to the source. At each hop, information such as the hop address, routing error conditions, and packet statistics are gathered and returned to the requester.

Data added by each hop includes:

- query arrival time
- incoming interface
- outgoing interface
- previous hop router address
- input packet count
- output packet count
- total packets for this source/group
- routing protocol
- TTL threshold
- forwarding/error code

The information enables the network administrator to determine:

- the flow of the multicast stream
- where multicast flows stop

When the trace response packet reaches the first-hop router (the router that is directly connected to the source's network interface), that router sends the completed response to the response destination (receiver) address specified in the trace query.

If a multicast router along the path does not implement the mtrace feature or if there is an outage, no response is returned. To solve this problem, the trace query includes a maximum hop count field to limit the number of hops traced before the response is returned. This allows a partial path to be traced.

The reports inserted by each router contain not only the address of the hop, but also the TTL required to forward the packets and flags to indicate routing errors, plus counts of the total number of packets on the incoming and outgoing interfaces and those forwarded for the specified group. Examining the differences in these counts for two separate traces and comparing the output packet counts from one hop with the input packet counts of the next hop allows the calculation of packet rate and packet loss statistics for each hop to isolate congestion problems.

3.1.14.1.1 Finding the last-hop router

The trace query must be sent to the multicast router that is the last hop on the path from the source to the receiver. If the receiver is on the local subnet (as determined by the subnet mask), the default method is to send the trace query to all-routers.mcast.net (224.0.0.2) with a TTL of 1. Otherwise, the trace query is sent to the group address since the last-hop router will be a member of that group if the receiver is. Therefore, it is necessary to specify a group that the intended receiver has joined. This multicast query is sent with a default TTL of 64, which may not be sufficient for all cases.

When tracing from a multihomed host or router, the default receiver address may not be the required interface for the path from the source. In that case, the required interface should be specified explicitly as the receiver.

3.1.14.1.2 Directing the response

By default, mtrace first attempts to trace the full reverse path, unless the number of hops to trace is explicitly set with the hop option. If there is no response within a 3-s timeout interval, a "*" is displayed and the probing switches to hop-by-hop mode. Trace queries are issued starting with a maximum hop count of one and increasing by one until the full path is traced or no response is received. At each hop, multiple probes are sent. The first attempt is made with the unicast address of the host running mtrace as the destination for the response. Because the unicast route may be blocked, the remainder of attempts request that the response be sent to mtrace.mcast.net (224.0.1.32) with the TTL set to 32 more than what is needed to pass the thresholds seen so far along the path to the receiver. For the last attempts, the TTL is increased by another 32.

Alternatively, the TTL may be set explicitly with the TTL option.

For each attempt, if no response is received within the timeout, a "*" is displayed. After the specified number of attempts have failed, mtrace will try to query the next-hop router with a DVMRP_ASK_NEIGHBORS2 request (as used by the mrinfo feature) to determine the router type.

The output of mtrace is a short listing of the hops in the order they are queried, that is, in the reverse of the order from the source to the receiver. For each hop, a line is displayed showing:

- the hop number (counted negatively to indicate that this is the reverse path)
- the multicast routing protocol
- the threshold required to forward data (to the previous hop in the listing as indicated by the up-arrow character)
- the cumulative delay for the query to reach that hop (valid only if the clocks are synchronized)

The response ends with a line showing the round-trip time which measures the interval from when the query is issued until the response is received, both derived from the local system clock.

Mtrace/mstat packets use special IGMP packets with IGMP type codes of 0x1E and 0x1F.

3.1.14.2 Mstat

The mstat feature adds the capability to show the multicast path in a limited graphic display and indicates drops, duplicates, TTLs, and delays at each node. This information is useful to the network operator because it identifies nodes with high drop and duplicate counts. Duplicate counts are shown as negative drops.

The output of mstat provides a limited pictorial view of the path in the forward direction with data flow indicated by arrows pointing downward and the query path indicated by arrows pointing upward. For each hop, both the entry and exit addresses of the router are shown if different, along with the initial TTL required on the packet in order to be forwarded at this hop and the propagation delay across the hop assuming that the routers at both ends have synchronized clocks. The output consists of two columns, one for the overall multicast packet rate that does not contain lost/sent packets and the other for the (S,G)-specific case. The (S,G) statistics also do not contain lost/sent packets.

3.1.14.3 Mrinfo

The mrinfo feature is a simple mechanism to display the configuration information from the target multicast router. The type of information displayed includes the multicast capabilities of the router, code version, metrics, TTL thresholds, protocols, and status. This information can be used by network operators, for example, to verify if bidirectional adjacencies exist. When the specified multicast router responds, the configuration is displayed.

3.1.15 Microwave awareness performance monitoring statistics

A 7705 SAR-8 Shelf V2 or 7705 SAR-18 equipped with a Packet Microwave Adapter card provides the capability to collect the following Microwave Awareness (MWA) performance monitoring statistics for microwave radios:

- [G.826 statistics](#)
- [Radio power level statistics](#)
- [Adaptive coding and modulation statistics](#)

Performance monitoring can be enabled using the **config>port>mw>radio>perfmon** command. See the 7705 SAR Interface Configuration Guide, "Microwave Link Commands".

3.1.15.1 G.826 statistics

G.826 statistics include 15-min. and 24-hr performance statistics of a radio's microwave link. These statistics include background block errors (BBE), errored seconds (ES), severely errored seconds (SES), and unavailable seconds (UAS) as specified in ITU-T Recommendation G.826.

3.1.15.2 Radio power level statistics

Power level statistics include 15-min. and 24-hr performance statistics of a radio's received and transmit minimum, average, and maximum levels for over the period. The statistics are collected in units of A-weighted decibels (dBA).

3.1.15.3 Adaptive coding and modulation statistics

The radios can automatically adjust their mode of operation based on the atmospheric conditions. A radio's adaptive coding and modulation (ACM) function use its highest modulation (256 QAM) in ideal conditions to attain the highest bandwidth possible and automatically brings down the level of modulation (and therefore bandwidth over the air) as needed in inferior atmospheric conditions.

The collected ACM statistics include 15-min. and 24-hr statistics of the time spent at each QAM level for a radio. The statistics are collected in units of milliseconds.

3.2 Link measurement

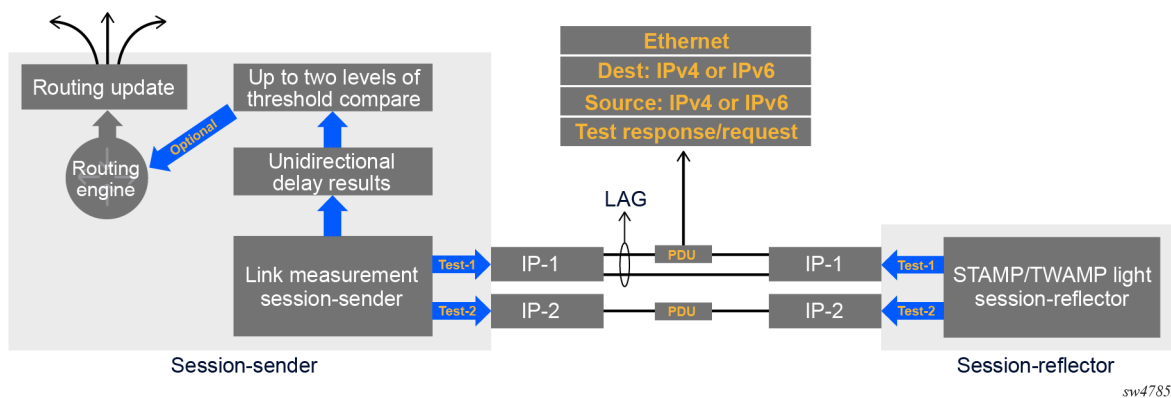
Link measurement reports IP interface delay measurements to the routing engine

Network elements use routing protocols to exchange information about local links, which can influence routing decisions. These interface attributes are typically static in nature. By using tools specifically designed to measure IP performance, dynamic unidirectional delay can be included in the advertised link attributes.

In link measurement, a single test session represents the IP interface. The test session is mapped to a single underlying Ethernet port. If the IP interface is configured over a single physical port, the results from this approach represent the connectivity between the directly connected IP peers.

The following figure shows directly connected IP interfaces and the link measurement interaction with routing.

Figure 26: Link measurement



Link measurement uses the last completed sample windows to determine whether a threshold event has occurred. If reporting is enabled, that threshold event is reported to the routing engine.

3.2.1 Interface assignment

The test criteria-specific link measurement configuration is under the link measurement template. Because the delay test is executed from the base router interface, a component of this configuration is required in the `config>router>interface>if-attribute>delay` context.

3.2.1.1 IP addressing

To enable dynamic measurements for the interface, the user must configure a link measurement template and enable the test protocol as either IPv4 or IPv6 in the **config>router>interface>if-attribute>delay>dynamic>twamp-light** context. The link measurement template does not include interface-specific requirements, such as the IP protocol encapsulating the test packet or IP source and destination addressing. Because of this, it is possible to enable the IPv4 or IPv6 protocol for link measurement without including any source or destination information.

When the IPv4 protocol is enabled with no addressing configured, the source address is automatically assigned to the primary IPv4 address of the IP interface. The destination address is automatically assigned if the primary IPv4 address has a prefix length of 30 or 31. In other cases, such as shorter prefix lengths or unnumbered interfaces, the destination address cannot be resolved and must be configured manually. The source and destination commands take precedence over the auto-assigned addressing; the IPv4 addresses must be unicast.

IPv4 auto-assigned addressing is not updated for operationally up interface delay tests when the IP addressing associated with that interface is changed. Nokia suggests the following options to update the auto-assigned addressing:

- administratively disable and enable the protocol used for the interface delay test
- disable and enable the IP interface under which the IP address has changed

When the IPv6 protocol is enabled without any source address, the system uses the link-local address associated with the interface as the source. If there is no destination address configured, the destination discovery process is initiated if the associated measurement template assigned to this interface has the **ipv6-destination-discovery** command enabled.

The source and destination can be globally routable unicast addresses of the link identifying the directly connected peers or the link local addresses connecting the peers. The link local address must follow the format fe80::/64, as described in RFC 4291, IP Version 6 Addressing Architecture.

TWAMP Light test packets consult the routing table to determine how to reach the destination. The test should be configured to use local IP interface source and directly connected IP peer interface destination addressing to ensure the packet egresses and returns over the same IP interface. The destination must be reachable from the IP interface where the interface delay test is configured. Using indirect IP addressing, such as unnumbered interfaces, does not guarantee that the measurement is reporting the delay for the expected interface.

Only one protocol, IPv4 or IPv6, can be enabled for an interface delay test at any time.

Interfaces defined as **loopback** do not support interface delay tests and are an invalid interface type. The configuration exists under these interfaces, but a detectable transmission error prevents the sending of packets.

The system interface does not support interface delay tests and the configuration is hidden.

3.2.1.2 Test initialization

When the link measurement template is assigned to an IP interface, the audit process determines the operational state of the test. The interface delay test transitions to operationally up if the following conditions are met:

- the associated measurement template is administratively enabled
- there is an administratively enabled test protocol configured for IPv4 or IPv6

- the system resources are available to start the test

Further validation determines if there are any underlying conditions that are considered detectable transmission errors, as listed in the following table.

Table 9: Detectable transmission errors

Detectable Tx error	Description	Prevents transmission
None	No detectable errors	No
interfaceDown	The link measurement test is configured on an IP interface with an operationally down state	Yes
UnexpectedError	Router resources not available	No
noRoute	The routing lookup has failed to resolve the destination as reachable from the interface where the test is configured. The packet is transmitted out of the interface resolved by the routing engine.	No
sourceIpNotLocal	The source IP address configured for the test is not local to the system	No
invalidDestIp	The destination IP address is not valid. This may occur because of a configuration error or an attempt to use auto assignment in conditions that are not supported.	Yes
invalidInterfaceType	The link measurement test is configured under an interface that does not support these test types (such as loopback interfaces)	Yes
sameSourceIpDestIp	A configuration error that indicates the source and destination IP addresses are the same	Yes

When all audit conditions successfully pass, the delay collection begins. When no thresholds values are configured, the test collects and stores delay information as history but does not report to the routing engine. If at least one threshold is configured, the interface enters the first report phase. Because no previous delay value has been reported, the first measurement window with a configured threshold that completes with integrity triggers the delay measurement report. After this benchmark is set, all subsequent thresholds use the last reported delay measurement for comparison.

3.2.1.3 History and results

Active interface delay tests retain 50 sample windows and 20 aggregate sample windows in history per entity or interface. After a CSM switchover, current measurement windows and historical results are lost; only the last reported delay measurement is maintained to retain a baseline. The interface does not enter the first reporting phase following a CSM switchover.

Several states exist to indicate the state of the measurement window:

- **InProgress**
The measurement window is open and collecting results.
- **Completed**
The delay test completed normally.
- **Terminated**
A configuration change to the measurement template being referenced, or an administrative action or system event caused the operational state to change to down, causing an abnormal termination.
- **SwReported**
The sample window has triggered a delay measurement last report.
- **AswReported**
The aggregate sample window has triggered a delay measurement last report.

3.2.1.4 Dynamic delay selection

The 7705 SAR supports the configuration of delay measurement, and provides a configuration option to determine precedence. The dynamic delay measurements use the link measurement templates and interface delay test packets to gather results.

The delay selection, configured using the **delay-selection** command can be configured as **dynamic** or **dynamic-preferred**.

3.2.1.5 Displaying interface delay tests

Use the **show>test-oam>link-meas>interface** command with the **detail**, **aggregate**, **sample**, or **debug-counters** options to display the interface-specific delay test information, including:

- operational data
- reporting information
- historical results for sample and aggregate sample windows
- count of unexpected conditions for response packets

Use the **show>test-oam>link-meas>interfaces** command to report a list of all interfaces configured with link measurement. The report includes all the basic operational summaries, including:

- interface name
- operational state
- protocol
- errors
- reporting

- delay metric of interest
- last delay
- timestamp of the last delay

3.2.2 Link measurement template

Link measurement templates are configured in the **config>test-oam>link-measurement** context. After a template is created, it can be referenced using the **config>router> interface>if-attribute>delay>dynamic>measurement-template** command.

When the association between the interface and the template is established, the system executes a process to determine the operational state of the test and detect any defect conditions that may prevent proper test execution. Assuming no underlying conditions are present, IP interface delay measurements are collected in measurement windows and compared to configured thresholds. When necessary, the measurements are reported to the routing engine for further processing.

The **measurement-template** context contains the command options that define the test criteria used by the interface test. Conceptually, the test criteria are divided into the following groups:

- [General configuration](#)
- [Collection and reporting](#)
- [Protocol](#)

3.2.2.1 General configuration

General configuration command options influence probe frequency, the delay metric type to monitor, and retention of the delay measurement last reported.

The notification process uses the **reporting** command and threshold configurations.

By default, reporting is enabled and the routing engine is informed of threshold events. At least one threshold must be configured to report to the routing engine. When reporting is disabled, test sessions still function, but threshold events are not reported to the routing engine. If this value is toggled when there is a previously reported delay value, the reported value is cleared and the process returns to the initial reporting phase.

The probe frequency, configured using the **interval** command, defines the transmission rate of the test packet.

The **delay** command configures the delay metric that is used for comparison against any configured thresholds. This metric is the same for both the sample window and aggregate sample window.

The **unidirectional-measurement** command specifies the method used to compute the unidirectional delay. If the clock synchronization between nodal clocks used by the OAM timestamp function is not synchronized to near exact accuracy, the **derived** option must be used. Specifying this option calculates the unidirectional measurement using the roundtrip delay divided by two computation. If synchronization can meet near exact accuracy, the **actual** option can be used. Specifying this option calculates the forward delay using the forward direction timestamps, T2-T1 computation.

When the operational state of the link measurement test transitions to down, the OAM function instructs the routing engine to clear the last reported delay value at the expiration of an aging timer configured with the **last-reported-delay-hold** command. The last reported delay value is considered valid for the duration of

this period. If the operational state returns to up before the timer expires, the previous value is not cleared and the counter is reset to until the next operational down event.

The operation state for the interface delay test is determined by administrative actions and system events. The administrative events that determine the operational state are:

- administratively disabling the measurement template associated with the interface
- administratively disabling the active IP protocol that is being used to generate the test packet under the **config>router>if>if-attribute>delay>dynamic** context

The resource issue system events that drive the operational state are:

- unavailability of the UDP port
- internal errors

The aging timer does not begin a countdown for failure conditions that do not affect the interface delay test operational state. The delay measurement last reported is maintained when conditions external to the interface delay test, such as fault conditions on the port, IP interface, routing changes, and so on, occur. If the **last-reported-delay-hold** is set to zero, previously reported delay values from that test are cleared immediately when the operational state changes to down.

3.2.2.2 Collection and reporting

The collection and reporting options define the length of the sample window and aggregate sample window, and the thresholds that trigger reporting. Two measurement windows are provided to support use cases that require a reporting hierarchy. Both measurement windows include the same configuration options. The threshold values determine when the measurement window can update the reported delay value.

The measurement windows use the **multiplier** command to determine the length of time the window remains open. The sample window length is a multiple of the interval. This window stores the results of individual test probes for a total length of the **interval** multiplied by the **multiplier** value. The aggregate sample window multiplier length is the number of sample windows collected to form the aggregate. This window stores the number of results passed from individual sample windows. In the aggregate sample window, the calculations are based on the following results received from the sample window:

- minimum - the minimum value for all average values received
- maximum - the maximum value for all average values received
- average - the average of all the average values received

The comparison to thresholds and reporting decisions occur at the end of the measurement window if it completes without termination and is deemed integral based on the **window-integrity** command configuration. The window integrity function is a percentage-based calculation that determines the number of samples that must be present in the measurement window for that window to be considered integral. If the number of samples in the window equals or exceeds the required number of samples, the result produced is treated as representative and follows normal post-measurement window processing. However, if the number of samples in the window does not achieve integrity, the result is not considered representative. Non-representative results are only recorded for historical purposes but are otherwise ignored and not processed. By default, integrity checking is disabled, and all results from a measurement window are treated as integral and compared to the configured thresholds from the packet-count perspective.

There are two types of thresholds:

- a microsecond increase or decrease, configured using the **absolute** command

- a percentage increase or decrease, configured using the **relative** command

At the end of a successful (completed) measurement window, the measurement window results are compared to the last delay measurement results reported. Reporting is on a per-threshold, per-measurement window basis. If multiple thresholds are reached for a completed measurement window, only one threshold triggers an update to the routing engine. The reporting trigger is recorded with a structure of <Window"Threshold"threshold>. For example, SampleThresholdAbsolute indicates that the absolute threshold in the sample window triggered the report. The report is accompanied by a timestamp and the last reported value. When a sample window triggers a new delay measurement, the current aggregate sample window is restarted, preempting any possible reporting from the aggregate sample window. This allows both measurement window types to use the last reported delay measurement as the new benchmark.

Configuration of the measurement windows depends on the specific solution requirements. The two measurement windows collect information regardless of configured thresholds. Both types of measurement windows support their own threshold and integrity configuration. By default, thresholds for both measurement windows are disabled; that is, neither window can report any values to the routing engine.

3.2.2.3 Protocol

TWAMP light or STAMP PDU test packet formats are available to gather IP link measurement delay information. When a link measurement request is made, the session-reflector, responds to the request.

A reflector must be configured on the peer with a **type** of either TWAMP light or STAMP to instruct the handling of link measurement packets. When configured for TWAMP light, the reflector processes test packets as TWAMP Light packets. When configured for STAMP, the reflector processes STAMP or TWAMP light packets provided the padding of the TWAMP Light PDU does not conflict with the mandatory STAMP Flags Field. A TWAMP light PDU can be treated as a STAMP PDU if it is at least 44 bytes with 28 zero MBZ bytes after SSID (from byte 17), and if longer, if the first TLV flags byte (byte 45) is 0x80.

The TWAMP Light test packet was first introduced to support the Network Time Protocol (NTP) timestamp encoding in the packet. Updates since the initial standardization of TWAMP Light support the use of the truncated Precision Time Protocol (PTP) timestamp format. A bit in the TWAMP Light test packet header is repurposed to indicate the timestamp format encoded by the Session-Reflector.

3.2.2.4 Modifying measurement template configuration

It is possible to modify the configuration of active measurement templates without first administratively disabling the template. However, modifying most existing options will cause any interface delay tests that were referencing the modified template to terminate the current sample and aggregate sample windows and start new measurement windows using the updated template options. All previous results are maintained in the history, but the State field of the current measurement window coinciding with the change indicates "Terminated". Modifying a description or the **last-reported-delay-hold** configuration does not cause a termination of the current sample and aggregate sample windows.

A measurement template cannot be removed if interfaces are referencing that template.

3.3 OAM Performance Monitoring

OAM Performance Monitoring (OAM-PM) provides an architecture for gathering and computing Key Performance Indicators (KPIs) using standard protocols and a robust collection model. The architecture consists of the following foundational components:

- **Session**

This is the overall collection of different tests, test options, measurement intervals, and mappings to configured storage models. It is the overall container that defines the attributes of the session.

- **Standard PM Packets**

These are the protocols defined by various standards bodies, which contain 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)**

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

- **Data Structures**

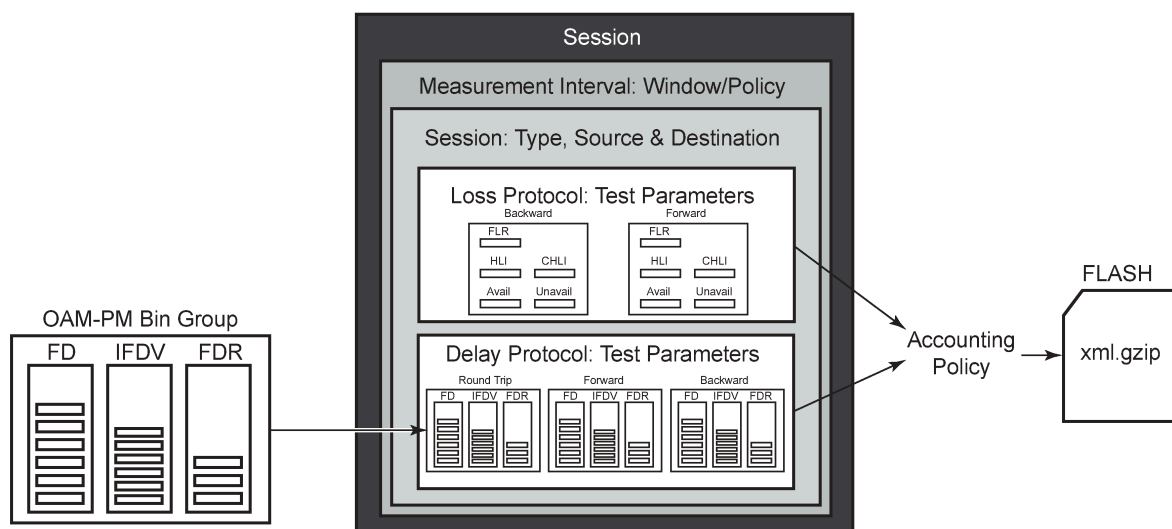
These are the unique counters and measurement results that represent the specific protocol.

- **Bin Group**

These are ranges in microseconds that count the results that fit into the range.

The following figure shows the hierarchy of the architecture. This figure is only meant to show the relationship between the components. It is not meant to depict all details of the required options.

Figure 27: OAM-PM architecture hierarchy



al_0386

OAM-PM configurations are not dynamic environments. All aspects of the architecture must be carefully considered before configuring the various architectural components, making external references to

other related components, or activating the OAM-PM architecture. No modifications are allowed to any components that are active or have any active sub-components. Any function being referenced by an active OAM-PM function or test cannot be modified or disabled. For example, to change any configuration element of a session, all active tests must be in a disabled state. To change any bin group configuration (described later in this section), all sessions that reference the bin group must have every test disabled. The **description** option is the only exception to this rule.

Session source and destination configuration options are not validated by the test that uses that information. When the test is activated using the following command, the test engine attempts 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.

- ```
configure oam-pm session ip twamp-light no shutdown
```

If the entity does not exist, the transmit count for the test is zero.

OAM-PM is not a hitless operation. If a high availability event occurs that causes the backup CPM or CPIOM to become the active CPM or CPIOM, or when ISSU functions are performed, the test data is not correctly reported. There is no synchronization of state between the active and the backup control modules. All OAM-PM statistics stored in volatile memory is lost. When the reload or high availability event is completed and all services are operational, the OAM-PM functions commence.

It is possible that during times of network convergence, high CPU utilizations, or contention for resources, OAM-PM may not be able to detect changes to an egress connection or allocate the necessary resources to perform its tasks.

### 3.3.1 Session

The session is the overall collection of test information fields. The container defines the attributes of the session. The fields are as follows:

- **session type**

The impetus of the test, which is either proactive (default) or on-demand. Individual test timing options are influenced by this setting. A proactive session starts immediately following the execution of the following **no shutdown** command for the test:

A proactive test continues to execute until being administratively disabled, which stops the individual test. All previous memory allocated to the test session is cleared when the new memory is allocated during the administrative enabling. Any results not collected from volatile memory are permanently lost. On-demand tests also start immediately following the administrative enabling. However, the user can override the default, which is no test duration, and configure a fixed amount of time that the test executes, up to 24 hours (86 400 seconds).

If an on-demand test is configured with a test duration, it is important to disable tests when they are completed. In the event of a high availability event causing the backup CPM or CPIOM to become the active CPM or CPIOM, all on-demand tests that have a test duration statement restart and run for the configured amount of time regardless of their progress on the previously active CPM or CPIOM.

- **test family**

The main branch of testing that addresses a specific technology. The available test types and the technology-specific configuration under the session are based on the test family. Each of the test types requires a test ID as part of the configuration.

- **test options**

The options included in individual tests, as well as the associated options including start and stop times and the ability to activate and deactivate the individual test.

- **measurement interval**

The assignment of collection windows to the session with the appropriate configuration options 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 together. If any aspects of the session are incomplete, the individual test cannot be activated and an "Invalid Ethernet session parameters" error occurs.

### 3.3.2 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.

### 3.3.3 Measurement intervals

A measurement interval is a window of time that compartmentalizes the gathered measurements for an individual test that has 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 user is executing multiple delay and loss tests under a single session, multiple measurement intervals are allocated, with one interval allocated per criteria per test.

Measurement intervals can be 1 minute (**1-min**), 5 minutes (**5-mins**), 15 minutes (**15-mins**), 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-relative** 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 starts at zero, in relation to the length.

When a boundary is clock-aligned and an offset is configured, the specified amount of time is 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 lists examples of the start times of each measurement interval.

*Table 10: Measurement interval start times*

| Offset      | 1-min           | 5-min           | 15-min         | 1-hour                | 1-day                 |
|-------------|-----------------|-----------------|----------------|-----------------------|-----------------------|
| 0 (default) | 0, 1, 2, 3, ... | 0, 5, 10, 15... | 00, 15, 30, 45 | 00 (top of the hour)  | midnight              |
| 10 minutes  | rejected        | rejected        | 10, 25, 40, 55 | 10 min after the hour | 10 min after midnight |
| 30 minutes  | rejected        | rejected        | rejected       | 30 min after the hour | 30 min after midnight |

| Offset     | 1-min    | 5-min    | 15-min   | 1-hour   | 1-day    |
|------------|----------|----------|----------|----------|----------|
| 60 minutes | rejected | rejected | 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 use test-aligned boundaries. On-demand tests are typically used for troubleshooting or short term monitoring that does not require alignment or comparison to other PM data.

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 have different defaults and ranges. The **intervals-stored** command 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.

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. Intervals indexes in CLI are renumbered from 1 to the number of intervals stored. Including the interval-number allows for the inspection of stored results, 1 being the active or most recently completed if there are not active test running, 2 would produce the results of the next most recent. The index values continue to the number of results stored in volatile memory.

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 or CPIOM switch flushes the results that are in volatile memory. Another consideration is the large amount of system memory consumed using this type of model. Considering 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, the indexing changes to maintain the relative position to the current run. Correct spacing of the collection is key to ensuring data integrity.



**Note:** Any interval that does not divide evenly into the length of the measurement interval duration may cause packet counts that are one higher or one lower than expected.

The following table describes the keywords and MIB references contained in the OAM-PM XML file.

Table 11: OAM-PM XML keywords and MIB reference

| XML file keyword                               | Description                                     | TIMETRA-OAM-PM-MIB object                  |
|------------------------------------------------|-------------------------------------------------|--------------------------------------------|
| oampm                                          | —                                               | None - header only                         |
| <b>Keywords shared by all OAM-PM protocols</b> |                                                 |                                            |
| sna                                            | OAM-PM session name                             | tmnxOamPmCfgSessName                       |
| mi                                             | Measurement Interval record                     | None - header only                         |
| dur                                            | Measurement Interval duration (minutes)         | tmnxOamPmCfgMeasIntvlDuration (enumerated) |
| ivl                                            | measurement interval number                     | tmnxOamPmStsIntvlNum                       |
| sta                                            | Start timestamp                                 | tmnxOamPmStsBaseStartTime                  |
| ela                                            | Elapsed time in seconds                         | tmnxOamPmStsBaseElapsedTime                |
| ftx                                            | Frames sent                                     | tmnxOamPmStsBaseTestFramesTx               |
| frx                                            | Frames received                                 | tmnxOamPmStsBaseTestFramesRx               |
| sus                                            | Suspect flag                                    | tmnxOamPmStsBaseSuspect                    |
| <b>TLD</b>                                     | <b>TWAMP Light Delay Record</b>                 | None - header only                         |
| mdr                                            | minimum frame delay, round-trip                 | tmnxOamPmStsDelayTwl2wyMin                 |
| xdr                                            | maximum frame delay, round-trip                 | tmnxOamPmStsDelayTwl2wyMax                 |
| adr                                            | average frame delay, round-trip                 | tmnxOamPmStsDelayTwl2wyAvg                 |
| mdf                                            | minimum frame delay, forward                    | tmnxOamPmStsDelayTwlFwdMin                 |
| xdf                                            | maximum frame delay, forward                    | tmnxOamPmStsDelayTwlFwdMax                 |
| adf                                            | average frame delay, forward                    | tmnxOamPmStsDelayTwlFwdAvg                 |
| mdb                                            | minimum frame delay, backward                   | tmnxOamPmStsDelayTwlBwdMin                 |
| xdb                                            | maximum frame delay, backward                   | tmnxOamPmStsDelayTwlBwdMax                 |
| adb                                            | average frame delay, backward                   | tmnxOamPmStsDelayTwlBwdAvg                 |
| mvr                                            | minimum inter-frame delay variation, round-trip | tmnxOamPmStsDelayTwl2wyMin                 |
| xvr                                            | maximum inter-frame delay variation, round-trip | tmnxOamPmStsDelayTwl2wyMax                 |

| XML file keyword | Description                                        | TIMETRA-OAM-PM-MIB object  |
|------------------|----------------------------------------------------|----------------------------|
| avr              | average inter-frame delay variation, round-trip    | tmnxOamPmStsDelayTwl2wyAvg |
| mvf              | minimum inter-frame delay variation, forward       | tmnxOamPmStsDelayTwlFwdMin |
| xvf              | maximum inter-frame delay variation, forward       | tmnxOamPmStsDelayTwlFwdMax |
| avf              | average inter-frame delay variation, forward       | tmnxOamPmStsDelayTwlFwdAvg |
| mvb              | minimum inter-frame delay variation, backward      | tmnxOamPmStsDelayTwlBwdMin |
| xvb              | maximum inter-frame delay variation, backward      | tmnxOamPmStsDelayTwlBwdMax |
| avb              | average inter-frame delay variation, backward      | tmnxOamPmStsDelayTwlBwdAvg |
| mrr              | minimum frame delay range, round-trip              | tmnxOamPmStsDelayTwl2wyMin |
| xrr              | maximum frame delay range, round-trip              | tmnxOamPmStsDelayTwl2wyMax |
| arr              | average frame delay range, round-trip              | tmnxOamPmStsDelayTwl2wyAvg |
| mrf              | minimum frame delay range, forward                 | tmnxOamPmStsDelayTwlFwdMin |
| xrf              | maximum frame delay range, forward                 | tmnxOamPmStsDelayTwlFwdMax |
| arf              | average frame delay range, forward                 | tmnxOamPmStsDelayTwlFwdAvg |
| mrbb             | minimum frame delay range, backward                | tmnxOamPmStsDelayTwlBwdMin |
| xrb              | maximum frame delay range, backward                | tmnxOamPmStsDelayTwlBwdMax |
| arb              | average frame delay range, backward                | tmnxOamPmStsDelayTwlBwdAvg |
| 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         |

| XML file keyword | Description                                                                                                                                                                                                                                                | TIMETRA-OAM-PM-MIB object                                                                             |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 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.<br><br>Note that the session_name, interval_duration, interval_number, {fd, fdr, ifdv}, bin_number, and {forward, backward, round-trip} indexes are all provided by the surrounding XML context. | tmnxOamPmStsDelayTwlBinFwdCount<br>tmnxOamPmStsDelayTwlBinBwdCount<br>tmnxOamPmStsDelayTwlBin2wyCount |
| <b>TLL</b>       | <b>TWAMP Light Loss Record</b>                                                                                                                                                                                                                             | None - header only                                                                                    |
| txf              | Transmitted frames in the forward direction                                                                                                                                                                                                                | tmnxOamPmStsLossTwlTxFwd                                                                              |
| rxfr             | Received frames in the forward direction                                                                                                                                                                                                                   | tmnxOamPmStsLossTwlRxFwd                                                                              |
| txb              | Transmitted frames in the backward direction                                                                                                                                                                                                               | tmnxOamPmStsLossTwlTxBwd                                                                              |
| rxbr             | Received frames in the backward direction                                                                                                                                                                                                                  | tmnxOamPmStsLossTwlRxBwd                                                                              |
| avf              | Available count in the forward direction                                                                                                                                                                                                                   | tmnxOamPmStsLossTwlAvailIndFwd                                                                        |
| avb              | Available count in the backward direction                                                                                                                                                                                                                  | tmnxOamPmStsLossTwlAvailIndBwd                                                                        |
| uvf              | Unavailable count in the forward direction                                                                                                                                                                                                                 | tmnxOamPmStsLossTwlUnavlIndFwd                                                                        |
| uvb              | Unavailable count in the backward direction                                                                                                                                                                                                                | tmnxOamPmStsLossTwlUnavlIndBwd                                                                        |
| uaf              | Undetermined available count in the forward direction                                                                                                                                                                                                      | tmnxOamPmStsLossTwlUndtAvlFwd                                                                         |
| uab              | Undetermined available count in the backward direction                                                                                                                                                                                                     | tmnxOamPmStsLossTwlUndtAvlBwd                                                                         |
| uuf              | Undetermined unavailable count in the forward direction                                                                                                                                                                                                    | tmnxOamPmStsLossTwlUndtUnavlFwd                                                                       |
| uub              | Undetermined unavailable count in the backward direction                                                                                                                                                                                                   | tmnxOamPmStsLossTwlUndtUnavlBwd                                                                       |
| hlf              | Count of HLIs in the forward direction                                                                                                                                                                                                                     | tmnxOamPmStsLossTwlHliFwd                                                                             |
| hlb              | Count of HLIs in the backward direction                                                                                                                                                                                                                    | tmnxOamPmStsLossTwlHliBwd                                                                             |
| chf              | Count of CHLIs in the forward direction                                                                                                                                                                                                                    | tmnxOamPmStsLossTwlChliFwd                                                                            |
| chb              | Count of CHLIs in the backward direction                                                                                                                                                                                                                   | tmnxOamPmStsLossTwlChliBwd                                                                            |

| XML file keyword | Description                           | TIMETRA-OAM-PM-MIB object    |
|------------------|---------------------------------------|------------------------------|
| mff              | minimum FLR in the forward direction  | tmnxOamPmStsLossTwlMinFlrFwd |
| xff              | maximum FLR in the forward direction  | tmnxOamPmStsLossTwlMaxFlrFwd |
| aff              | average FLR in the forward direction  | tmnxOamPmStsLossTwlAvgFlrFwd |
| mfb              | minimum FLR in the backward direction | tmnxOamPmStsLossTwlMinFlrBwd |
| xfb              | maximum FLR in the backward direction | tmnxOamPmStsLossTwlMaxFlrBwd |
| afb              | average FLR in the backward direction | tmnxOamPmStsLossTwlAvgFlrBwd |

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 the **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 user may clear the contents of the raw measurement interval and flush stale statistical data to look at current conditions. This measurement interval has no configuration options, cannot be written to flash memory, and cannot be disabled; it is a single never-ending window.

Memory allocation for the measurement intervals is performed when the test is configured. Volatile memory is not flushed until the test is deleted from the configuration; a high availability event causes the backup CPM or CPIOM to become the newly active CPM or CPIOM, or some other event clears the active CPM or CPIOM system memory. Disabling 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 is set to true only under the following conditions:

- The time-of-day clock is adjusted by more than 10 seconds.
- The 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.
- The test is 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 events for measurement intervals that executed during the time that relates to the specific interruption or condition. Because each measurement interval contains a start and stop time, the information is readily available for higher-level systems to discount the specific windows of time.



### 3.3.4 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 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.

Unidirectional and round-trip results are stored for each delay metric. The delay metrics are as follows:

- **Frame Delay**

Frame Delay (FD) is the amount of time required to send and receive the packet.

- **InterFrame Delay Variation**

InterFrame Delay Variation (IFDV) is the difference in the delay metrics between two adjacent packets.

- **Frame Delay Range**

Frame Delay Range (FDR) is the difference between the minimum frame delay and the individual packet.

- **Mean Frame Delay**

Mean Frame Delay (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 are not representative. In one direction, the measurement is artificially increased by the difference in the clocks. In the other direction, the measurement is 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, because the four timestamps allow for accurate representation of the round-trip delay. The mathematical computation removes remote processing and any difference in time-of-day clocking. Round-trip measurements do require stable local time-of-day clocks.

Any delay metric that is negative is 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 report Frame Loss Ratio (FLR) and availability information. FLR 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. FLR 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.

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 does not complete until the declaration has occurred. Typically, standard bodies indicate the timeout per packet.

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 FLRs exceeding the configured acceptable limit. A HLI is any single small window that exceeds the configured FLR. This could equate to a severely errored second, assuming the small window is one second in length. A CHIL is a consecutive high loss interval that exceeds a consecutive threshold within the sliding window. Only one HLI is counted for a window.

### 3.3.5 Bin groups

Bin groups are templates that are referenced by the session. Three types of binnable delay metric types 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 captures all frame delay statistics results between 0 and 1 ms. Bin 1 captures all results above 1 ms and below the bin 2 lower boundary. The last bin configured represents the bin that collects all the results at and above that value. Not all ten bins have to be configured.

Each binnable delay metric type requires their own values for the bin groups. Each bin in a type is configurable for one value. It is not possible to configure a bin with different values for round-trip, forward, and backward. Consider the configuration of the boundaries that represent the important statistics for that specific service.

As stated earlier in this section, this is not a dynamic environment. If a bin group is being referenced by any active test, the bin group cannot be disabled. To modify the bin group, a user must disable the bin group. 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 options can be considered to reduce the maintenance window. To modify any session parameter, every test in the session must be disabled.

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.

Use the following command to show bin-group 1 information.

```
show oam-pm bin-group 1
```

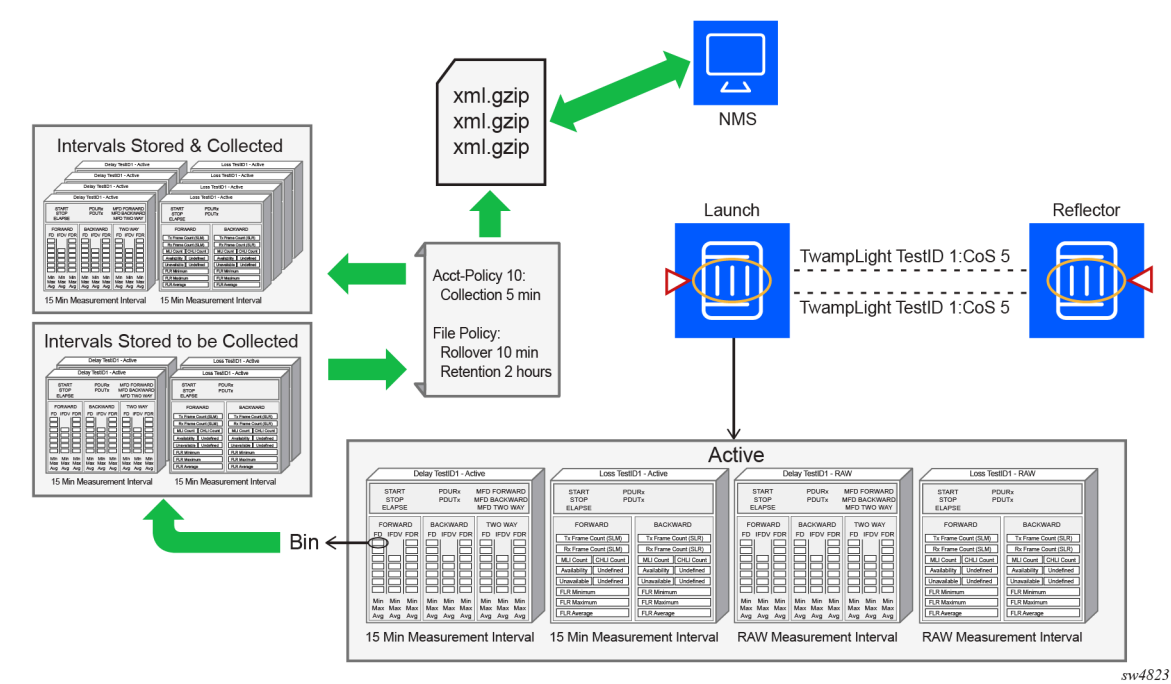
Example: Bin group 1 configuration output

| Configured Lower Bounds for Delay 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  | -       | -        |

3.3.6 Relating the components

The following figure shows the architecture of all of the OAM-PM concepts previously discussed. 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.

Figure 28: Relating OAM-PM components



3.3.7 Monitoring

The following configuration examples demonstrate the show and monitoring commands available to check OAM-PM.

### 3.3.7.1 Accounting policy configuration

The following example displays the accounting policy configuration.

#### Example

```
A:node-2>config>log# info

 file-id 1
 description "OAM PM XML file Parameters"
 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

```

### 3.3.7.2 OAM-PM configuration

#### Example

```
*A:7705:Dut-A# configure oam-pm
*A:7705:Dut-A>config>oam-pm# info

 bin-group 100 fd-bin-count 10 fdr-bin-count 10 ifdv-bin-count 10 create
 no shutdown
 exit
 bin-group 101 fd-bin-count 10 fdr-bin-count 10 ifdv-bin-count 10 create
 no shutdown
 exit
 session "sess1" test-family ip session-type proactive create
 bin-group 100
 meas-interval 5-mins create
 boundary-type test-relative
 exit
 meas-interval 15-mins create
 boundary-type test-relative
 exit
 meas-interval 1-hour create
 boundary-type test-relative
 exit
 meas-interval 1-day create
 boundary-type test-relative
 exit
 ip
 dest-udp-port 64364
 destination 10.10.1.2
 profile in
 source 10.10.1.1
 twamp-light test-id 1 create
 interval 100
 no shutdown
```

```

 exit
 exit
exit
session "demand_1" test-family ip session-type on-demand create
 bin-group 101
 meas-interval 5-mins create
 boundary-type test-relative
 exit
 meas-interval 15-mins create
 boundary-type test-relative
 exit
 meas-interval 1-hour create
 boundary-type test-relative
 exit
 meas-interval 1-day create
 boundary-type test-relative
 exit
ip
 dest-udp-port 64364
 destination 10.10.1.2
 profile in
 source 10.10.1.1
 twamp-light test-id 2 create
 interval 100
 no shutdown
 exit
exit
exit
exit

*A:7705:Dut-A>config>oam-pm#
*A:7705:Dut-A>config>oam-pm#
```

3.3.7.3 Show and monitor commands

Use the following command to display the configuration data for all OAM Performance Monitoring bin groups.

```
show oam-pm bin-group
```

Example: Bin groups data output

|                                                          |                                |           |   |        |         |          |
|----------------------------------------------------------|--------------------------------|-----------|---|--------|---------|----------|
| -----                                                    |                                |           |   |        |         |          |
| Configured Lower Bounds for Delay 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.

```

Use the following command to display configuration data for a specific OAM Performance Monitoring bin group.

```
show oam-pm bin-group 2
```

### Example: Data for a specific bin group output

```

Configured Lower Bounds for Delay 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

```

Use the following command to display the list of sessions configured against one or all OAM Performance Monitoring bin groups.

```
show oam-pm bin-group-using
```

### Example: Bin group configuration for sessions output

```
=====
OAM Performance Monitoring Bin Group Configuration for Sessions
=====
Bin Group Admin Session Session State

2 Up eth-pm-service-4 Act
=====
```

Use the following command to display a session configured for a specific OAM Performance Monitoring bin group session.

```
show oam-pm bin-group-using bin-group 2
```

### Example: Specific bin group session configuration output

```
=====
OAM Performance Monitoring Bin Group Configuration for Sessions
=====
Bin Group Admin Session Session State

2 Up eth-pm-service-4 Act
=====
```

```

=====
```

Use the following command to display sessions that match a specific test family type.

```
show oam-pm sessions test-family ethernet
```

### Example: Ethernet test family output

```
=====
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 TWL
=====
```

Use the following command to display the configuration and status information for a specific OAM Performance Monitoring session.

```
show oam-pm session "sess1" bin-group
```

### Example: Basic session configuration output

```

Configured Lower Bounds for Delay Tests, in microseconds

Group Description Admin Bin FD(us) FDR(us) IFDV(us)

100 Up 0 0 0 0
 1 5000 5000 5000
 2 10000 10000 10000
 3 15000 15000 15000
 4 20000 20000 20000
 5 25000 25000 25000
 6 30000 30000 30000
 7 35000 35000 35000
 8 40000 40000 40000
 9 45000 45000 45000

Bins Excluded from Average

Bin Type Direction Bins

Bins Excluded from Delay Event Count

Bin Type Direction Lowest Excluded Bin Lower Bound (us)


```

Use the following command to display the delay statistics for the specified test using the options specified.

```
show oam-pm statistics session "sess1" twamp-light meas-interval 15-mins interval-number 2
```

**Example: Delay statistics output**

```

Start (UTC) : 2026/04/28 13:32:06 Status : completed
Elapsed (seconds) : 900 Suspect : no
Frames Sent : 9000 Frames Received : 9000

```

```

=====
TWAMP-LIGHT DELAY STATISTICS

```

| Bin Type | Direction  | Minimum (us) | Maximum (us) | Average (us) | EfA |
|----------|------------|--------------|--------------|--------------|-----|
| FD       | Forward    | 0            | 25           | 0            | no  |
| FD       | Backward   | 0            | 1236         | 765          | no  |
| FD       | Round Trip | 3            | 8            | 4            | no  |
| FDR      | Forward    | 0            | 25           | 0            | no  |
| FDR      | Backward   | 0            | 880          | 427          | no  |
| FDR      | Round Trip | 0            | 5            | 1            | no  |
| IFDV     | Forward    | 0            | 6            | 0            | no  |
| IFDV     | Backward   | 0            | 25           | 0            | no  |
| IFDV     | Round Trip | 0            | 4            | 0            | no  |

```

EfA = yes: one or more bins configured to be Excluded from the Average calc.

```

```

Frame Delay (FD) Bin Counts

```

| Bin | Lower Bound | Forward | Backward | Round Trip |
|-----|-------------|---------|----------|------------|
| 0   | 0 us        | 9000    | 9000     | 9000       |
| 1   | 5000 us     | 0       | 0        | 0          |
| 2   | 10000 us    | 0       | 0        | 0          |
| 3   | 15000 us    | 0       | 0        | 0          |
| 4   | 20000 us    | 0       | 0        | 0          |
| 5   | 25000 us    | 0       | 0        | 0          |
| 6   | 30000 us    | 0       | 0        | 0          |
| 7   | 35000 us    | 0       | 0        | 0          |
| 8   | 40000 us    | 0       | 0        | 0          |
| 9   | 45000 us    | 0       | 0        | 0          |

```

Frame Delay Range (FDR) Bin Counts

```

| Bin | Lower Bound | Forward | Backward | Round Trip |
|-----|-------------|---------|----------|------------|
| 0   | 0 us        | 9000    | 9000     | 9000       |
| 1   | 5000 us     | 0       | 0        | 0          |
| 2   | 10000 us    | 0       | 0        | 0          |
| 3   | 15000 us    | 0       | 0        | 0          |
| 4   | 20000 us    | 0       | 0        | 0          |
| 5   | 25000 us    | 0       | 0        | 0          |
| 6   | 30000 us    | 0       | 0        | 0          |
| 7   | 35000 us    | 0       | 0        | 0          |
| 8   | 40000 us    | 0       | 0        | 0          |
| 9   | 45000 us    | 0       | 0        | 0          |

```

Inter-Frame Delay Variation (IFDV) Bin Counts

```

| Bin | Lower Bound | Forward | Backward | Round Trip |
|-----|-------------|---------|----------|------------|
|-----|-------------|---------|----------|------------|



```

0 0 us 8999 8999 8999
1 5000 us 0 0 0
2 10000 us 0 0 0
3 15000 us 0 0 0
4 20000 us 0 0 0
5 25000 us 0 0 0
6 30000 us 0 0 0
7 35000 us 0 0 0
8 40000 us 0 0 0
9 45000 us 0 0 0

=====
TWAMP-LIGHT LOSS STATISTICS: NONE
=====

```

Use the following command to display the delay statistics for the specified test using the options specified.

```
show oam-pm statistics session "sess1" twamp-light meas-interval raw
```

### Example: Delay statistics output

```

Start (UTC) : 2026/04/28 13:32:06 Status : in-progress
Elapsed (seconds) : 1530 Suspect : yes
Frames Sent : 15307 Frames Received : 15307

=====
TWAMP-LIGHT DELAY STATISTICS
=====

Bin Type Direction Minimum (us) Maximum (us) Average (us) EfA

FD Forward 0 121 23 no
FD Backward 0 1236 453 no
FD Round Trip 3 8 4 no
FDR Forward 0 121 23 no
FDR Backward 0 880 254 no
FDR Round Trip 0 5 1 no
IFDV Forward 0 6 0 no
IFDV Backward 0 25 0 no
IFDV Round Trip 0 4 0 no

EfA = yes: one or more bins configured to be Excluded from the Average calc.

Frame Delay (FD) Bin Counts

Bin Lower Bound Forward Backward Round Trip

0 0 us 15319 15319 15319
1 5000 us 0 0 0
2 10000 us 0 0 0
3 15000 us 0 0 0
4 20000 us 0 0 0
5 25000 us 0 0 0
6 30000 us 0 0 0
7 35000 us 0 0 0
8 40000 us 0 0 0
9 45000 us 0 0 0

```

| -----                                         |             |         |          |            |
|-----------------------------------------------|-------------|---------|----------|------------|
| Frame Delay Range (FDR) Bin Counts            |             |         |          |            |
| -----                                         |             |         |          |            |
| Bin                                           | Lower Bound | Forward | Backward | Round Trip |
| -----                                         |             |         |          |            |
| 0                                             | 0 us        | 15331   | 15331    | 15331      |
| 1                                             | 5000 us     | 0       | 0        | 0          |
| 2                                             | 10000 us    | 0       | 0        | 0          |
| 3                                             | 15000 us    | 0       | 0        | 0          |
| 4                                             | 20000 us    | 0       | 0        | 0          |
| 5                                             | 25000 us    | 0       | 0        | 0          |
| 6                                             | 30000 us    | 0       | 0        | 0          |
| 7                                             | 35000 us    | 0       | 0        | 0          |
| 8                                             | 40000 us    | 0       | 0        | 0          |
| 9                                             | 45000 us    | 0       | 0        | 0          |
| -----                                         |             |         |          |            |
| Inter-Frame Delay Variation (IFDV) Bin Counts |             |         |          |            |
| -----                                         |             |         |          |            |
| Bin                                           | Lower Bound | Forward | Backward | Round Trip |
| -----                                         |             |         |          |            |
| 0                                             | 0 us        | 15331   | 15331    | 15331      |
| 1                                             | 5000 us     | 0       | 0        | 0          |
| 2                                             | 10000 us    | 0       | 0        | 0          |
| 3                                             | 15000 us    | 0       | 0        | 0          |
| 4                                             | 20000 us    | 0       | 0        | 0          |
| 5                                             | 25000 us    | 0       | 0        | 0          |
| 6                                             | 30000 us    | 0       | 0        | 0          |
| 7                                             | 35000 us    | 0       | 0        | 0          |
| 8                                             | 40000 us    | 0       | 0        | 0          |
| 9                                             | 45000 us    | 0       | 0        | 0          |
| -----                                         |             |         |          |            |
| =====                                         |             |         |          |            |
| TWAMP-LIGHT LOSS STATISTICS: NONE             |             |         |          |            |
| =====                                         |             |         |          |            |

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

### 3.4 Service assurance agent overview

Broadband service delivery technologies have enabled the introduction of broadband service termination applications such as voice over IP (VoIP), TV service delivery, and video and high-speed Internet services. These new applications force carriers to produce services where the health and quality of service-level agreement (SLA) commitments are verifiable, both to the customer and internally (within the carrier).

SAA is a feature that monitors network operations using statistics for parameters such as latency, jitter, response time, and packet loss. The information can be used to troubleshoot network problems and help in problem prevention and network topology planning. The 7705 SAR also supports the following SAA Ethernet CFM tests: loopback, linktrace, two-way delay measurement, and two-way SLM.

The results are saved in SNMP tables that 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 CFM tests can be saved to accounting files that can be accessed by the network management system.

SAA allows two-way timing for several applications. This provides carriers and their customers with data to verify that the SLA agreements are being properly enforced. For SAA ICMP ping, one-way timestamping can be enabled at the system level for all outbound SAA ICMP ping packets.

### 3.4.1 Traceroute implementation

For various applications, such as LSP traceroute, packets must pass through the network processor while on their way to the control CPU. When the packets exit the control CPU in the egress direction, the network processor inserts a timestamp inside each packet. Only packets processed by the control CPU will receive a timestamp.

When interpreting these timestamps, care must be taken because 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 which hop is being measured.

### 3.4.2 SAA jitter

Mobile operators require millisecond granularity for delay and jitter measurements. This is especially true for synchronization-over-packet based applications.

Two-way jitter tests measure the jitter in each direction separately. The 7705 SAR provides two-way jitter tests with millisecond granularity for all network deployment applications.

### 3.4.3 SAA Ethernet CFM test support

CFM loopback, linktrace, and two-way delay measurement tests (ETH-DM) can be initiated using SAA. Additional timestamping is required for 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 that any time measurements resulting from the loopback and linktrace tests include the packet processing time used by the remote node. Because ETH-DM uses a four timestamp 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-DM tests support send-count, interval, timeout, and FC. The summary of the test results are stored in an SAA accounting file.

The 7705 SAR supports SAA-triggered ETH-DM tests for both Y.1731 and 802.1ag MEPs for Ethernet SAPs (Epipe and VPLS) and facility MEPs on network interfaces.

#### 3.4.3.1 Writing SAA Ethernet CFM test results to accounting files

When each SAA CFM test is completed, the 7705 SAR collects the results in an accounting file that can be accessed by the network management system. In order to write the SAA test results to an accounting file in a compressed XML format, the results must be collected and entered in the appropriate MIB table, and a record must be generated in the appropriate accounting file. After an accounting file has been created, accounting information can be specified and collected under the **config>log>acct-policy>to file log-file-**

*id* context. See the 7705 SAR System Management Guide, "Configuring an Accounting Policy" section for information about creating accounting files and writing to them.

### 3.5 Configuring SAA test parameters

Use the following CLI syntax to create an SAA test and set test parameters:

**CLI syntax:**

```
config# saa
config>saa# test ping
config>saa>test$ type
config>saa>test>type$ icmp-ping 10.10.221.131 count 50 fc "nc" profile out
config>saa>test>type$ exit
config>saa>test# no shutdown
config>saa>test# exit
config>saa# exit
```

The following example displays the SAA test configuration output:

```
A:ALU-48>config>saa

test "ping"
 type
 icmp-ping 10.10.221.131 count 50 fc "nc" profile out
 exit
 no shutdown
 exit

```

The following example displays the result after running the test:

```
A:ALU-48>config>saa# show saa ping
=====
SAA Test Information
=====
Test name : ping
Owner name : TiMOS CLI
Description : N/A
Accounting policy : None
Administrative status : Enabled
Test type : icmp-ping 10.10.221.131 count 50 fc "nc"
 : profile out
Trap generation : None
Test runs since last clear : 1
Number of failed test runs : 0
Last test result : Success
=====
Threshold
Type Direction Threshold Value Last Event Run #

Jitter-in Rising None None Never None
 Falling None None Never None
Jitter-out Rising None None Never None
 Falling None None Never None
Jitter-rt Rising None None Never None
 Falling None None Never None
Latency-in Rising None None Never None
 Falling None None Never None
Latency-out Rising None None Never None
```

|            |         |      |      |       |      |
|------------|---------|------|------|-------|------|
| Latency-rt | Falling | None | None | Never | None |
|            | Rising  | None | None | Never | None |
| Loss-in    | Falling | None | None | Never | None |
|            | Rising  | None | None | Never | None |
| Loss-out   | Falling | None | None | Never | None |
|            | Rising  | None | None | Never | None |
| Loss-rt    | Falling | None | None | Never | None |
|            | Rising  | None | None | Never | None |
|            | Falling | None | None | Never | None |

=====

Test Run: 1

Total number of attempts: 50

Number of requests that failed to be sent out: 0

Number of responses that were received: 50

Number of requests that did not receive any response: 0

Total number of failures: 0, Percentage: 0

| (in ms)     | Min   | Max   | Average | Jitter |
|-------------|-------|-------|---------|--------|
| Outbound :  | -9.61 | -8.75 | -9.18   | 0.016  |
| Inbound :   | 9.53  | 12.0  | 10.2    | 0.412  |
| Roundtrip : | 0.674 | 2.59  | 1.02    | 0.406  |

Per test packet:

| Sequence | Outbound | Inbound | RoundTrip | Result            |
|----------|----------|---------|-----------|-------------------|
| 1        | -8.75    | 9.53    | 0.784     | Response Received |
| 2        | -8.76    | 9.54    | 0.779     | Response Received |
| 3        | -8.78    | 9.59    | 0.805     | Response Received |
| 4        | -8.79    | 11.3    | 2.46      | Response Received |
| 5        | -8.82    | 9.61    | 0.786     | Response Received |
| 6        | -8.83    | 9.59    | 0.760     | Response Received |
| 7        | -8.86    | 9.65    | 0.795     | Response Received |
| 8        | -8.86    | 9.63    | 0.767     | Response Received |
| 9        | -8.89    | 9.68    | 0.797     | Response Received |
| 10       | -8.90    | 9.68    | 0.775     | Response Received |
| 11       | -8.93    | 9.73    | 0.805     | Response Received |
| 12       | -8.93    | 10.4    | 1.44      | Response Received |
| 13       | -8.97    | 9.75    | 0.788     | Response Received |
| 14       | -8.98    | 11.2    | 2.23      | Response Received |
| 15       | -9.00    | 9.80    | 0.801     | Response Received |
| 16       | -9.01    | 9.79    | 0.787     | Response Received |
| 17       | -9.03    | 9.82    | 0.794     | Response Received |
| 18       | -9.04    | 10.9    | 1.89      | Response Received |
| 19       | -9.06    | 9.87    | 0.801     | Response Received |
| 20       | -9.08    | 9.85    | 0.770     | Response Received |
| 21       | -9.10    | 9.90    | 0.804     | Response Received |
| 22       | -9.11    | 9.90    | 0.782     | Response Received |
| 23       | -9.14    | 9.97    | 0.828     | Response Received |
| 24       | -9.15    | 9.93    | 0.780     | Response Received |
| 25       | -9.17    | 9.99    | 0.813     | Response Received |
| 26       | -9.18    | 9.97    | 0.786     | Response Received |
| 27       | -9.21    | 10.5    | 1.28      | Response Received |
| 28       | -9.22    | 11.0    | 1.79      | Response Received |
| 29       | -9.25    | 10.1    | 0.807     | Response Received |
| 30       | -9.26    | 10.0    | 0.767     | Response Received |
| 31       | -9.28    | 10.1    | 0.804     | Response Received |
| 32       | -9.29    | 9.96    | 0.676     | Response Received |
| 33       | -9.31    | 10.0    | 0.719     | Response Received |
| 34       | -9.32    | 10.1    | 0.785     | Response Received |
| 35       | -9.35    | 10.2    | 0.808     | Response Received |
| 36       | -9.36    | 10.1    | 0.782     | Response Received |
| 37       | -9.39    | 11.3    | 1.87      | Response Received |
| 38       | -9.40    | 12.0    | 2.59      | Response Received |
| 39       | -9.43    | 10.2    | 0.792     | Response Received |
| 40       | -9.43    | 10.2    | 0.771     | Response Received |

|            |       |      |       |          |          |
|------------|-------|------|-------|----------|----------|
| 41         | -9.46 | 10.3 | 0.815 | Response | Received |
| 42         | -9.46 | 10.1 | 0.674 | Response | Received |
| 43         | -9.49 | 12.0 | 2.46  | Response | Received |
| 44         | -9.50 | 10.3 | 0.782 | Response | Received |
| 45         | -9.53 | 10.3 | 0.810 | Response | Received |
| 46         | -9.54 | 10.3 | 0.780 | Response | Received |
| 47         | -9.57 | 10.3 | 0.768 | Response | Received |
| 48         | -9.58 | 10.3 | 0.769 | Response | Received |
| 49         | -9.60 | 10.4 | 0.797 | Response | Received |
| 50         | -9.61 | 11.2 | 1.60  | Response | Received |
| =====      |       |      |       |          |          |
| *A:ALU-48# |       |      |       |          |          |

### 3.6 Synthetic loss measurement (SLM)

SLM is a single-ended test that can be run on demand or proactively to determine in-loss, out-loss, and unacknowledged packets. The test uses a small amount of synthetic test traffic as a substitute for customer traffic. SLM is used between peer MEPs in point-to-point configurations. Only remote peer MEPs within the association and matching the unicast destination will respond to the SLM packet. SLM uses an optional TLV with a timestamp on the near-end and far-end MEPs for the combined loss and delay measurement.

Various sequence numbers and counters are used to determine loss in each direction. To properly use the information that is gathered, the following terms are defined:

- count – number of probes that are sent if the last frame is not lost. If the last frame is lost, the count plus the number of unacknowledged packets equals the number of probes sent.
- out-loss (far end) – packets lost on the way to the remote node from the test initiator
- in-loss (near end) – packets lost on the way back from the remote node to the test initiator
- unacknowledged – number of packets not responded to by the end of the test

An SLM test packet can be generated using the CLI or SNMP for an on-demand test and SAA for a proactive test. The on-demand test provides per-probe-specific loss indicators or individual probe information stored in the MIB. The test does not store data for later processing. An SAA scheduled or continuous test summarizes the per-probe data but does not maintain per-probe information, and any unacknowledged packets are recorded as in-loss packets.

SLM packets originate and terminate on the CSM card. The probe count for SLM has a configurable range of 1 to 100 with probe spacing between 1 s and 10 s. A single test therefore can be up to 1000 s in length. A node may only initiate and maintain a single active on-demand test at any given time. The results table maintains a maximum of one storage entry per remote MEP. Subsequent tests on the same peer overwrite the results for that peer. For this reason, operators should run the on-demand test and check the results before starting another test.

Proactive measurement functions are linked to SAA and provide scheduling, storage, and summarization capabilities. Scheduling can be continuous or periodic. Proactive measurement also allows for the interpretation and representation of data that may enhance the specification. As an example, an optional TLV allows for the measurement of both loss and delay/ jitter with a single test. The optional TLV is ignored by equipment that does not support it. In mixed-vendor environments, loss measurement is tracked but delay and jitter only report round-trip times.

The round-trip times in mixed-vendor environments include the remote node's processing time because only two timestamps are included in the packet. In an environment where both nodes support the optional TLV to include timestamps, unidirectional and round-trip times are reported. Because all four timestamps are included in the packet, the round-trip time in this case does not include remote node processing time.

The ETH-SL packet format contains a test-id that is internally generated and not configurable. The display summary for the on-demand test shows the test-id. A remote node processing the SLM frames could receive overlapping test-ids as a result of multiple MEPs measuring the loss at the same remote MEP. For this reason, the uniqueness of the test is based on the remote MEP-ID, test-id, and source MAC address of the packet.

All Ethernet adapter cards and ports in access mode support SLM Up and Down MEPs, and all Ethernet adapter cards and ports in network mode that support spoke or mesh SDPs support SLM Up and Down MEPs. SLM Down MEPs are also supported on Ethernet network interfaces. There is no coordination between various fault conditions that could impact loss measurement. This is also true for conditions where MEPs are placed in a shutdown state as a result of linkage to a redundancy scheme such as MC-LAG.

It is possible to have a valid configuration where multiple MEPs on the same remote node have the same MAC address. If this is the case, the first responder is used to measure packet loss. The second responder is dropped.

A configurable inactivity timer determines the length of time that an on-demand test is valid. The test is active as long as packets are received within the timeframe set by the inactivity timer, as defined by the test-id, remote MEP ID, and source MAC address. If there is a gap between the packets that exceeds the inactivity timer value, the responding node responds with a sequence number of 1. For the remote MEP, the previous test has expired and any new probes are now part of a new test. The inactivity timer default is 100 s with a range of 10 to 100 s.

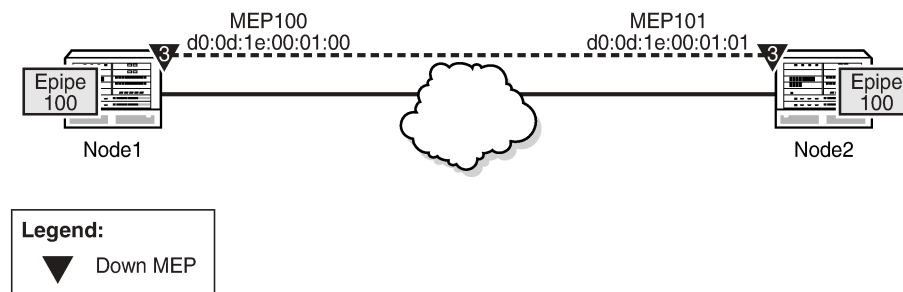
The responding node is limited to 1000 concurrent SLM tests. A node that is already actively processing 1000 SLM tests will show as out-loss or unacknowledged packets on the node that initiated the test because the packets will be silently discarded at the responder. No log entries or alarms will be raised. These packets are ETH-CFM-based and the stated receive rate for ETH-CFM must not be exceeded for the platform.

Only the configuration is supported by the high availability function. There is no synchronization of data between active and standby. Any unwritten or active tests are lost during a switchover and the data cannot be recovered.

### 3.6.1 Configuration example

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

Figure 29: SLM example



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Node1 is tested for this example. The SAA configuration does not include the accounting policy required to collect the statistics before they are overwritten. Node2 does not have an SAA configuration. Node2 includes the configuration to build the MEP in the Epipe service context.

The following example displays the Node1 SAA test configuration:

```
Node1>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

Node1>config>service>epipe# info

 sap 1/3/1:100 create
 eth-cfm
 mep 100 domain 3 association 1 direction down
 ccm-enable
 no shutdown
 exit
 exit
 spoke-sdp 131:100 create
 exit
 no shutdown

Node1>config>saa# info

 test "slml"
 type
 eth-cfm-two-way-slm d0:0d:1e:00:01:01 mep 100 domain 3
 association 1 count 100 timeout 1 interval 1
 exit
 continuous
 no shutdown
 exit

```

The following example displays the Node2 configuration:

```
Node2>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 100
 exit
 exit

Node2>config>service>epipe# info

 sap 1/3/1:100 create
 eth-cfm
 mep 101 domain 3 association 1 direction down
 ccm-enable
 no shutdown
```



```

 exit
 exit
 exit
 spoke-sdp 131:100 create
 exit
 no shutdown

```

The following output example shows the different loss conditions that an operator may see. The total number of attempts is '99' because the final probe in the test was not acknowledged.

```

show saa slm1
Test Run: 183
Total number of attempts: 99
Number of requests that failed to be sent out: 0
Number of responses that were received: 48
Number of requests that did not receive any response: 50
Total number of failures: 50, Percentage: 50
(in ms) Min Max Average Jitter
Outbound : -370 -362 -366 0.432
Inbound : 363 371 367 0.308
Roundtrip : 0.000 5.93 1.38 0.496
Per test packet:
Sequence Outbound Inbound RoundTrip Result
1 0.000 0.000 0.000 Out Loss
2 0.000 0.000 0.000 Out Loss
3 0.000 0.000 0.000 Out Loss
4 0.000 0.000 0.000 Out Loss
...snip...
46 -369 370 1.28 Response Received
47 -362 363 1.42 Response Received
48 0.000 0.000 0.000 In Loss
49 0.000 0.000 0.000 In Loss
50 -362 363 1.42 Response Received
51 -362 363 1.16 Response Received
52 -362 364 1.20 Response Received
53 -362 364 1.18 Response Received
54 -363 364 1.20 Response Received
...snip...
96 -369 370 1.29 Response Received
97 -369 370 1.30 Response Received
98 0.000 0.000 0.000 Unacknowledged
99 0.000 0.000 0.000 Unacknowledged
100 0.000 0.000 0.000 Unacknowledged

```

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

```

#oam eth-cfm two-way-slm-test d0:0d:1e:00:01:01 mep 100 domain 3 association 1 send-
count 20 interval 1 timeout 1
Sending 20 packets to d0:0d:1e:00:01:01 from MEP 100/3/1 (Test-id: 588)
Sent 20 packets, 20 packets received from MEP ID 101, (Test-id: 588)
(0 out-loss, 0 in-loss, 0 unacknowledged)
show eth-cfm mep 100 domain 3 association 1 two-way-slm-test
=====
Eth CFM Two-way SLM Test Result Table (Test-id: 588)
=====
Peer Mac Addr Remote MEP Count In Loss Out Loss Unack

d0:0d:1e:00:01:01 101 20 0 0 0

```

### 3.7 OAM timestamping

The following tables provide information about OAM timestamping for OAM tests:

- [Table 12: Location of OAM timestamping](#) lists the locations where each type of OAM timestamping can occur
- [Table 13: Mapping of OAM tests to timestamping](#) lists the mapping of OAM tests to timestamping
- [Table 14: Timestamps per OAM test](#) lists the timestamps per OAM test

Table 12: Location of OAM timestamping

| Timestamping type | Timestamp location        |                            |
|-------------------|---------------------------|----------------------------|
|                   | Tx                        | Rx                         |
| A                 | At the edge after enqueue | At the edge before enqueue |
| B                 | Before enqueueing         | At the edge before enqueue |
| C                 | CSM timestamping          |                            |

Table 13: Mapping of OAM tests to timestamping

| Test execution | Test    | OAM type  | MEP and direction               | Timestamping type |
|----------------|---------|-----------|---------------------------------|-------------------|
| SAA            | eth-cfm | Loopback  | SAP Down MEP                    | A                 |
| SAA            | eth-cfm | Loopback  | SAP Up MEP                      | A                 |
| SAA            | eth-cfm | Loopback  | Spoke SDP and Mesh SDP Down MEP | A                 |
| SAA            | eth-cfm | Loopback  | Spoke SDP and Mesh SDP Up MEP   | A                 |
| SAA            | eth-cfm | Loopback  | Network interface Down MEP      | A                 |
| SAA            | eth-cfm | Linktrace | SAP Down MEP                    | A                 |
| SAA            | eth-cfm | Linktrace | SAP Up MEP                      | A                 |
| SAA            | eth-cfm | Linktrace | Spoke SDP and Mesh SDP Down MEP | A                 |
| SAA            | eth-cfm | Linktrace | Spoke SDP and Mesh SDP Up MEP   | A                 |

| Test execution | Test      | OAM type  | MEP and direction               | Timestamping type |
|----------------|-----------|-----------|---------------------------------|-------------------|
| SAA            | eth-cfm   | Linktrace | Network interface Down MEP      | A                 |
| SAA            | eth-cfm   | SLM       | SAP Down MEP                    | A                 |
| SAA            | eth-cfm   | SLM       | SAP Up MEP                      | A                 |
| SAA            | eth-cfm   | SLM       | Spoke SDP and Mesh SDP Down MEP | A                 |
| SAA            | eth-cfm   | SLM       | Spoke SDP and Mesh SDP Up MEP   | A                 |
| SAA            | eth-cfm   | SLM       | Network interface Down MEP      | A                 |
| SAA            | eth-cfm   | DM        | SAP Down MEP                    | A                 |
| SAA            | eth-cfm   | DM        | SAP Up MEP                      | B                 |
| SAA            | eth-cfm   | DM        | Spoke/Mesh SDP Down MEP         | A                 |
| SAA            | eth-cfm   | DM        | Spoke/Mesh SDP Up MEP           | B                 |
| SAA            | eth-cfm   | DM        | Network interface Down MEP      | A                 |
| SAA            | lsp-ping  | —         | —                               | A                 |
| SAA            | vccv-ping | —         | —                               | A                 |
| SAA            | sd-ping   | —         | —                               | A                 |
| SAA            | vprn-ping | —         | —                               | A                 |
| SAA            | mac-ping  | —         | —                               | A                 |
| SAA            | icmp-ping | —         | —                               | C                 |
| SAA            | cpe-ping  | —         | —                               | A                 |
| On demand      | eth-cfm   | DM        | SAP Down MEP                    | A                 |
| On demand      | eth-cfm   | DM        | SAP Up MEP                      | B                 |
| On demand      | eth-cfm   | DM        | Spoke SDP and Mesh SDP Down MEP | A                 |

| Test execution | Test              | OAM type | MEP and direction               | Timestamping type |
|----------------|-------------------|----------|---------------------------------|-------------------|
| On demand      | eth-cfm           | DM       | Spoke SDP and Mesh SDP Up MEP   | B                 |
| On demand      | eth-cfm           | DM       | Network interface Down MEP      | A                 |
| On demand      | eth-cfm           | 1DM      | SAP Down MEP                    | B                 |
| On demand      | eth-cfm           | 1DM      | SAP Up MEP                      | A                 |
| On demand      | eth-cfm           | 1DM      | Spoke SDP and Mesh SDP Down MEP | B                 |
| On demand      | eth-cfm           | 1DM      | Spoke SDP and Mesh SDP Up MEP   | A                 |
| On demand      | eth-cfm           | 1DM      | Network interface Down MEP      | B                 |
| On demand      | twamp/twamp-light | —        | Ethernet ports                  | A                 |
| On demand      | twamp/twamp-light | —        | Non-Ethernet ports              | C                 |
| On demand      | lsp-ping          | —        | —                               | A                 |
| On demand      | vccv-ping         | —        | —                               | A                 |
| On demand      | sdp-ping          | —        | —                               | A                 |
| On demand      | vpn-ping          | —        | —                               | A                 |
| On demand      | mac-ping          | —        | —                               | A                 |

Table 14: Timestamps per OAM test

| Type   | Test          | Line card timestamp | Timestamp       |                 |                 |                 |
|--------|---------------|---------------------|-----------------|-----------------|-----------------|-----------------|
|        |               |                     | T1 <sup>1</sup> | T2 <sup>2</sup> | T3 <sup>3</sup> | T4 <sup>4</sup> |
| CFM    | loopback      | ✓                   | ✓               |                 |                 | ✓               |
|        | linktrace     | ✓                   | ✓               |                 |                 | ✓               |
|        | slm           | ✓                   | ✓               | ✓               | ✓               | ✓               |
|        | two-way-delay | ✓                   | ✓               | ✓               | ✓               | ✓               |
| Others | lsp-ping      | ✓                   | ✓               | ✓               |                 | ✓               |
|        | vccv-ping     | ✓                   | ✓               | ✓               |                 | ✓               |
|        | sdp-ping      | ✓                   | ✓               | ✓               | ✓               | ✓               |

| Type | Test                             | Line card timestamp | Timestamp       |                 |                 |                 |
|------|----------------------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
|      |                                  |                     | T1 <sup>1</sup> | T2 <sup>2</sup> | T3 <sup>3</sup> | T4 <sup>4</sup> |
|      | vprn-ping                        | ✓                   | ✓               | ✓               | ✓               | ✓               |
|      | mac-ping                         | ✓                   | ✓               | ✓               | ✓               | ✓               |
|      | icmp-ping (with enable icmp-vse) | ✓                   | ✓               | T2 = T3         | T3 = T2         | ✓               |

Notes:

- 1. At the Tx of the initiator or test head
- 2. At the Rx of the responder
- 3. At the Tx of the responder
- 4. At the Rx of the initiator or test head

## 3.8 OAM and SAA command reference

### 3.8.1 Command hierarchies

- Operational commands
  - Operational commands
  - Multicast commands
- OAM commands
  - ATM diagnostics
  - TWAMP
  - TWAMP Light
  - Global downstream mapping commands
  - LSP diagnostics
  - LDP diagnostics
  - SDP diagnostics
  - Service diagnostics
  - VLL diagnostics
  - Y.1564 diagnostics
  - VPLS diagnostics
  - Ethernet in the first mile (EFM) commands
  - ETH-CFM commands
- OAM-PM commands
- SAA commands
  - SAA diagnostics
- Show commands
- Clear commands
- Debug commands

#### 3.8.1.1 Operational commands

##### 3.8.1.1.1 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 | fc-
queue fc-name profile {in | out}]
```

```
- 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]
```

### 3.8.1.1.2 Multicast commands

```
global
- mrinfo ip-address | dns-name [router router-instance | service-name service-name]
- mstat source ip-address | dns-name group grp-ip-address | dns-name [destination dst-ip-address | dns-name] [hop hop] [router router-instance | service-name service-name] [wait-time wait-time]
- mtrace source ip-address | dns-name group grp-ip-address | dns-name [destination dst-ip-address | dns-name] [hop hop] [router router-instance | service-name service-name] [wait-time wait-time]
```

### 3.8.1.2 OAM commands

#### 3.8.1.2.1 ATM diagnostics

```
global
- oam
- atm-ping {port-id | bundle-id [:vpi | vpi/vci]} [end-to-end | segment] [dest destination-id] [send-count send-count] [timeout timeout] [interval interval]
```

#### 3.8.1.2.2 TWAMP

```
config
- test-oam
- twamp
- server
- [no] enforce-test-session-start-time
- inactivity-timeout timer
- no inactivity-timeout
- max-conn-server count
- no max-conn-server
- max-sess-server count
- no max-sess-server
- [no] prefix ip-prefix/mask [create]
- description description-string
- no description
- max-conn-prefix count
- no max-conn-prefix
- max-sess-prefix count
- no max-sess-prefix
- ref-inactivity-timeout timer
- no ref-inactivity-timeout
- [no] shutdown
```

### 3.8.1.2.3 TWAMP Light

For descriptions of Router TWAMP Light commands, see the Router Configuration Guide.

```
config
- router
- twamp-light
- reflector [udp-port udp-port-number] [create]
- no reflector
- description description-string
- [no] prefix ip-prefix/prefix-length [create]
- description description-string
- [no] shutdown
```

For descriptions of VPRN TWAMP Light commands, see the Services Guide.

```
config
- service
- vprn
- twamp-light
- reflector [udp-port udp-port-number] [create]
- no reflector
- description description-string
- [no] prefix ip-prefix/prefix-length [create]
- description description-string
- [no] shutdown
```

```
config
- test-oam
- twamp
- twamp-light
- inactivity-timeout seconds
- no inactivity-timeout
- source-udp-port-pools
- port port-number
- pool-type pool-type
```

### 3.8.1.2.4 Link measurement template

```
config
- test-oam
- link-measurement
- measurement-template template-name [create]
- no measurement-template template-name
- aggregate-sample-window
- multiplier sample-window-durations
- threshold
- absolute microseconds
- [no] absolute
- relative percent
- [no] relative
- window-integrity percent
- no window-integrity
- delay delay-measuremet-type
- description description-string
- no description
- interval seconds
```



```

- last-reported-delay-hold seconds
- no last-reported-delay-hold
- [no] reporting
- sample-window
 - multiplier interval-durations
 - threshold
 - absolute microseconds
 - [no] absolute
 - relative percent
 - [no] relative
 - window-integrity percent
 - [no] window-integrity
- shutdown
- no shutdown
- twamp-light
 - [no] allow-ipv6-udp-checksum-zero
 - dest-udp-port port number
 - dscp dscp-name
 - fc fc-name
 - ipv6-destination-discovery
 - discovery-interval seconds
 - discovery-timer seconds
 - [no] shutdown
 - update-interval seconds
 - pad-tlv-size octets
 - [no] pad-tlv-size
 - profile quality-of-service-profile
 - return-path
 - [no] link
 - src-udp-port port-number
 - no src-udp-port
 - timestamp-format timestamp-format
 - ttl time-to-live
- unidirectional-measurement measurement-type

```

### 3.8.1.2.5 Global downstream mapping commands

```

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

```

### 3.8.1.2.6 LSP diagnostics

```

global
- oam
 - 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]]
 - lsp-ping sr-isis prefix ip-prefix/prefix-length [igp-instance igp-instance] [path-
 destination ip-address [interface if-name | next-hop ip-address]]
 - lsp-ping sr-ospf prefix ip-prefix/prefix-length [igp-instance igp-instance] [path-
 destination ip-address [interface if-name | next-hop ip-address]]
 - lsp-ping sr-te lsp-name [path path-name] [path-destination ip-address [interface if-
 name | next-hop ip-address]]
 - NOTE: options common to all lsp-ping cases:

```

```
[fc fc-name [profile {in | out}]] [interval interval] [send-count send-count] [size octets]
[src-ip-address ip-address] [timeout timeout] [ttl label-ttl]
- lsp-trace lsp-name [path path-name]
- lsp-trace bgp-label prefix ip-prefix/prefix-length [path-destination ip-address
[interface if-name | next-hop ip-address]]
- lsp-trace prefix ip-prefix/prefix-length [path-destination ip-address [interface if-
name | next-hop ip-address]]
- lsp-trace sr-isis prefix ip-prefix/prefix-length [igp-instance igp-instance] [path-
destination ip-address [interface if-name | next-hop ip-address]]
- lsp-trace sr-ospf prefix ip-prefix/prefix-length [igp-instance igp-instance] [path-
destination ip-address [interface if-name | next-hop ip-address]]
- lsp-trace sr-te lsp-name [path path-name] [path-destination ip-address
[interface if-name | next-hop ip-address]]
- NOTE: options common to all lsp-trace cases:
[downstream-map-tlv downstream-map-tlv] [fc fc-name [profile {in | out}]] [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]
- p2mp-lsp-ping {ldp p2mp-identifier [sender-addr ip-address] [leaf-addr ip-
address[...up to 5 max]]} [fc fc-name [profile {in | out}]] [size octets] [timeout timeout]
[detail]
```

### 3.8.1.2.7 LDP diagnostics

```
global
- oam
- lsp-treetrace prefix ip-prefix/mask [max-ttl max-label-ttl] [max-path max-paths]
[timeout timeout] [retry-count retry-count] [fc fc-name [profile {in | out}]] [downstream-map-
tlv {dsmap | ddmap}]
```

```
config
- test-oam
- [no] lsp-treetrace
- fc fc-name [profile {in | out}]
- 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 [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
```

### 3.8.1.2.8 SDP diagnostics

```
global
- oam
- sdp-mtu orig-sdp-id size-inc start-octets end-octets [step step-size]
[timeout timeout] [interval interval]
- sdp-ping orig-sdp-id [resp-sdp resp-sdp-id] [fc fc-name [profile {in | out}]]
[size octets] [count send-count] [timeout timeout] [interval interval]
```

### 3.8.1.2.9 Service diagnostics

```
global
- oam
- svc-ping ip-address service [service-id] [local-sdp] [remote-sdp]
- vprn-ping [service-id | service service-name] source ip-address destination ip-
address [fc fc-name [profile {in | out}]] [size size] [ttl vc-label-ttl] [count send-count]
[return-control] [timeout timeout] [interval interval]
- vprn-trace [service-id | service service-name] source ip-address destination ip-
address [fc fc-name [profile {in | out}]] [size size] [min-ttl vc-label-ttl] [max-ttl vc-label-
ttl] [probe-count send-count] [return-control] [timeout timeout] [interval interval]
```

### 3.8.1.2.10 VLL diagnostics

```
global
- oam
- vccv-ping sdp-id:vc-id [src-ip-address ip-addr dst-ip-address ip-addr pw-id pw-id]
[reply-mode {ip-routed | control-channel}] [fc fc-name [profile {in | out}]] [size octets]
[count send-count] [timeout timeout] [interval interval] [ttl vc-label-ttl]
- vccv-trace sdp-id:vc-id [size octets] [min-ttl min-vc-label-ttl] [max-ttl max-vc-
label-ttl] [max-fail no-response-count] [probe-count probe-count] [reply-mode {ip-routed |
control-channel}] [timeout timeout-value] [interval interval-value] [fc fc-name [profile {in |
out}]] [detail]
```

### 3.8.1.2.11 Y.1564 diagnostics

```
global
- oam
- testhead test-name [owner test-owner] testhead-profile profile-id [frame-
payload frame-payload-id] sap sap-id [acceptance-criteria acceptance-criteria-id] [color-aware
{enable | disable}] [performance-monitoring {enable | disable}]
- testhead test-name owner test-owner stop
config
- test-oam
- testhead-marker-packet-src-mac mac-address
- testhead-profile profile-id [create]
- acceptance-criteria acceptance-criteria-id [create]
- no acceptance-criteria acceptance-criteria-id
- cir-threshold cir-threshold
- no cir-threshold
- jitter-rising-threshold threshold
- no jitter-rising-threshold
- jitter-rising-threshold-in in-profile-threshold
```

```

- no jitter-rising-threshold-in
- jitter-rising-threshold-out out-profile-threshold
- no jitter-rising-threshold-out
- latency-rising-threshold threshold
- no latency-rising-threshold
- latency-rising-threshold-in in-profile-threshold
- no latency-rising-threshold-in
- latency-rising-threshold-out out-profile-threshold
- no latency-rising-threshold-out
- loss-rising-threshold threshold
- no loss-rising-threshold
- loss-rising-threshold-in in-profile-threshold
- no loss-rising-threshold-in
- loss-rising-threshold-out out-profile-threshold
- no loss-rising-threshold-out
- pir-threshold pir-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-id
- data-pattern hex-string
- no data-pattern
- description description-string
- no description
- [no] dscp dscp-name
- dst-ip ipv4 ipv4-address
- no dst-ip ipv4
- dst-mac ieee-address
- no dst-mac
- dst-port dst-port-number
- no dst-port
- ethertype 0x0600..0xffff
- no ethertype
- frame-size frame-size
- no frame-size
- ip-proto ip-protocol-number
- no ip-proto
- ip-tos type-of-service
- no ip-tos
- ip-ttl ttl-value
- no ip-ttl
- rate rate-in-kbs
- no rate
- src-ip ipv4 ipv4-address
- no src-ip
- src-mac ieee-address
- no src-mac
- src-port src-port-number
- no src-port
- 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]
- no vlan-tag-2
- rate cir cir-rate-in-kbs [pir pir-rate-in-kbs]
- no rate
- [no] test-completion-trap-enable
- test-duration {[hours hours] [minutes minutes] [seconds seconds]}
- no test-duration

- config
- service

```

```

- [no] epipe service-id [customer customer-id] [vpn vpn-id] [vc-switching]
- sap sap-id [no-endpoint]
- loopback {line | internal} {timer seconds | persistent} [swap-src-dst-
mac]
- no loopback

```

### 3.8.1.2.12 VPLS diagnostics

```

global
- oam
- cpe-ping service service-id destination ip-address [source ip-address] [source-
mac ieee-address] [fc fc-name] [profile {in | out}] [ttl vc-label-ttl] [count send-count] [send-
control] [return-control] [timeout timeout] [interval interval]
- mac-ping service service-id destination dst-ieee-address [source src-ieee-address]
[fc fc-name] [profile {in | out}]] [ttl vc-label-ttl] [count send-count] [send-control]
[return-control] [interval interval] [timeout timeout]
- mac-populate service-id mac ieee-address [flood] [age seconds] [force] [target-
sap sap-id] [send-control]
- mac-purge service-id target ieee-address [flood] [send-control] [register] [force]
- mac-trace service service-id destination ieee-address [source ieee-address] [fc fc-
name] [profile {in | out}]] [size octets] [min-ttl vc-label-ttl] [max-ttl vc-label-ttl] [probe-
count send-count] [send-control] [return-control] [interval interval] [timeout timeout]

```

### 3.8.1.2.13 Ethernet in the first mile (EFM) commands

```

global
- oam
- efm port-id
- local-loopback {start | stop}
- remote-loopback {start | stop}
config
- [no] port {port-id}
- ethernet
- efm-oam
- [no] accept-remote-loopback
- hold-time time-value
- no hold-time
- mode {active | passive}
- [no] shutdown
- [no] transmit-interval interval [multiplier multiplier]
- [no] tunneling

```

### 3.8.1.2.14 ETH-CFM commands

```

global
- 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]

```

```

- single-ended-loss-test mac-address mep mep-id domain md-index association ma-
index [priority priority] [interval {100ms | 1s}] [send-count send-count]
- 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]
config
- eth-cfm
- domain md-index [format {dns | mac | none | string}] name md-name level level
- domain md-index
- no domain md-index
- association ma-index [format {icc-based | integer | string | vid | vpn-id}]
name ma-name
- association ma-index
- no association ma-index
- [no] bridge-identifier bridge-id
- vlan vlan-id
- no vlan
- ccm-interval {10ms | 100ms | 1 | 10 | 60 | 600}
- no ccm-interval
- [no] remote-mepid mep-id
- slm
- inactivity-timer timeout
- no inactivity-timer
config
- [no] port {port-id}
- ethernet
- cfm-loopback priority {low | high | dot1p} [match-vlan {vlan-range | none}]
- no cfm-loopback
config
- service
- epipe service-id [customer customer-id] [create] [vpn vpn-id]
- sap sap-id [create]
- eth-cfm
- [no] hold-mep-up-on-failure
- mep mep-id domain md-index association ma-index [direction {up | down}]
- no mep mep-id domain md-index association ma-index
- [no] ais-enable
- client-meg-level [level [level ...]]
- no client-meg-level
- interval [1 | 60]
- no interval
- priority priority-value
- no priority
- [no] ccm-enable
- ccm-ltm-priority priority
- no ccm-ltm-priority
- description description-string
- no description
- [no] dual-ended-loss-test-enable
- alarm-clear-threshold percentage
- no alarm-clear-threshold
- alarm-threshold percentage
- no alarm-threshold
- [no] eth-test-enable
- bit-error-threshold bit-errors
- test-pattern {all-zeros | all-ones} [crc-enable]
- no test-pattern
- low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon |
xcon | noXcon}
- one-way-delay-threshold seconds
- [no] shutdown
- spoke-sdp sdp-id:vc-id [vc-type {ether | vlan}] [create] [no-endpoint]

```

```

- spoke-sdp sdp-id:vc-id [vc-type {ether | vlan}] [create] endpoint endpoint-name
- eth-cfm
 - mep mep-id domain md-index association ma-index [direction {up | down}]
 - no mep mep-id domain md-index association ma-index
 - [no] ccm-enable
 - ccm-ltm-priority priority
 - no ccm-ltm-priority
 - description description-string
 - no description
 - low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon |
xcon | noXcon}
 - [no] shutdown
config
- service
 - vpls service-id [customer customer-id] [create]
 - sap sap-id [create]
 - eth-cfm
 - mep mep-id domain md-index association ma-index [direction {up | down}]
 - no mep mep-id domain md-index association ma-index
 - [no] ais-enable
 - client-meg-level [level [level ...]]
 - no client-meg-level
 - interval [1 | 60]
 - no interval
 - priority priority-value
 - no priority
 - [no] ccm-enable
 - ccm-ltm-priority priority
 - no ccm-ltm-priority
 - description description-string
 - no description
 - [no] eth-test-enable
 - bit-error-threshold bit-errors
 - test-pattern {all-zeros | all-ones} [crc-enable]
 - no test-pattern
 - low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon |
xcon | noXcon}
 - mac-address mac-address
 - no mac-address
 - one-way-delay-threshold seconds
 - [no] shutdown
 - mesh-sdp sdp-id[:vc-id] [vc-type {ether | vlan}] [create]
 - eth-cfm
 - mep mep-id domain md-index association ma-index [direction {up | down}]
 - no mep mep-id domain md-index association ma-index
 - [no] ccm-enable
 - ccm-ltm-priority priority
 - no ccm-ltm-priority
 - description description-string
 - no description
 - low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon |
xcon | noXcon}
 - [no] shutdown
 - spoke-sdp sdp-id:vc-id [vc-type {ether | vlan}] [split-horizon-group group-name]
[create] [no-endpoint]
 - spoke-sdp sdp-id:vc-id [vc-type {ether | vlan}] [split-horizon-group group-name]
[create] endpoint endpoint-name
 - eth-cfm
 - mep mep-id domain md-index association ma-index [direction {up | down}]
 - no mep mep-id domain md-index association ma-index
 - [no] ccm-enable
 - ccm-ltm-priority priority
 - no ccm-ltm-priority
 - description description-string

```

```

- no description
- low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon |
xcon | noXcon}
- [no] shutdown
config
- router [router-name]
- interface ip-int-name
- eth-cfm
- mep mep-id domain md-index association ma-index
- no mep mep-id domain md-index association ma-index
- [no] ccm-enable
- ccm-ltm-priority priority
- no ccm-ltm-priority
- ccm-tlv-ignore [port-status] [interface-status]
- no ccm-tlv-ignore
- description description-string
- no description
- [no] dual-ended-loss-test-enable
- alarm-threshold percentage
- no alarm-threshold
- alarm-clear-threshold percentage
- no alarm-clear-threshold
- [no] eth-test-enable
- bit-error-threshold bit-errors
- [no] test-pattern {all-zeros | all-ones} [crc-enable]
- low-priority-defect {allDef | macRemErrXcon | remErrXcon | errXcon | xcon
| noXcon}
- one-way-delay-threshold seconds
- [no] shutdown

```

### 3.8.1.3 OAM-PM commands

```

configure
- 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]
- 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}
- delay-event-exclusion {forward | backward | round-trip} lowest-bin bin-number
- no delay-event-exclusion {forward | backward | round-trip}
- exclude-from-avg {forward | backward | round-trip} bins bin-numbers
- no exclude-from-avg {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
- ip

```



```

- dest-udp-port udp-port-number
- no dest-udp-port
- destination ip-address
- [no] do-not-fragment
- dscp dscp-name
- dscp resolve
- no destination
- fc fc-name
- no fc
- forwarding {next-hop ip-address | interface interface-name | bypass-routing}
- no forwarding
- profile {in | out}
- no profile
- router router-or-service 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
 - [no] allow-ipv6-udp-checksum-zero
 - interval milliseconds
 - no interval
 - loss
 - flr-threshold percentage
 - no flr-threshold
 - [no] hli-force-count
 - 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-
percentage [clear clear-threshold-percentage]
 - 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
- meas-interval {1-min | 5-mins | 15-mins | 1-hour | 1-day} [create]
- no meas-interval {1-min | 5-mins | 15-mins | 1-hour | 1-day}
 - 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

```

### 3.8.1.4 SAA commands

```

config
- saa
 - [no] test test-name [owner test-owner]
 - accounting-policy acct-policy-id
 - no accounting-policy
 - description description-string
 - no description
 - no continuous
 - jitter-event rising-threshold threshold [falling-threshold threshold] [direction]
 - no jitter-event
 - latency-event rising-threshold threshold [falling-threshold threshold]
 [direction]
 - no latency-event
 - loss-event rising-threshold threshold [falling-threshold threshold] [direction]
 - no loss-event
 - [no] shutdown
 - [no] trap-gen
 - [no] probe-fail-enable
 - probe-fail-threshold threshold
 - no probe-fail-threshold
 - [no] test-completion-enable
 - [no] test-fail-enable
 - test-fail-threshold threshold
 - no test-fail-threshold
 - [no] type
 - cpe-ping service service-id destination ip-address source ip-address [source-
mac ieee-address] [fc fc-name [profile {in | out}]] [ttl vc-label-ttl] [count send-count] [send-
control] [return-control] [interval interval]
 - eth-cfm-linktrace mac-address mep mep-id domain md-index association ma-
index [ttl ttl-value] [fc fc-name [profile {in | out}]] [count send-count] [timeout timeout]
[interval interval]
 - eth-cfm-loopback mac-address mep mep-id domain md-index association ma-
index [size data-size] [fc fc-name [profile {in | out}]] [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 [profile {in | out}]] [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] [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 [profile
{in | out}]]
 - icmp-trace [ip-address | dns-name] [ttl time-to-live] [wait milli-seconds]
[source ip-address] [tos type-of-service] [router router-instance | service-name service-name]
 - 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]]
- lsp-ping sr-isis prefix ip-prefix/prefix-length [igmp-instance igmp-instance]
[path-destination ip-address [interface if-name | next-hop ip-address]]
- lsp-ping sr-ospf prefix ip-prefix/prefix-length [igmp-instance igmp-instance]
[path-destination ip-address [interface if-name | next-hop ip-address]]
- lsp-ping sr-te lsp-name [path path-name] [path-destination ip-address
[interface if-name | next-hop ip-address]]
- NOTE: options common to all lsp-ping cases:
[fc fc-name [profile {in | out}]] [interval interval] [send-count send-count] [size octets]
[src-ip-address ip-address] [timeout timeout] [ttl label-ttl]
- lsp-trace lsp-name [path path-name]
- lsp-trace bgp-label prefix ip-prefix/prefix-length [path-destination ip-
address [interface if-name | next-hop ip-address]]
- lsp-trace prefix ip-prefix/prefix-length [path-destination ip-
address [interface if-name | next-hop ip-address]]
- lsp-trace sr-isis prefix ip-prefix/prefix-length [igmp-instance igmp-instance]
[path-destination ip-address [interface if-name | next-hop ip-address]]
- lsp-trace sr-ospf prefix ip-prefix/prefix-length [igmp-instance igmp-instance]
[path-destination ip-address [interface if-name | next-hop ip-address]]
- lsp-trace sr-te lsp-name [path path-name] [path-destination ip-address
[interface if-name | next-hop ip-address]]
- NOTE: options common to all lsp-trace cases:
[downstream-map-tlv downstream-map-tlv] [fc fc-name [profile {in | out}]] [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]
- mac-ping service service-id destination dst-ieee-address [source src-ieee-
address] [fc fc-name [profile {in | out}]] [size octets] [ttl vc-label-ttl] [count send-count]
[send-control] [return-control] [interval interval] [timeout timeout]
- mac-trace service service-id destination ieee-address [source ieee-
address] [fc fc-name [profile {in | out}]] [size octets] [min-ttl vc-label-ttl] [max-ttl vc-
label-ttl] [probe-count send-count] [send-control] [return-control] [interval interval]
[timeout timeout]
- sdp-ping orig-sdp-id [resp-sdp resp-sdp-id] [fc fc-name [profile {in | out}]]
[size octets] [count send-count] [timeout timeout] [interval interval]
- 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 [profile {in | out}]]
[size octets] [count send-count] [timeout timeout] [interval interval] [ttl vc-label-ttl]
- vccv-trace sdp-id:vc-id [size octets] [min-ttl min-vc-label-ttl] [max-
ttl max-vc-label-ttl] [max-fail no-response-count] [probe-count probe-count] [reply-mode {ip-
routed | control-channel}] [timeout timeout-value] [interval interval-value] [fc fc-name
[profile {in | out}]] [detail]
- vprn-ping [service-id | service service-name] source ip-address
destination ip-address [fc fc-name [profile {in | out}]] [size size] [ttl vc-label-ttl]
[count send-count] [return-control] [timeout timeout] [interval interval]
- vprn-trace [service-id | service service-name] source ip-address
destination ip-address [fc fc-name [profile {in | out}]] [size size] [min-ttl vc-label-
ttl] [max-ttl vc-label-ttl] [probe-count send-count] [return-control] [timeout timeout]
[interval interval]
config
- system
- [no] enable-icmp-vse

```

### 3.8.1.4.1 SAA diagnostics

```

global
- oam
- saa test-name [owner test-owner] {start | stop}

```

### 3.8.1.5 Show commands

```

show
- eth-cfm
 - association [ma-index] [detail]
 - cfm-stack-table
 - cfm-stack-table port [port-id [vlan vlan-id]] [level 0..7] [direction {up | down}]
 - cfm-stack-table sdp sdp-id[:vc-id]] [level 0..7] [direction {up | down}]
 - cfm-stack-table virtual [service-id] [level 0..7]
 - domain [md-index] [association ma-index | all-associations] [detail]
 - mep mep-id domain md-index association ma-index [loopback] [linktrace]
 - mep mep-id domain md-index association ma-index {remote-mepid mep-id | all-remote-
meps}
 - 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 single-ended-loss-test [remote-
peer mac-address]
 - mep mep-id domain md-index association ma-index dual-ended-loss-test [remote-
peer mac-address]
 - mep mep-id domain md-index association ma-index two-way-slm-test [remote-peer mac-
address]
 - system-config
- oam-pm
 - bin-group bin-group-number [detail]
 - bin-group-using [bin-group bin-group-number]
 - session session-name [all | base | bin-group | event-mon | meas-interval]
 - sessions [test-family {ethernet | ip}
 - sessions [test-family {ethernet | ip} detectable-tx-errors
 - sessions [test-family {ethernet | ip} event-mon
 - statistics
 - session
 - twamp-light
 - meas-interval raw [loss]
 - meas-interval raw delay [all | bins | summary]
 - meas-interval {1-min | 5-mins | 15-mins | 1-hour | 1-day} interval-number
interval-number [loss]
 - meas-interval { 1-min | 5-mins | 15-mins | 1-hour | 1-day} interval-
number interval-number delay [all | bins | summary]
 - tests [session session-name] [test-id test-id] [test-type {dm | dmm | lmm | slm |
twamp-light}]
 - saa [test-name [owner test-owner]]
 - test-oam
 - ldp-treetrace [prefix ip-prefix/mask] [detail]
 - oam-perf [detail]
 - link-measurement
 - interface interface-name [detail | aggregate | sample | debug-counters]
 - measurement-template [template-name]
 - measurement-template-using [measurement-template]
 - twamp
 - server [all] [prefix ip-prefix/mask]
 - twamp-light
 - reflectors
 - source-udp-port-pools
 - testhead-profile profile-id
 - testhead [test-name owner test-name] [detail]

```

### 3.8.1.6 Clear commands

```
clear
- saa [test-name [owner test-owner]]
- eth-cfm
 - dual-ended-loss-test mep mep-id domain md-index association ma-index
- oam-pm session-name twamp-light
- test-oam
 - twamp
 - server
- testhead [result] [test-name [owner test-owner]]
```

### 3.8.1.7 Monitor commands

```
monitor
- oam-pm
 - session session-name
 - twamp-light [interval seconds] [repeat repeat] [absolute | rate] [delay | loss]
```

### 3.8.1.8 Debug commands

```
debug
- [no] oam
 - lsp-ping-trace [tx | rx | both] [raw | detail]
 - no lsp-ping-trace
```

## 3.8.2 Command descriptions

- [OAM and SAA commands](#)
- [Show commands](#)
- [Clear commands](#)
- [Debug commands](#)

### 3.8.2.1 OAM and SAA commands

- [Operational commands](#)
- [Multicast commands](#)
- [ATM diagnostics](#)
- [Service diagnostics](#)
- [EFM commands](#)
- [ETH-CFM commands](#)
- [SAA commands](#)
- [Y.1564 diagnostics](#)
- [TWAMP commands](#)
- [Global downstream mapping commands](#)
- [LDP diagnostics](#)
- [OAM SAA commands](#)

#### 3.8.2.1.1 Operational commands

##### ping

##### Syntax

**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* | **fc-queue** *fc-nameprofile* {**in** | **out**}]

##### Context

<global>

##### Description

This command verifies the reachability of a remote host.

## Parameters

### *ip-address*

identifies the far-end IP address to which to send the **ping** request message

### *dns-name*

identifies the DNS name of the far-end device to which to send the **ping** request message, expressed as a character string up to 63 characters

### **rapid**

changes the units for the interval from seconds to hundredths of seconds

### **detail**

displays detailed information

### *time-to-live*

specifies the TTL value for the MPLS label, expressed as a decimal integer

**Values** 1 to 128

### *type-of-service*

specifies the service type

**Values** 0 to 255

### *bytes*

specifies the request packet size in bytes, expressed as a decimal integer

**Values** 0 to 16384

### *pattern*

specifies the pattern that will be used to fill the data portion in a ping packet. If no pattern is specified, position information will be filled instead.

**Values** 0 to 65535

### **source** *ip-address*

specifies the IP address to be used

### *seconds*

defines the minimum amount of time, expressed as a decimal integer, that must expire before the next message request is sent.

This parameter is used to override the default request message send interval. If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values** 1 to 10000

**Default** 1

### **next-hop** *ip-address*

displays only the static routes with the specified next-hop IP address

*interface-name*

specifies the name of an IP 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

*requests*

specifies the number of times to perform an OAM ping probe operation. Each OAM echo message request must either time out 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 (does not apply to ICMPv6)

*router-instance*

specifies the router name or service ID

**Values** *router-name:* Base, management  
*service-id:* 1 to 2147483647

**Default** Base

*service-name*

the service name, up to 64 characters

*timeout*

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

This value is used to override the default timeout value.

**Values** 1 to 10

**Default** 5

**fc fc-name**

specifies the forwarding class for ICMP echo-request packets, which controls the dot1p marking of packets based on the configured SAP egress or network QoS policy. The packets use the egress control queue. If the **fc** option is not specified, the ICMP echo-request packets use the nc forwarding class by default. The DSCP value in the ping packets is determined by the **application icmp dscp** setting in the **sgt-qos** configuration (see the 7705 SAR Quality of Service Guide, "Self-generated traffic commands", for **sgt-qos** command descriptions).

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



**Default** nc

**fc-queue *fc-name***

specifies that the ICMP echo-request packets should use the egress data queue associated with the specified *fc-name* instead of the egress control queue (see the 7705 SAR Quality of Service Guide, "SGT Redirection" for more information)

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

**Default** nc

**profile {in | out}**

specifies the profile state of packets assigned to the specified forwarding class; this parameter applies only when the **fc-queue** parameter is configured

## shutdown

### Syntax

[no] shutdown

### Context

```
config>port>ethernet>efm-oam
config>router>if>eth-cfm>mep
config>saa>test
config>service>epipe>sap>eth-cfm>mep
config>service>epipe>spoke-sdp>eth-cfm>mep
config>service>vpls>sap>eth-cfm>mep
config>service>vpls>mesh-sdp>eth-cfm>mep
config>service>vpls>spoke-sdp>eth-cfm>mep
config>test-oam>ldp-treetrace
config>test-oam>twamp>server
```

### Description

The **shutdown** command administratively disables a test. A **shutdown** can only be performed if a test is not executing at the time the command is entered.

When a test is created, it remains in shutdown mode until a **no shutdown** command is executed.

To modify an existing test, it must first be shut down.

When used with the **ethernet>efm-oam** command, **shutdown** enables tunneling on the port (see [tunneling](#)), and **no shutdown** enables Ethernet EFM OAM 802.3ah.

The **no** form of this command sets the state of the test to operational.

Default

shutdown

traceroute

Syntax

**traceroute** [*ip-address* | *dns-name*] [**t***tl* *ttl*] [**w***ait* *milli-seconds*] [**n***o-dns*] [**s***ource* *ip-address*] [**t***os* *type-of-service*] [**r***outer* *router-instance* | **s***ervice-name* *service-name*]

Context

<global>

Description

This command determines the route to a destination address.

Parameters

*ip-address*

specifies the far-end IP address to which to send the traceroute request message

*dns-name*

specifies the DNS name of the far-end device to which to send the traceroute request message, expressed as a character string

*ttl*

specifies the maximum Time-To-Live (TTL) value to include in the traceroute request, expressed as a decimal integer

**Values** 1 to 255

*milli-seconds*

specifies the time in milliseconds to wait for a response to a probe, expressed as a decimal integer

**Values** 10 to 60000

**Default** 5000

**no-dns**

when the **no-dns** keyword is specified, DNS lookups of the responding hosts will not be performed; only the IP addresses will be printed

**Default** DNS lookups of the responding hosts are performed

**source** *ip-address*

specifies the source IP address to use as the source of the probe packets. If the IP address is not one of the device's interfaces, an error is returned.

*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-instance*

specifies a router name or service ID

**Values** *router-name* Base, management  
*service-id* 1 to 2147483647

**Default** Base

*service-name*

the service name, up to 64 characters

**Output**

The following output is an example of traceroute information.

**Destination address route example**

```
*A:ALU-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:ALU-1#
```

**3.8.2.1.2 Multicast commands****mrinfo****Syntax**

**mrinfo** *ip-address* | *dns-name* [**router** *router-instance* | **service-name** *service-name*]

**Context**

<global>

**Description**

This command is used to display relevant multicast information from the target multicast router. Information displayed includes adjacency information, protocol, metrics, thresholds, and flags from the target multicast router. This information can be used by network operators to determine whether bidirectional adjacencies exist.

**Parameters**

*ip-address*

specifies an IPv4 unicast address (a.b.c.d) for the multicast-capable target router

- dns-name

specifies the DNS name of the multicast-capable target router (if DNS name resolution is configured)
- router-instance

specifies a router name or service ID

Values

router-name

Base

service-id

1 to 2147483647

Default

Base
- service-name

specifies the service name, up to 64 characters

Output

The following output is an example of **mrinfo** information, and [Table 15: Multicast mrinfo field descriptions](#) describes the fields. In the example, the target router has IP address 239.255.0.1.

Output example

```
*A:7CSA:Dut-C# mrinfo 239.255.0.1
239.252.0.1 [version 0.0,prune,genid,mtrace]:
? 10.1.7.1 -> ? 10.1.7.7 [1/0/pim]
? 10.1.1.1 -> ? 10.0.0.0 [1/0/pim/leaf]
```

Table 15: Multicast mrinfo field descriptions

| Label           | Description                                                      |
|-----------------|------------------------------------------------------------------|
| General flags   |                                                                  |
| version         | The software version on the queried router                       |
| prune           | Indicates that the router understands pruning                    |
| genid           | Indicates that the router sends generation IDs                   |
| mtrace          | Indicates that the router handles mtrace requests                |
| Neighbors flags |                                                                  |
| ?               | Indicates that the IPAddr to Name conversion in DNS is not found |
| 1               | The metric                                                       |
| 0               | The threshold (multicast time-to-live)                           |
| pim             | Indicates that PIM is enabled on the interface                   |
| down            | The operational status of the interface                          |

| Label    | Description                                                       |
|----------|-------------------------------------------------------------------|
| disabled | The administrative status of the interface                        |
| leaf     | Indicates that there are no downstream neighbors on the interface |
| querier  | Indicates that the interface is an IGMP querier                   |
| tunnel   | The neighbor reached via the tunnel                               |

## mstat

### Syntax

**mstat** **source** *ip-address* | *dns-name* **group** *grp-ip-address*|*dns-name* [**destination** *dst-ip-address* | *dns-name*] [**hop** *hop*] [**router** *router-instance* | **service-name** *service-name*] [**wait-time** *wait-time*]

### Context

<global>

### Description

This command traces a multicast path from a source to a receiver and displays multicast packet rate and loss information. The **mstat** command adds the capability to show the multicast path in a limited graphic display and provides information about drops, duplicates, TTLs, and delays at each node. This information is useful to network operators because it identifies nodes with high drop and duplicate counts. Duplicate counts are shown as negative drops.

### Parameters

*ip-address*

specifies an IPv4 unicast address (a.b.c.d) for the multicast-capable source. This is the unicast address of the beginning of the path to be traced.

*dns-name*

specifies the DNS name of the multicast-capable source

*dst-ip-address*

specifies the IP address of the unicast destination. If this parameter is omitted, the IP address of the system where the command is entered is used. The destination parameter can also be used to specify a local interface address as the destination address to send the trace query to.

**Default** the incoming IETF format for that (S,G)

*grp-ip-address*

specifies the multicast group address that will be used

*hop*

specifies the maximum number of hops that will be traced from the receiver back toward the source

**Values** 1 to 255

**Default** 32

*router-instance*

specifies a router name or service ID

**Values**    *router-name*    Base  
              *service-id*        1 to 2147483647

**Default**    Base

*service-name*

specifies the service name, up to 64 characters

*wait-time*

specifies the number of seconds to wait for the response

**Values** 1 to 60

**Default** 10

**Output**

The following output is an example of **mstat** information, and [Table 16: Multicast mstat field descriptions](#) describes the fields.

For each interface between two nodes, a line is displayed. Note the following:

- the forwarding information/error code is only displayed when it is different from "No Error"
- "?" means that there is no reverse DNS translation

**Output example**

To follow the packet, start at Source and read down to Receiver. To count the number of hops, read back up from Query Source to Response Dest. The example below shows two hops between Query Source and Response Dest.

```
A:7CSA:Dut-C# mstat source 239.255.0.0 group 10.0.0.0

Mtrace from 239.255.0.via group 10.0.0.0
Querying full reverse path...

Waiting to accumulate statistics...Results after 10 seconds:

 Source Response Dest Overall Packet Statistics For Traffic From
239.255.0.0 10.0.0.0 Mcast Pkt 239.255.0.0 To 239.255.0.1
 | / rtt 11.0ms Rate
 v /
239.255.0.1 ?
10.1.7.1 ?
 | \ ttl 2 0 pps 0/0 = -- 0 pps
 v \
10.1.7.7 10.0.0.1
Receiver Query Source
```

Table 16: Multicast mstat field descriptions

| Label                                                                    | Description                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source                                                                   | The start ("Source") of the trace                                                                                                                                                                                                                       |
| Response Dest                                                            | The name of the router for this hop or "?" when there is no reverse DNS translation                                                                                                                                                                     |
| rtt                                                                      | The round-trip time                                                                                                                                                                                                                                     |
| Overall Mcast Pkt Rate                                                   | The overall multicast packet rate (that is, the average multicast packet rate across the router), expressed in pps (packets per second)                                                                                                                 |
| Packet Statistics For Traffic From ( <i>source</i> ) To ( <i>group</i> ) | The packet statistics from the specified source to the specified multicast group                                                                                                                                                                        |
| Lost/Sent = Pct Rate                                                     | The number of packets lost and sent, expressed as a percentage and as a rate                                                                                                                                                                            |
| Receiver                                                                 | The end ("Receiver") of the trace                                                                                                                                                                                                                       |
| Query Source                                                             | The query source address. On the 7705 SAR, the query source is the receiver-end router, which generates queries to determine if there is a path to the source when a receiver is available. The query source and the response destination are the same. |

## mtrace

### Syntax

**mtrace** **source** *ip-address* | *dns-name* **group** *grp-ip-address* | *dns-name* [**destination** *dst-ip-address* | *dns-name*] [**hop** *hop*] [**router** *router-instance* | **service-name** *service-name*] [**wait-time** *wait-time*]

### Context

<global>

### Description

This command traces the multicast path from a source to a receiver by passing a trace query hop-by-hop along the reverse path from the receiver to the source. At each hop, information such as the hop address, routing error conditions, and packet statistics are gathered and returned to the requester. A network administrator can determine where multicast flows stop and verify the flow of the multicast stream.

### Parameters

*ip-address*

specifies an IPv4 unicast address (a.b.c.d) for the multicast-capable source. This is a unicast address of the beginning of the path to be traced.

- dns-name*

specifies the DNS name of the multicast-capable source
- dst-ip-address*

specifies the IP address of the unicast destination. If this parameter is omitted, the IP address of the system where the command is entered is used. The destination parameter can also be used to specify a local interface address as the destination address to send the trace query to.

Default

the incoming IETF format for that (S,G)
- grp-ip-address*

specifies the multicast group address that will be used
- hop*

specifies the maximum number of hops that will be traced from the receiver back toward the source

Values

1 to 255

Default

32
- router-instance*

specifies a router name or service ID

Values

*router-name*

Base

*service-id*

1 to 2147483647

Default

Base
- service-name*

specifies the service name, up to 64 characters
- wait-time*

specifies the number of seconds to wait for the response

Values

1 to 60

Default

10

Output

The following output is an example of **mtrace** information, where each line consists of fields separated by a space. If the output was formatted as a table, it would look like the following:

| Hop  | Router Name | (Address)    | Protocol | TTL       | Forwarding Code |
|------|-------------|--------------|----------|-----------|-----------------|
| ---- | -----       | -----        | -----    | -----     | -----           |
| -1   | ?           | (10.10.10.5) | PIM      | thresh^ 1 | No Error        |

Table 17: Multicast mtrace field descriptions describes the fields.

Output example

```
*A:7CSA:Dut-C# mtrace source 239.255.0.0 group 10.0.0.0
```



```

Mtrace from 239.255.0.via group 10.0.0.0
Querying full reverse path...

 0 ? (10.1.7.7)
-1 ? (10.1.7.1) PIM thresh^ 1 No Error
-2 ? (239.255.0)
Round trip time 11.0 ms; total ttl of 2 required.

```

Table 17: Multicast mtrace field descriptions

| Field           | Description                                                                                                                                                                                                                                                                                 |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hop             | The number of hops from the source to the listed router. The "-" sign indicates that the TTL value is decremented by 1 after each hop.                                                                                                                                                      |
| Router Name     | The name of the router for this hop. If a DNS name query is not successful, a "?" displays.                                                                                                                                                                                                 |
| (Address)       | The address of the router for this hop                                                                                                                                                                                                                                                      |
| Protocol        | The protocol used                                                                                                                                                                                                                                                                           |
| TTL             | The forward TTL threshold, which is the TTL that a packet is required to have before it will be forwarded over the outgoing interface<br><br>The TTL default value of 1 s cannot be changed for multicast control messages because the packets are not forwarded beyond the next-hop router |
| Forwarding Code | The forwarding information/error code for this hop                                                                                                                                                                                                                                          |

### 3.8.2.1.3 ATM diagnostics

#### atm-ping

##### Syntax

**atm-ping** {port-id | bundle-id [:vpi | vpi/vci]} [end-to-end | segment] [dest destination-id] [send-count send-count] [timeout timeout] [interval interval]

##### Context

oam

##### Description

This command tests ATM path connectivity on an ATM VCC.

This command is not supported on ATM VCC SAPs that are members of a SAP aggregation group.



*interval*

specifies the minimum amount of time that must expire before the next message request is sent

If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

This parameter is used to override the default request message send interval.

**Values** 1 to 10

**Default** 1

### 3.8.2.1.4 Service diagnostics

#### sdp-mtu

##### Syntax

**sdp-mtu** *orig-sdp-id* **size-inc** *start-octets* *send-octets* [**step** *step-size*] [**timeout** *timeout*] [**interval** *interval*]

##### Context

oam

##### 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 specified 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 7705 SAR. OAM request messages sent within an IP SDP must have the "DF" IP header bit set to 1 to prevent message fragmentation.

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 will be sent unless a valid response is received for one of the requests at that size. When a response is received, the next size message is sent. The response message indicates the result of the message request.

After the last reply has been received or a response timeout occurs, the maximum size message replied to indicates the largest size OAM request message that received a valid reply.

To terminate an **sdp-mtu** in progress, use the CLI break sequence Ctrl-c.



**Note:** The **sdp-mtu** command probes the far-end port using the configured MTU of the near-end port, not the configured MTU of the far-end port. For example, a far-end port that is physically capable of receiving jumbo frames would respond to **sdp-mtu** probes up to the jumbo frame

size, regardless of the configured MTU of the far-end port. This assumes that the intermediate transport network can switch frames of this size.

## Parameters

### *orig-sdp-id*

specifies the SDP-ID to be used by **sdp-mtu** 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 SDP tunnel encapsulation used to reach the far end: GRE, 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-mtu** will attempt to send the next request if required).

**Values** 1 to 17407

### *start-octets**end-octets*

indicates that an incremental path MTU test will be performed by sending a series of message requests with increasing MTU sizes

### *start-octets*

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

**Values** 72 to 9702

### *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** 72 to 9702

### *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 will not be 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 will be sent.

**Values** 1 to 512

**Default** 32

### *timeout*

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be 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 will be silently discarded.

This value is used to override the default **timeout** value.

**Values** 1 to 10

**Default** 5

*interval*

defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

This parameter is used to override the default request message send interval.

**Values** 1 to 10

**Default** 1

**Output**

The following output is an example of SDP MTU path test information.

**SDP MTU path test output**

```
*A:router 1> sdp-mtu 6 size-inc 512 3072 step 256
 Size Sent Response

 512 . Success
 768 . Success
 1024 . Success
 1280 . Success
 1536 . Success
 1792 . Success
 2048 . Success
 2304 ... Request Timeout
 2560 ... Request Timeout
 2816 ... Request Timeout
 3072 ... Request Timeout
Maximum Response Size: 2048
```

**svc-ping**

**Syntax**

**svc-ping** *ip-address* **service** [*service-id*] [**local-sdp**] [**remote-sdp**]

**Context**

oam

**Description**

This command tests a service ID for correct and consistent provisioning between two service endpoints. The 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 will be sent per command; no count or interval parameter is supported and round-trip time is not calculated. A timeout value of 10 s is used before failing the request. The forwarding class is assumed to be NC In-Profile.

If no request is sent or a reply is not received, all remote information will be shown as N/A.

To terminate an **svc-ping** in progress, use the CLI break sequence Ctrl-c.

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

Table 18: SVC ping report field

| Field                     | Description                                                                                                                                 | Values                                       |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Request Result            | The result of the <b>svc-ping</b> 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 Service-ID being tested                                                                                                                 | Service-ID                                   |
| Local Service Type        | The type of service being tested. If <i>service-id</i> does not exist locally, N/A is displayed.                                            | Apipe, Epipe, Fpipe, Hpipe                   |
|                           |                                                                                                                                             | TLS                                          |
|                           |                                                                                                                                             | IES                                          |
|                           |                                                                                                                                             | Mirror-Dest                                  |
|                           |                                                                                                                                             | N/A                                          |
| Local Service Admin State | The local administrative state of <i>service-id</i> . If the service does not exist locally, the administrative state will be Non-Existent. | Admin-Up                                     |

| Field                            | Description                                                                                                                                                                                           | Values                     |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|                                  |                                                                                                                                                                                                       | Admin-Down                 |
|                                  |                                                                                                                                                                                                       | Non-Existent               |
| Local Service Oper State         | The local operational state of <i>service-id</i> . If the service does not exist locally, the state will be N/A.                                                                                      | Oper-Up                    |
|                                  |                                                                                                                                                                                                       | Oper-Down                  |
|                                  |                                                                                                                                                                                                       | N/A                        |
| Remote Service Type              | The remote type of service being tested. If <i>service-id</i> does not exist remotely, N/A is displayed.                                                                                              | Apipe, Epipe, Fpipe, Hpipe |
|                                  |                                                                                                                                                                                                       | TLS                        |
|                                  |                                                                                                                                                                                                       | IES                        |
|                                  |                                                                                                                                                                                                       | Mirror-Dest                |
|                                  |                                                                                                                                                                                                       | N/A                        |
| Remote Service Admin State       | The remote administrative state of <i>service-id</i> . If the service does not exist remotely, the administrative state is Non-Existent.                                                              | Up                         |
|                                  |                                                                                                                                                                                                       | Down                       |
|                                  |                                                                                                                                                                                                       | Non-Existent               |
| Local Service MTU                | The local <b>service-mtu</b> for <i>service-id</i> . If the service does not exist, N/A is displayed.                                                                                                 | service-mtu                |
|                                  |                                                                                                                                                                                                       | N/A                        |
| Remote Service MTU               | The remote <b>service-mtu</b> for <i>service-id</i> . If the service does not exist remotely, N/A is displayed.                                                                                       | remote-service-mtu         |
|                                  |                                                                                                                                                                                                       | N/A                        |
| Local Customer ID                | The local <i>customer-id</i> associated with <i>service-id</i> . If the service does not exist locally, N/A is displayed.                                                                             | customer-id                |
|                                  |                                                                                                                                                                                                       | N/A                        |
| Remote Customer ID               | The remote <i>customer-id</i> associated with <i>service-id</i> . 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 a remotely configured SDP-ID (as the <b>far-end</b> 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                         |

| Field                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Values                          |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Down                            |
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Non-Existent                    |
| Expected Far-end Address                | The expected IP address for the remote system IP interface. This must be the <b>far-end</b> address entered for the <b>svc-ping</b> command.                                                                                                                                                                                                                                                                                                                                                                                                                                          | orig-sdp-far-end-addr           |
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | dest-ip-addr                    |
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A                             |
| Actual Far-end Address                  | The returned remote IP address. If a response is not received, the displayed value is N/A. If the far-end service IP interface is down or non-existent, a message reply is not expected. The <b>sdp-ping</b> command should also fail.                                                                                                                                                                                                                                                                                                                                                | resp-ip-addr                    |
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A                             |
| Responders Expected Far-end Address     | The expected source of the originator's SDP-ID from the perspective of the remote 7705 SAR 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 <b>far-end</b> IP address if <b>sdp-path</b> is defined. The originating SDP-ID must be bound to the <b>service-id</b> and terminate on the <b>far-end</b> 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            | Indicates whether the originating 7705 SAR used the originating SDP-ID to send the <b>svc-ping</b> request. If a valid originating SDP-ID is found, is operational and has a valid egress service label, the originating 7705 SAR should use the SDP-ID as the requesting path if <b>sdp-path</b> has been defined. If the originating 7705 SAR uses the originating SDP-ID as the request path, Yes is displayed. If the originating 7705 SAR 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 shut down, Admin-Down is displayed. If the originating SDP-ID is in the <b>no shutdown</b> state, Admin-Up is displayed. If an originating SDP-ID is not found, N/A is displayed.                                                                                                                                                                                                                                                                                                                    | Admin-Up                        |
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Admin-Down                      |
|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 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                             |



| Field                                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Values       |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Originating SDP-ID Binding Admin State | The local administrative state of the originating SDP-ID binding to <i>service-id</i> . If an SDP-ID is not bound to the service, N/A is displayed.                                                                                                                                                                                                                                                                                                                                                                                                                 | Admin-Up     |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Admin-Down   |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | N/A          |
| Originating SDP-ID Binding Oper State  | The local operational state of the originating SDP-ID binding to <i>service-id</i> . If an SDP-ID is not bound to the service, N/A is displayed.                                                                                                                                                                                                                                                                                                                                                                                                                    | Oper-Up      |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Oper-Down    |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | N/A          |
| Responding SDP-ID                      | The SDP-ID used by the far end to respond to the <b>svc-ping</b> request. If the request was received without the <b>sdp-path</b> parameter, the responding 7705 SAR will not use an SDP-ID as the return path, but the appropriate responding SDP-ID will be displayed. If a valid SDP-ID return path is not found to the originating 7705 SAR that is bound to the <i>service-id</i> , Non-Existent is displayed.                                                                                                                                                 | resp-sdp-id  |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Non-Existent |
| Responding SDP-ID Path Used            | Indicates whether the responding 7705 SAR used the responding SDP-ID to respond to the <b>svc-ping</b> request. If the request was received via the originating SDP-ID and a valid return SDP-ID is found, is operational and has a valid egress service label, the far-end 7705 SAR 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 <i>service-id</i> . 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-Down   |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | N/A          |
| Responding SDP-ID Operational State    | The operational state of the far-end SDP-ID associated with the return path for <i>service-id</i> . 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 <i>service-id</i> . 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   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Oper-Up      |

| Field                                   | Description                                                                                                                                                                                                                                                                                                                                                | Values           |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                                         | The local operational state of the responder's SDP-ID binding to <i>service-id</i> . If an SDP-ID is not bound to the service, N/A is displayed.                                                                                                                                                                                                           | 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 <i>service-id</i> . If the SDP-ID signaling is off, <i>originator-vc-id</i> is 0. If the <i>originator-vc-id</i> does not exist, N/A is displayed.                                                                                                               | originator-vc-id |
|                                         |                                                                                                                                                                                                                                                                                                                                                            | N/A              |
| Responding VC-ID                        | The responder's VC-ID associated with the SDP-ID to <i>originator-id</i> that is bound to <i>service-id</i> . If the SDP-ID signaling is off or the service binding to SDP-ID does not exist, <i>responder-vc-id</i> 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 <i>service-id</i> for the originating SDP-ID. If <i>service-id</i> does not exist locally, N/A is displayed. If <i>service-id</i> 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 <i>service-id</i> 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 7705 SAR considers the displayed egress service label operational, Up is displayed. If the originating 7705 SAR considers the egress service label inoperative, Down is displayed. If the <i>service-id</i> 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 7705 SAR for this <i>service-id</i> to the originating 7705 SAR. If <i>service-id</i> does not exist in the remote 7705 SAR, N/A is displayed. If <i>service-id</i> 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 <i>service-id</i> 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 considers its egress service label operational, Up is displayed. If the responding 7705 SAR considers its egress                                                                                                                                                                              | Up               |
|                                         |                                                                                                                                                                                                                                                                                                                                                            | Down             |

| Field                                  | Description                                                                                                                                                                                                                                                                                                                                                                                                      | Values                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
|                                        | service label inoperative, Down is displayed. If the <i>service-id</i> 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 <i>service-id</i> when sending to the originating 7705 SAR. If <i>service-id</i> does not exist locally, N/A is displayed. If <i>service-id</i> exists but an ingress service label has not been assigned, Non-Existent is displayed.                                                              | ingress-vc-label      |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | N/A                   |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | Non-Existent          |
| Expected Ingress Label Source          | The originator's ingress service label source. If the originator's ingress service label is manually defined, Manual is displayed. If the originator's ingress service label is dynamically signaled, Signaled is displayed. If the <i>service-id</i> does not exist on the originator or the originator's ingress service label has not been assigned, N/A is displayed.                                        | Manual                |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | Signaled              |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | N/A                   |
| Expected Ingress Service Label State   | The originator's ingress service label state. If the originating 7705 SAR considers its ingress service label operational, Up is displayed. If the originating 7705 SAR considers its ingress service label inoperative, Down is displayed. If the <i>service-id</i> does not exist locally, N/A is displayed.                                                                                                   | Up                    |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | Down                  |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | N/A                   |
| Responders Ingress Service Label       | The assigned ingress service label on the remote 7705 SAR. This is the service label that the far end is expecting to receive for <i>service-id</i> when sending to the originating 7705 SAR. If <i>service-id</i> does not exist in the remote 7705 SAR, N/A is displayed. If <i>service-id</i> exists, but an ingress service label has not been assigned in the remote 7705 SAR, 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 7705 SAR. If the ingress service label is manually defined on the remote 7705 SAR, Manual is displayed. If the ingress service label is dynamically signaled on the remote 7705 SAR, Signaled is displayed. If the <i>service-id</i> does not exist on the remote 7705 SAR, N/A is displayed.                                                            | Manual                |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | Signaled              |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | N/A                   |
| Responders Ingress Service Label State | The assigned ingress service label state on the remote 7705 SAR. If the remote 7705 SAR considers its ingress service label operational, Up is displayed. If the remote 7705 SAR considers its ingress service label inoperative, Down is displayed. If the <i>service-id</i> does not exist on the remote 7705 SAR or the ingress service label has not been assigned on the remote 7705 SAR, N/A is displayed. | Up                    |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | Down                  |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  | N/A                   |

## Parameters

### *ip-address*

specifies the far-end IP address to which to send the **svc-ping** request message in dotted-decimal notation

### *service-id*

identifies the service being tested. The Service ID need not exist on the local 7705 SAR to receive a reply message.

This is a mandatory parameter.

**Values** 1 to 2147483647, or *service-name*

### **local-sdp**

specifies that 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 SDP tunnel encapsulation used to reach the far end: GRE, 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 GRE 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 19: Local SDP message results

| Local service state                       | Local SDP (local-sdp) not specified |                          | Local SDP (local-sdp) specified |                                                   |
|-------------------------------------------|-------------------------------------|--------------------------|---------------------------------|---------------------------------------------------|
|                                           | Message sent                        | Message encapsulation    | Message sent                    | Message encapsulation                             |
| Invalid Local Service                     | Yes                                 | Generic IP/GRE OAM (PLP) | No                              | None                                              |
| No Valid SDP-ID Bound                     | Yes                                 | Generic IP/GRE OAM (PLP) | No                              | None                                              |
| SDP-ID Valid But Down                     | Yes                                 | Generic IP/GRE OAM (PLP) | No                              | None                                              |
| SDP-ID Valid and Up, But No Service Label | Yes                                 | Generic IP/GRE OAM (PLP) | No                              | None                                              |
| SDP-ID Valid, Up and Egress Service Label | Yes                                 | Generic IP/GRE OAM (PLP) | Yes                             | SDP Encapsulation with Egress Service Label (SLP) |

### **remote-sdp**

specifies that the **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 SDP tunnel encapsulation used to reply to the originator: GRE, 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. If **remote-sdp** is not specified, the **svc-ping** request message is sent with GRE encapsulation with the OAM label.

The following table indicates how the message response is encapsulated based on the state of the remote Service ID.

Table 20: Remote SDP message results

| Remote service state                                          | Message encapsulation                 |                                                   |
|---------------------------------------------------------------|---------------------------------------|---------------------------------------------------|
|                                                               | Remote SDP (remote-sdp) not specified | Remote SDP (remote-sdp) specified                 |
| Invalid Ingress Service Label                                 | Generic IP/GRE OAM (PLP)              | Generic IP/GRE OAM (PLP)                          |
| Invalid Service-ID                                            | Generic IP/GRE OAM (PLP)              | Generic IP/GRE OAM (PLP)                          |
| No Valid SDP-ID Bound on Service-ID                           | Generic IP/GRE OAM (PLP)              | Generic IP/GRE OAM (PLP)                          |
| SDP-ID Valid But Down                                         | Generic IP/GRE OAM (PLP)              | Generic IP/GRE OAM (PLP)                          |
| SDP-ID Valid and Up, but No Service Label                     | Generic IP/GRE OAM (PLP)              | Generic IP/GRE OAM (PLP)                          |
| SDP-ID Valid and Up, Egress Service Label, but VC-ID Mismatch | Generic IP/GRE OAM (PLP)              | Generic IP/GRE OAM (PLP)                          |
| SDP-ID Valid and Up, Egress Service Label, but VC-ID Match    | Generic IP/GRE OAM (PLP)              | SDP Encapsulation with Egress Service Label (SLP) |

## Output

The following output is an example of SVC ping information.

### Output example

```
*A:router1> svc-ping far-end 10.10.10.10 service 101 local-sdp remote-sdp
Service-ID: 101
Err Info Local Remote

Type: CPIPE CPIPE
Admin State: Up Up
Oper State: Up Up
Service-MTU: 1000 1000
Customer ID: 1001 1001
==> IP Interface State: Down
Actual IP Addr: 10.10.10.11 10.10.10.10
Expected Peer IP: 10.10.10.10 10.10.10.11
==> SDP Path Used: Yes Yes
SDP-ID: 123 325
Admin State: Up Up
Operative State: Up Up
Binding Admin State: Up Up
Binding Oper State: Up Up
```

|                                       |          |          |
|---------------------------------------|----------|----------|
| Binding VC ID:                        | 101      | 101      |
| Binding Type:                         | Spoke    | Spoke    |
| Binding Vc-type:                      | CesoPsn  | CesoPsn  |
| Binding Vlan-vc-tag:                  | 0        | 0        |
| ==> Egress Label:                     | 131066   | 131064   |
| Ingress Label:                        | 131064   | 131066   |
| Egress Label Type:                    | Signaled | Signaled |
| Ingress Label Type:                   | Signaled | Signaled |
| Request Result: Sent - Reply Received |          |          |

3.8.2.1.5 EFM commands

efm

Syntax

efm *port-id*

Context

oam

Description

This command enables Ethernet in the first mile (EFM) OAM loopbacks on the specified port. The EFM OAM remote loopback OAMPDU will be sent to the peering device to trigger a 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

Description

This command enables local loopback tests on the specified port.

## remote-loopback

### Syntax

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

### Context

oam>efm

### Description

This command enables remote EFM OAM loopback tests on the specified port. The EFM OAM remote loopback OAMPDU will be sent to the peering device to trigger a remote loopback.

## ethernet

### Syntax

**ethernet**

### Context

config>port

### Description

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

## efm-oam

### Syntax

**efm-oam**

### Context

config>port>ethernet

### Description

This command configures EFM OAM attributes.

## accept-remote-loopback

### Syntax

**[no] accept-remote-loopback**

## Context

config>port>ethernet>efm-oam

## Description

This command enables reactions to loopback control OAMPDUs from peers.

The **no** form of this command disables reactions to loopback control OAMPDUs.

## hold-time

## Syntax

**hold-time** *time-value*

**no hold-time**

## Context

config>port>ethernet>efm-oam

## Description

This command sets the amount of time that EFM-OAM will wait before going from a non-operational state to an operational state.

If EFM-OAM goes from an operational state to a non-operational state (other than link-fault), it enters the hold-time period. During this time, EFM-OAM continues to negotiate with the peer if possible, but will not transition to the "up" state until the hold time has expired.

If EFM-OAM goes down because of a lower-level fault (for example, the port goes down and EFM-OAM enters the link-fault state), the hold timer is not triggered. When the lower-level fault is cleared, EFM-OAM immediately starts running on the port and transitions to the operational state as soon as possible.

If EFM-OAM goes down because the user administratively disables the protocol, EFM-OAM immediately transitions to the disabled state. When the user re-enables EFM-OAM, the protocol enters the hold time period and EFM-OAM is not operational until the hold time expires. A hold-time value of 0 indicates that EFM-OAM returns to the operational state without delay.

The hold time affects only the transition from a non-operational state to an operational state; it does not apply to a transition from an operational state to a non-operational state.

## Parameters

*time-value*

the number of seconds that EFM-OAM will wait before returning to an operational state from a non-operational state

**Values** 0 to 50

**Default** 0



## mode

### Syntax

**mode** {**active** | **passive**}

### Context

config>port>ethernet>efm-oam

### Description

This command configures the mode of OAM operation for this Ethernet port.

**Active** mode causes the port to initiate the negotiation process and continually send out EFM OAM information PDUs. **Passive** mode waits for the peer to initiate the negotiation process. A passive mode port cannot initiate monitoring activities (such as loopback) with the peer.

### Default

active

## transmit-interval

### Syntax

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

### Context

config>port>ethernet>efm-oam

### Description

This command configures the transmit interval of OAMPDUs.

### Parameters

*interval*

specifies the transmit interval

**Values** 1 to 600 (in 100 ms)

*multiplier*

specifies the multiplier for the transmit interval to set the local link down timer

**Values** 2 to 5

tunneling

Syntax

[no] tunneling

Context

config>port>ethernet>efm-oam

Description

This command enables EFM OAMPDU tunneling. OAMPDU tunneling is required when a loopback is initiated from a router end and must be transported over the existing network infrastructure to the other end. Enabling tunneling will allow the PDUs to be mapped to Epipes so that the OAM frames can be tunneled over MPLS to the far end. To enable Ethernet EFM OAM 802.3ah on the port, use the **efm-oam>no shutdown** command. The **no** form of the command disables tunneling.

3.8.2.1.6 ETH-CFM commands

eth-test

Syntax

**eth-test** *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**priority** *priority*] [**data-length** *data-length*]

Context

oam>eth-cfm

Description

This command specifies to initiate an Ethernet (signal) test.

Parameters

*mac-address*

specifies a unicast MAC address

**Values**    *xx:xx:xx:xx:xx:xx* or *xx-xx-xx-xx-xx-xx*, where *xx* is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values**    1 to 8191

*md-index*

specifies the MD index

**Values** 1 to 4294967295

*priority*

specifies the value used for priority mapping. See [Table 8: Priority mapping based on message type and MEP direction](#) to determine how the priority is derived; if it is user-defined, see [Table 7: Y.1731 priority-to-FC mapping](#) for the priority-to-FC mappings.

**Values** 0 to 7

**Default** the CCM and LTM priority of the MEP

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*data-length*

specifies the packet size in bytes, expressed as a decimal integer, used for the ETH-CFM test

**Values** 64 to 1500

**Default** 64

# linktrace

## Syntax

**linktrace** *mac-address mep mep-id domain md-index association ma-index [ttl ttl-value]*

## Context

oam>eth-cfm

## Description

This command specifies to initiate a linktrace test.

## Parameters

*mac-address*

specifies a unicast destination MAC address

**Values** xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values** 1 to 8191

*md-index*

specifies the MD index

**Values** 1 to 4294967295

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*ttl-value*

specifies the TTL for a returned linktrace

**Values** 0 to 255

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

Description

This command specifies to initiate a loopback test.

Parameters

*mac-address*

specifies a unicast MAC address

**Values** xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values** 1 to 8191

*md-index*

specifies the MD index

**Values** 1 to 4294967295

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

- send-count

specifies the number of messages to send, expressed as a decimal integer. Dot1ag loopback messages are sent back-to-back, with no delay between the transmissions.

Values

1 to 5

Default

1
- data-size

specifies the packet size in bytes, expressed as a decimal integer

Values

0 to 1500

Default

0
- priority

specifies the value used for priority mapping. See [Table 8: Priority mapping based on message type and MEP direction](#) to determine how the priority is derived; if it is user-defined, see [Table 7: Y.1731 priority-to-FC mapping](#) for the priority-to-FC mappings.

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

Description

This command specifies to initiate an ETH-CFM one-way delay test.

Parameters

mac-address

specifies a unicast MAC address

Values

xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

mep-id

specifies the target MEP ID

Values

1 to 8191

|                 |                                                                                                                                                                                                                                                                                                   |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>md-index</i> | specifies the MD index                                                                                                                                                                                                                                                                            |
| <b>Values</b>   | 1 to 4294967295                                                                                                                                                                                                                                                                                   |
| <i>ma-index</i> | specifies the MA index                                                                                                                                                                                                                                                                            |
| <b>Values</b>   | 1 to 4294967295                                                                                                                                                                                                                                                                                   |
| <i>priority</i> | specifies the value used for priority mapping. See <a href="#">Table 8: Priority mapping based on message type and MEP direction</a> to determine how the priority is derived; if it is user-defined, see <a href="#">Table 7: Y.1731 priority-to-FC mapping</a> for the priority-to-FC mappings. |
| <b>Values</b>   | 0 to 7                                                                                                                                                                                                                                                                                            |
| <b>Default</b>  | 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

**Description**  
This command specifies to initiate an ETH-CFM two-way delay test.

|                    |                                                                          |
|--------------------|--------------------------------------------------------------------------|
| <i>mac-address</i> | specifies a unicast MAC address                                          |
| <b>Values</b>      | xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number |
| <i>mep-id</i>      | specifies the target MEP ID                                              |
| <b>Values</b>      | 1 to 8191                                                                |
| <i>md-index</i>    | specifies the MD index                                                   |
| <b>Values</b>      | 1 to 4294967295                                                          |

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*priority*

specifies the value used for priority mapping. See [Table 8: Priority mapping based on message type and MEP direction](#) to determine how the priority is derived; if it is user-defined, see [Table 7: Y.1731 priority-to-FC mapping](#) for the priority-to-FC mappings.

**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

Description

This command specifies to initiate an Ethernet CFM two-way SLM test.

Parameters

*mac-address*

specifies a unicast MAC address

**Values** xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values** 1 to 8191

*md-index*

specifies the MD index

**Values** 1 to 4294967295

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*priority*

specifies the value used for priority mapping. See [Table 8: Priority mapping based on message type and MEP direction](#) to determine how the priority is derived; if it is user-defined, see [Table 7: Y.1731 priority-to-FC mapping](#) for the priority-to-FC mappings.

**Values** 0 to 7

**Default** 7

*send-count*

the number of messages to send, expressed as a decimal integer. The message interval value must be expired before the next message request is sent.

**Values** 1 to 1000

**Default** 1

*data-size*

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*

the timeout parameter in seconds. This value is the length of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded. The timeout value must be less than or equal to the interval.

**Values** 1 to 10

**Default** 5

*interval*

the time, in seconds between probes within a test run

**Values** 1 to 10

**Default** 5

single-ended-loss-test

Syntax

**single-ended-loss-test** *mac-address mep mep-id domain md-index association ma-index* [**priority** *priority*] [**interval** {100ms | 1s}] [**send-count** *send-count*]



Context

oam>eth-cfm

Description

This command specifies to initiate a loss measurement test between the specified *mac-address* router and the specified *mep-id* MEP.

Single-ended and dual-ended loss tests are mutually exclusive tests. Single-ended loss tests can be run when dual-ended loss tests are disabled (under the **config>service>epipe>spoke-sdp>eth-cfm>mep** or **config>router>if>eth-cfm>mep** context).

Parameters

*mac-address*

specifies a unicast MAC address

**Values**    xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values**    1 to 8191

*md-index*

specifies the index of the MD to which the MEP is associated, or 0, if none

**Values**    1 to 4294967295

*ma-index*

specifies the index to which the MEP is associated, or 0, if none

**Values**    1 to 4294967295

*send-count*

specifies the number of LMM messages to send, expressed as a decimal integer

**Values**    2 to 5

**Default**    2

**interval {100ms | 1s}**

specifies the interval between groups of consecutive LMM packets (for example, if *send-count* is 5 and *interval* is 1s, then 5 LMM packets are sent at 1-s intervals)

**Values**    100ms | 1s

**Default**    1s

*priority*

specifies the value used for priority mapping. See [Table 8: Priority mapping based on message type and MEP direction](#) to determine how the priority is derived; if it is user-defined, see [Table 7: Y.1731 priority-to-FC mapping](#) for the priority-to-FC mappings.

**Values** 0 to 7

**Default** the CCM and LTM priority of the MEP

## eth-cfm

### Syntax

**eth-cfm**

### Context

```
config
config>router>interface
config>service>epipe>sap
config>service>epipe>spoke-sdp
config>service>vpls>sap
config>service>vpls>mesh-sdp
config>service>vpls>spoke-sdp
```

### Description

This command enables the context to configure 802.1ag Connectivity Fault Management (CFM) parameters.

## domain

### Syntax

```
domain md-index [format {dns | mac | none | string}] [name md-name] level level
domain md-index
no domain md-index
```

### Context

```
config>eth-cfm
```

### Description

This command configures CFM domain parameters.

The **dns**, **mac**, and **string** keywords apply to dot1ag. The **none** keyword applies to Y.1731. If the **none** keyword is used, the [association](#) command must use the **icc-based** or **string** format. A MEP associated with domain format **none** and association format **icc-based** is a Y.1731 MEP. A MEP associated with domain format **none** and association format **string** is a Y.1731 MEP that can interoperate with a dot1ag MEP. All other configurations are associated with dot1ag MEPs.

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

Parameters

*md-index*

specifies the maintenance domain (MD) index value

**Values** 1 to 4294967295

**format {dns | mac | none | string}**

specifies a value that represents the type (format) of the *md-name*

**Values**    **dns:**        specifies the DNS name format  
              **mac:**        X:X:X:X:X-u  
                              X: [0 to FF] hex  
                              u: [0 to 65535] decimal  
              **none:**      no name specified (the domain represents a Y.1731 MEG,  
                              not a dot1ag domain)  
              **string:**    specifies an ASCII string

**Default**    string

*md-name*

specifies a generic maintenance domain (MD) name

**Values**    1 to 43 characters

*level*

specifies the integer identifying the maintenance domain level (MD level). Higher numbers correspond to higher-level maintenance domains (those with the greatest physical reach) with the highest values for customers' CFM packets. Lower numbers correspond to lower-level 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 {icc-based | integer | string | vid | vpn-id}**] **name** *ma-name*  
**association** *ma-index*  
**no association** *ma-index*

Context

config>eth-cfm>domain

Description

This command configures the maintenance association (MA) for the domain.

The **integer**, **string**, **vid**, and **vpn-id** keywords apply to dot1ag MAs. The **icc-based** keyword applies to Y.1731 MEGs, and is only available when the domain format is **none**. A MEP associated with domain format **none** and association format **icc-based** is a Y.1731 MEP. A MEP associated with domain format **none** and association format **string** is a Y.1731 MEP that can interoperate with a dot1ag MEP. All other configurations are associated with dot1ag MEPs.

Parameters

*ma-index*

specifies the MA index value

**Values** 1 to 4294967295

**format {icc-based | integer | string | vid | vpn-id}**

specifies a value that represents the type (format) of the *ma-name*

**Values**   **icc-based:**   raw ASCII, exactly 13 characters (the association is a Y.1731 MEG, not a dot1ag MA)

**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:xxx    where x is a value between 00 and FF (for example 00164D:AABBCCDD)

**Default** integer

*ma-name*

specifies the part of the maintenance association identifier that is unique within the maintenance domain name

**Values** 1 to 45 characters

bridge-identifier

Syntax

[no] **bridge-identifier** *bridge-id*

Context

config>eth-cfm>domain>association

Description

This command configures the service ID for the domain association. The *bridge-id* should be configured to match the *service-id* of the service where MEPs for this association will be created. For example, for Epipe service-id 2, set the bridge-id to 2. There is no verification that the service with a matching *service-id* exists.

This command does not apply to facility MEPs on network interfaces, as these MEPs are not bound to a service.

### Parameters

*bridge-id*

specifies the bridge ID for the domain association

**Values** 1 to 2147483647

vlan

### Syntax

**vlan** *vlan-id*

**no vlan**

### Context

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

### Description

This command configures the bridge-identifier primary VLAN ID. This command is informational only; no verification is done to ensure that MEPs on this association are on the configured VLAN.

### Parameters

*vlan-id*

specifies a VLAN ID monitored by MA.

**Values** 0 to 4094

ccm-interval

### Syntax

**ccm-interval** {10ms | 100ms | 1 | 10 | 60 | 600}

**no ccm-interval**

### Context

config>eth-cfm>domain>association

### Description

This command configures the CCM transmission interval for all MEPs in the association, in milliseconds and seconds.

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

**Default**

10 s

**remote-mepid****Syntax****[no] remote-mepid** *mep-id***Context**

config&gt;eth-cfm&gt;domain&gt;association

**Description**

This command configures the remote maintenance association endpoint MEP identifier.

**Parameters***mep-id*

maintenance association endpoint identifier of a remote MEP whose information from the MEP database is to be returned

**Values** 1 to 8191**slm****Syntax****slm****Context**

config&gt;eth-cfm

**Description**

This command enables the context to configure ITU-T Synthetic Loss Measurement (ETH-SL).

**inactivity-timer****Syntax****inactivity-timer** *timeout***no inactivity-timer****Context**

config&gt;eth-cfm&gt;slm

## Description

This command configures the time that the responder keeps a test active. If the time between packets exceeds this value within a test, the responder marks the previous test as complete. It treats any new packets from a peer with the same test-id, source MAC address, and MEP-ID as a new test, and indicates this by responding with the sequence number 1.

## Default

100 s

## Parameters

*timeout*

specifies the inactivity timeout value, in seconds

**Values** 10 to 100

**Default** 100

## cfm-loopback

## Syntax

**cfm-loopback priority** {**low** | **high** | **dot1p**} [**match-vlan** {*vlan-range* | **none**}]

**no cfm-loopback**

## Context

config>port>ethernet

## Description

This command enables the port to respond to loopback messages (LBMs) and sets the queuing and scheduling conditions for handling CFM LBM frames. The user selects the required QoS treatment by enabling the CFM loopback and including the high or low priority with the **high** or **low** keyword. The queue parameters and scheduler mappings associated with the **high** and **low** keywords are preconfigured and cannot be altered by the user.

The **priority dot1p** and **match-vlan** keywords apply only to physical ring ports on the 2-port 10GigE (Ethernet) Adapter card/module.

The parameters and mappings have the following settings:

- for network egress or access egress, where 4-priority scheduling is enabled:
  - **high-priority**: either cir = port\_speed, which applies to all frames that are scheduled via an expedited in-profile scheduler, or RR for all other (network egress queue) frames that reside in expedited queues and are in an in-profile state
  - **low-priority**: either cir = 0, pir = port\_speed, which applies to all frames that are scheduled via a best effort out-of-profile scheduler, or RR for all other frames that reside in best-effort queues and are in an out-of-profile state

- for the 8-port Gigabit Ethernet Adapter card, the 10-port 1GigE/1-port 10GigE X-Adapter card, and the v-port on the 2-port 10GigE (Ethernet) Adapter card/module, for network egress, where 16-priority scheduling is enabled:
  - **high-priority**: has higher priority than any user frames
  - **low-priority**: has lower priority than any user frames
- for the physical ring ports on the 2-port 10GigE (Ethernet) Adapter card/module, which can only operate as network egress, the priority of the LBR frame is derived from the dot1p setting of the received LBM frame. Based on the assigned ring-type network queue policy, dot1p-to-queue mapping is handled using the same mapping rule that applies to all other user frames.

CFM loopback support on a physical ring port on the 2-port 10GigE (Ethernet) Adapter card/module differs from other Ethernet ports. For these ports, **cfm-loopback** is configured using **dot1p** and an optional list of up to 16 VLANs. The null VLAN is always applied. The CFM LBM will be processed if it does not contain a VLAN header, or if it contains a VLAN header with a VLAN ID that matches one in the configured **match-vlan** list.

The **no** form of the command disables the handling of CFM loopback frames.

Default

no cfm-loopback

Parameters

**low**

sets the queue parameters and scheduler mappings, as described above

**high**

sets the queue parameters and scheduler mappings, as described above

**dot1p**

sets the queue parameters and scheduler mappings on a physical ring port, as described above

**match-vlan**

sets the matching VLAN IDs that will allow a CFM loopback on a physical ring port when **priority** is set to **dot1p**, as described above

**Values**    *vlan-range*: 1 to 4094 (for example, 1-10,33,2123)  
**none**: only untagged CFM LBMs are accepted

**Default**    **none**

hold-mep-up-on-failure

Syntax

[no] hold-mep-up-on-failure

Context

config>service>epipe>sap>eth-cfm



## Description

This command keeps an 802.1ag or Y.1731 maintenance association endpoint (MEP) in operation regardless of the operational state of the SAP. The MEP remains in operation when the SAP is down or non-operational.

The **no** form of the command disables the MEP from remaining in operation when the SAP is down or non-operational.

This command is not supported for VPLS SAPs.

## Default

enabled

mep

## Syntax

**mep** *mep-id* **domain** *md-index* **association** *ma-index* [**direction** {**up** | **down**}]

**no mep** *mep-id* **domain** *md-index* **association** *ma-index*

## Context

config>router>if>eth-cfm

config>service>epipe>sap>eth-cfm

config>service>epipe>spoke-sdp>eth-cfm

config>service>vpls>sap>eth-cfm

config>service>vpls>mesh-sdp>eth-cfm

config>service>vpls>spoke-sdp>eth-cfm

## Description

This command provisions an 802.1ag or a Y.1731 maintenance association endpoint (MEP).

The 7705 SAR supports Up and Down MEPs for both 802.1ag and Y.1731 on Ethernet (Epipe and VPLS) SAPs, Ethernet spoke and mesh SDPs (mesh SDPs are only supported for VPLS), and facility MEPs on network interfaces.

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

## Parameters

*mep-id*

specifies the maintenance association endpoint identifier

**Values** 1 to 81921

*md-index*

specifies the maintenance domain (MD) index value

**Values** 1 to 4294967295

*ma-index*

specifies the MA index value

**Values** 1 to 4294967295

**up | down**

specifies the direction in which the maintenance association (MEP) faces on the bridge port (**up** sends continuity check messages (CCMs) toward the fabric, **down** sends CCMs toward the egress port or line). The **direction** parameter is not supported on network interfaces.

**ais-enable****Syntax**

[no] **ais-enable**

**Context**

config>service>epipe>sap>eth-cfm>mep

config>service>vpls>sap>eth-cfm>mep

**Description**

This command enables the generation and the reception of AIS messages and applies to Y.1731 SAP MEPs only.

**Default**

disabled

**client-meg-level****Syntax**

**client-meg-level** [/level [/level ...]]

**no client-meg-level**

**Context**

config>service>epipe>sap>eth-cfm>mep>ais-enable

config>service>vpls>sap>eth-cfm>mep>ais-enable

**Description**

This command configures the client maintenance entity group (MEG) levels to use for AIS message generation. Up to seven levels can be provisioned, with the restriction that the client (remote) MEG level must be higher than the local MEG level.

**Parameters**

*level*  
specifies the client MEG level

|                |        |
|----------------|--------|
| <b>Values</b>  | 1 to 7 |
| <b>Default</b> | 1      |

interval

**Syntax**

`interval {1 | 60}`  
`no interval`

**Context**

`config>service>epipe>sap>eth-cfm>mep>ais-enable`  
`config>service>vpls>sap>eth-cfm>mep>ais-enable`

**Description**

This command specifies the transmission interval of AIS messages in seconds.

**Parameters**

`1 | 60`  
the transmission interval of AIS messages in seconds

|                |   |
|----------------|---|
| <b>Default</b> | 1 |
|----------------|---|

priority

**Syntax**

`priority priority-value`  
`no priority`

**Context**

`config>service>epipe>sap>eth-cfm>mep>ais-enable`  
`config>service>vpls>sap>eth-cfm>mep>ais-enable`

**Description**

This command specifies the priority of AIS messages originated by the MEP, which is used for priority-mapping OAM frames.

## Parameters

*priority-value*

specifies the priority value of the AIS messages originated by the node

**Values** 0 to 7

**Default** 7

## ccm-enable

### Syntax

[no] **ccm-enable**

### Context

```
config>router>if>eth-cfm>mep
config>service>epipe>sap>eth-cfm>mep
config>service>epipe>spoke-sdp>eth-cfm>mep
config>service>vpls>sap>eth-cfm>mep
config>service>vpls>mesh-sdp>eth-cfm>mep
config>service>vpls>spoke-sdp>eth-cfm>mep
```

### Description

This command enables the generation of CCM messages.

The **no** form of the command disables the generation of CCM messages.

## ccm-ltm-priority

### Syntax

**ccm-ltm-priority** *priority*

**no ccm-ltm-priority**

### Context

```
config>router>if>eth-cfm>mep
config>service>epipe>sap>eth-cfm>mep
config>service>epipe>spoke-sdp>eth-cfm>mep
config>service>vpls>sap>eth-cfm>mep
config>service>vpls>mesh-sdp>eth-cfm>mep
config>service>vpls>spoke-sdp>eth-cfm>mep
```

## Description

This command specifies the priority value for continuity check messages (CCMs) and linktrace messages (LTMs) transmitted by the MEP.

The default priority is 7, which means that CCM frames map to the NC forwarding class by default.

The **no** form of the command removes the priority value from the configuration.

## Default

7

## Parameters

*priority*

specifies the value used for priority mapping. See [Table 8: Priority mapping based on message type and MEP direction](#) to determine how the priority is derived; if it is user-defined, see [Table 7: Y.1731 priority-to-FC mapping](#) for the priority-to-FC mappings.

**Values** 0 to 7

## ccm-tlv-ignore

## Syntax

**ccm-tlv-ignore** [**port-status**] [**interface-status**]

**no ccm-tlv-ignore**

## Context

config>router>if>eth-cfm>mep

## Description

This command allows the receiving MEP to ignore the specified TLVs in the ETH CCM PDU. Ignored TLVs will be reported as absent and will have no effect on the MEP.

The **no** form of the command causes the receiving MEP to process all recognized TLVs in the ETH CCM PDU.

## Default

n/a

## Parameters

**port-status**

ignore the port status TLV when it is received

**interface-status**

ignore the interface status TLV when it is received

## description

### Syntax

**description** *description-string*

**no description**

### Context

config>router>if>eth-cfm>mep

config>service>epipe>sap>eth-cfm>mep

config>service>epipe>spoke-sdp>eth-cfm>mep

config>service>vpls>sap>eth-cfm>mep

config>service>vpls>mesh-sdp>eth-cfm>mep

config>service>vpls>spoke-sdp>eth-cfm>mep

### Description

This command creates a text description of a MEP. The description can be changed at any time, even while the server is running.

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

### Default

no description

### Parameters

*description-string*

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

## dual-ended-loss-test-enable

### Syntax

**[no] dual-ended-loss-test-enable**

### Context

config>router>if>eth-cfm>mep

config>service>epipe>sap>eth-cfm>mep

### Description

This command enables dual-ended loss measurement testing on a MEP. When enabled, the test runs in the background.

CCM must be enabled before the dual-ended loss measurement test can be enabled.

The dual-ended loss measurement test is not supported for VPLS SAPs.

The dual-ended and single-ended loss measurement tests are mutually exclusive tests. When the dual-ended loss measurement test is enabled, the single-ended test is not available.

The **no** form of the command disables the dual-ended loss measurement test.

This command applies only to Y.1731 MEPs.

## Default

enabled

## alarm-clear-threshold

## Syntax

**alarm-clear-threshold** *percentage*

**[no] alarm-clear-threshold**

## Context

config>router>if>eth-cfm>mep>dual-ended-loss-test-enable

config>service>epipe>sap>eth-cfm>mep>dual-ended-loss-test-enable

## Description

This command configures a clearing alarm threshold for frame loss measurement, where *percentage* is defined as (the total number of Tx frames) divided by (the total number of frames dropped) expressed as a percentage.

If a dual-ended-loss alarm is outstanding and the alarm-clear-threshold is configured to a non-zero value, the dual-ended-loss clear alarm will not be raised until the dual-ended-loss ratio drops below the alarm-clear-threshold. If the alarm-clear-threshold is configured to 0, the dual-ended-loss clear alarm is raised immediately when the dual-ended-loss ratio drops below the alarm threshold.

This functionality prevents too many alarms from being generated if the loss ratio is toggling above and below the alarm threshold.

The **alarm-clear-threshold** cannot be greater than the **alarm-threshold**.

Setting the percentage to 0 means that no alarm-clear-threshold is configured; clear alarm traps will continue to be sent when the loss ratio is no longer above the alarm threshold. This is equivalent to using the **no** form of the command.

## Parameters

*percentage*

0.00 to 100.00, adjustable in 0.01% increments

**Default** 0.00

## alarm-threshold

### Syntax

**alarm-threshold** *percentage*

**no alarm-threshold**

### Context

config>router>if>eth-cfm>mep>dual-ended-loss-test-enable

config>service>epipe>sap>eth-cfm>mep>dual-ended-loss-test-enable

### Description

This command specifies the alarm threshold ratio for frame loss measurement, where *percentage* is defined as (the total number of Tx frames) divided by (the total number of frames dropped) expressed as a percentage. When the alarm threshold is reached, an alarm is raised.

The **no** form of the command removes the priority value from the configuration. Setting the percentage to 0.00 is equivalent to using the **no** form of the command.

### Parameters

*percentage*

0.00 to 100.00, adjustable in 0.01% increments

**Default** 0.25

## eth-test-enable

### Syntax

**[no] eth-test-enable**

### Context

config>router>if>eth-cfm>mep

config>service>epipe>sap>eth-cfm>mep

config>service>vpls>sap>eth-cfm>mep

### Description

This command enables an Ethernet (signal) test (ETH-Test) on a MEP. When enabled, the test runs in the background. This command applies to Y.1731 MEPs only.

For this test, operators must configure ETH-Test parameters on both sender and receiver nodes. The ETH-Test can then be run using the following OAM command:

**oam eth-cfm eth-test** *mac-address mep mep-id domain md-index association ma-index* [**priority** *priority*] [**data-length** *data-length*]



A check is done on the provisioning and the test commands to ensure that the MEP is a Y.1731 MEP. If the MEP is not a Y.1731 MEP, the operation fails and an error message in the CLI and SNMP will indicate the problem. A Y.1731 MEP has domain format **none** and association format **icc-based** or **string** (the **string** keyword enables the Y.1731 MEP to interoperate with a dot1ag MEP).

The **no** form of the command disables the ETH-Test on a MEP.

**Default**  
enabled

bit-error-threshold

**Syntax**  
**bit-error-threshold** *bit-errors*

**Context**  
config>router>if>eth-cfm>mep>eth-test-enable  
config>service>epipe>sap>eth-cfm>mep>eth-test-enable  
config>service>vpls>sap>eth-cfm>mep>eth-test-enable

**Description**  
This command configures a threshold for raising SNMP traps for one-way CFM tests.

For bit-error-threshold tests, test results are available only at the destination node. In order for the network management system to collect the results, SNMP traps need to be raised. This threshold is used to control when to raise a trap. When the number of bit errors reaches the threshold, an SNMP trap is raised.

Configuring a threshold value of 0 will cause the node to raise an SNMP trap for every one-way test it receives.

**Parameters**

|                         |            |
|-------------------------|------------|
| <i>bit-errors</i>       |            |
| the bit-error threshold |            |
| <b>Values</b>           | 0 to 11840 |
| <b>Default</b>          | 1          |

test-pattern

**Syntax**  
**[no] test-pattern** {**all-zeros** | **all-ones**} [**crc-enable**]

**Context**  
config>router>if>eth-cfm>mep>eth-test-enable

```
config>service>epipe>sap>eth-cfm>mep>eth-test-enable
config>service>vpls>sap>eth-cfm>mep>eth-test-enable
```

### Description

This command configures the test pattern for ETH-Test frames.

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

### Parameters

#### **all-zeros | all-ones**

specifies to use all zeros or all ones in the test pattern

**Default**    all-zeros

#### **crc-enable**

specifies to generate a CRC checksum

## low-priority-defect

### Syntax

**low-priority-defect** {allDef | macRemErrXcon | remErrXcon | errXcon | xcon | noXcon}

### Context

```
config>router>if>eth-cfm>mep
config>service>epipe>sap>eth-cfm>mep
config>service>epipe>spoke-sdp>eth-cfm>mep
config>service>vpls>sap>eth-cfm>mep
config>service>vpls>mesh-sdp>eth-cfm>mep
config>service>vpls>spoke-sdp>eth-cfm>mep
```

### Description

This command specifies the lowest priority defect that is allowed to generate a fault alarm.

### Default

remErrXcon

### Parameters

#### **allDef**

DefRDICCM, DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM

#### **macRemErrXcon**

DefMACstatus, DefRemoteCCM, DefErrorCCM, and DefXconCCM

#### **remErrXcon**

only DefRemoteCCM, DefErrorCCM, and DefXconCCM

- errXcon**
  - only DefErrorCCM and DefXconCCM
- xcon**
  - only DefXconCCM
- noXcon**
  - no defects DefXcon or lower are to be reported

mac-address

Syntax

- mac-address** *mac-address*
- no mac-address**

Context

config>service>vpls>sap>eth-cfm>mep

Description

This command specifies the MAC address of the MEP. The command applies to VPLS SAPs only. The **no** form of the command resets the MAC address to the MAC address of the port.

Default

n/a

Parameters

- mac-address*
    - MAC address of the MEP
- |               |                                                                          |
|---------------|--------------------------------------------------------------------------|
| <b>Values</b> | xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number |
|---------------|--------------------------------------------------------------------------|

one-way-delay-threshold

Syntax

- one-way-delay-threshold** *seconds*

Context

config>router>if>eth-cfm>mep  
config>service>epipe>sap>eth-cfm>mep  
config>service>vpls>sap>eth-cfm>mep

**Description**

This command configures a threshold for raising SNMP traps for one-way CFM tests.

For one-way-delay-threshold tests, test results are available only at the destination node. In order for the network management system to collect the results, SNMP traps need to be raised. This threshold is used to control when to raise a trap. When the delay time reaches the threshold, an SNMP trap is raised.

Configuring a threshold value of 0 will cause the node to raise an SNMP trap for every one-way test it receives.

**Parameters**

*seconds*  
the delay time threshold value

|                |          |
|----------------|----------|
| <b>Values</b>  | 0 to 600 |
| <b>Default</b> | 3        |

**3.8.2.1.7 SAA commands**

saa

**Syntax**

saa

**Context**

config

**Description**

This command enables the context to configure the SAA tests.

test

**Syntax**

[no] test test-name [owner test-owner]

**Context**

config>saa

**Description**

This command identifies a test and creates or modifies the context to provide 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 must be shut down before it can be modified or removed from the configuration.

The **no** form of this command removes the test from the configuration.

### Parameters

*test-name*

identifies the SAA test name to be created or edited

*test-owner*

specifies the owner of an SAA operation, up to 32 characters in length

**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

### Description

This command associates an accounting policy to the SAA test. The accounting policy must already be defined before it can be associated or else an error message is generated.

A notification (trap) is issued when a test is completed.

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

### Parameters

*acct-policy-id*

specifies the accounting *acct-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

## Description

This command creates a text description stored in the configuration file for a configuration context.

The **no** form of this command removes the string from the configuration.

## Default

no description

## Parameters

*description-string*

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

## continuous

## Syntax

[no] continuous

## Context

config>saa>test

## Description

This command specifies whether the SAA test is continuous. After you have configured a test as continuous, you cannot start or stop it by using the **oam saa test-name {start | stop}** command. This option is not applicable to all SAA test types.

The **no** form of the command disables the continuous execution of the test.

## jitter-event

## Syntax

**jitter-event rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]

**no jitter-event**

## Context

config>saa>test

## 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.

After 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 will be re-enabled when it falls below the threshold after the initial crossing that generated 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 greater than the configured rising threshold value, then an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

**Values**    0 to 2147483 ms

**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, then an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

**Values**    0 to 2147483 ms

**Default**    0

*direction*

specifies the direction for OAM ping responses received for an OAM ping test run

- Values**
- inbound** – monitors the jitter value calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run
  - outbound** – monitors the jitter value calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run
  - roundtrip** – monitors the jitter value 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

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.

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, then an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

**Values** 0 to 2147483647 ms

**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, then an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

**Values** 0 to 2147483647 ms

**Default** 0

*direction*

specifies the direction for OAM ping responses received for an OAM ping test run

**Values** **inbound** – monitors the latency value calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run  
**outbound** – monitors the latency value calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run  
**roundtrip** – monitors the latency value calculated for the round-trip, two-way, OAM ping requests and replies for an OAM ping test run

**Default** roundtrip

loss-event

Syntax

**loss-event** rising-threshold *threshold* [**falling-threshold** *threshold*] [*direction*]

**no loss-event**



## Context

config>saa>test

## Description

This command specifies that at the termination of an SAA test run, 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, then 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, then 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** – monitors the loss value calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run

**outbound** – monitors the loss value calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run

**roundtrip** – monitors the loss value calculated for the round-trip, two-way, OAM ping requests and replies for an OAM ping test run

**Default** roundtrip

## trap-gen

### Syntax

**trap-gen**

### Context

config>saa>test

### Description

This command enables the context to configure SNMP trap generation for the SAA test.

## probe-fail-enable

### Syntax

**[no] probe-fail-enable**

### Context

config>saa>test>trap-gen

### Description

This command works in conjunction with the **probe-fail-threshold** command. The command enables the generation of an SNMP trap after *threshold* consecutive probe failures during the execution of the SAA ping test. This command is not applicable to SAA trace route tests.

The **no** form of the command disables the generation of an SNMP trap.

## probe-fail-threshold

### Syntax

**probe-fail-threshold** *threshold*

**no probe-fail-threshold**

### Context

config>saa>test>trap-gen

### Description

This command works in conjunction with the **probe-fail-enable** command. When the **probe-fail-enable** command is enabled, the generation of an SNMP trap occurs after *threshold* consecutive probe failures during the execution of the SAA ping test. This command is not applicable to SAA trace route tests.

This command has no effect when the **probe-fail-enable** command is disabled.

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

**Default**

1

**Parameters***threshold*

specifies the number of consecutive SAA ping probe failures before an SNMP trap is generated

**Values** 0 to 15**test-completion-enable****Syntax****[no] test-completion-enable****Context**

config&gt;saa&gt;test&gt;trap-gen

**Description**

This command enables the generation of an SNMP trap when an SAA test completes.

The **no** form of the command disables the trap generation.

**test-fail-enable****Syntax****[no] test-fail-enable****Context**

config&gt;saa&gt;test&gt;trap-gen

**Description**

This command enables the generation of an SNMP 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** *threshold* parameter.

The **no** form of the command disables the trap generation.

**test-fail-threshold****Syntax****test-fail-threshold** *threshold***no test-fail-threshold**

**Context**

```
config>saa>test>trap-gen
```

**Description**

This command configures the threshold for SNMP trap generation on test failure. This command is not applicable to SAA trace route tests.

This command has no effect when the **test-fail-enable** command is disabled.

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

**Default**

1

**Parameters**

*threshold*

specifies the number of consecutive test failures before an SNMP trap is generated

**Values** 0 to 15

**type****Syntax**

[no] type

**Context**

```
config>saa>test
```

**Description**

This command enables the context to 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 shutdown mode.

When 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 [source-mac ieee-address] [fc fc-name [profile {in | out}]] [ttl vc-label-ttl] [count send-count] [send-control] [return-control] [timeout timeout] [interval interval]**

## Context

oam

config>saa>test>type

## Description

This ping utility determines the IP connectivity to a CPE within a specified VPLS service.

## Parameters

*service-id*

specifies the service ID or name of the service to diagnose or manage

**Values** 1 to 2147483647 or *service-name*

**destination** *ip-address*

specifies the IP address to be used as the destination for performing an OAM ping operation

**source** *ip-address*

specifies an unused IP address in the same network that is associated with the VPLS

**profile** {in | out}

specifies the profile state of the MPLS echo request encapsulation

**Default** out

*ieee-address*

specifies the source MAC address that will be sent to the CPE. If not specified or set to 0, the MAC address configured for the CSM 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

*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-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 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 255

**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

#### **return-control**

specifies that the MAC OAM reply to a data plane MAC OAM request is sent using the control plane instead of the data plane

**Default** MAC OAM reply sent using the data plane

#### *timeout*

specifies the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** parameter overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded. The **timeout** value must be less than the **interval** value.

**Values** 1 to 10

**Default** 5

#### *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 s and the timeout value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values** 1 to 10

**Default** 1

## eth-cfm-linktrace

### Syntax

**eth-cfm-linktrace** *mac-address mep mep-id domain md-index association ma-index* [**t***tl* *t**tl-value*] [**f***c* *f**c-name*] [**p***rofile* {*i**n* | *o**ut*}] [**c***ount* *s**end-count*] [**t***imeout* *t**imeout*] [**i***nterval* *i**nterval*]

### Context

config>saa>test>type

Description

This command configures an Ethernet CFM linktrace test in SAA.

Parameters

|                           |                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>mac-address</i>        | specifies a unicast destination MAC address                                                                                                                                                                                                                                                                                                              |
| <b>Values</b>             | xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number                                                                                                                                                                                                                                                                                 |
| <i>mep-id</i>             | specifies the target MEP ID                                                                                                                                                                                                                                                                                                                              |
| <b>Values</b>             | 1 to 8191                                                                                                                                                                                                                                                                                                                                                |
| <i>md-index</i>           | specifies the MD index                                                                                                                                                                                                                                                                                                                                   |
| <b>Values</b>             | 1 to 4294967295                                                                                                                                                                                                                                                                                                                                          |
| <i>ma-index</i>           | specifies the MA index                                                                                                                                                                                                                                                                                                                                   |
| <b>Values</b>             | 1 to 4294967295                                                                                                                                                                                                                                                                                                                                          |
| <i>ttl-value</i>          | specifies the number of hops to use in a linktrace test                                                                                                                                                                                                                                                                                                  |
| <b>Values</b>             | 0 to 255                                                                                                                                                                                                                                                                                                                                                 |
| <i>fc-name</i>            | specifies the forwarding class for CFM test traffic. The <i>fc-name</i> is mapped to the dot1p priority that is set in the CFM frame forwarding class. See <a href="#">Table 8: Priority mapping based on message type and MEP direction</a> for the Dot1p Priority-to-FC mapping.                                                                       |
| <b>Values</b>             | be, l2, af, l1, ef, h1, nc                                                                                                                                                                                                                                                                                                                               |
| <b>Default</b>            | nc                                                                                                                                                                                                                                                                                                                                                       |
| <b>profile {in   out}</b> | specifies the profile state for CFM test traffic; this parameter is not used                                                                                                                                                                                                                                                                             |
| <i>send-count</i>         | 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 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. |
| <b>Values</b>             | 1 to 10                                                                                                                                                                                                                                                                                                                                                  |
| <b>Default</b>            | 1                                                                                                                                                                                                                                                                                                                                                        |

*timeout*

specifies the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** parameter overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded. The **timeout** value must be less than the **interval** value.

|                |         |
|----------------|---------|
| <b>Values</b>  | 1 to 10 |
| <b>Default</b> | 5       |

*interval*

specifies the minimum amount of time, in seconds, that must expire before the next message request is sent. The **interval** parameter is used to override the default request message send interval. If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. The **timeout** value must be less than the **interval** value.

|                |         |
|----------------|---------|
| <b>Values</b>  | 1 to 10 |
| <b>Default</b> | 5       |

eth-cfm-loopback

**Syntax**

**eth-cfm-loopback** *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**size** *data-size*] [**fc** *fc-name*] [**profile** {**in** | **out**}] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]

**Context**

config>saa>test>type

**Description**

This command configures an Ethernet CFM loopback test in SAA.

**Parameters**

*mac-address*

specifies a unicast destination MAC address

|               |                                                                          |
|---------------|--------------------------------------------------------------------------|
| <b>Values</b> | xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number |
|---------------|--------------------------------------------------------------------------|

*mep-id*

specifies the target MEP ID

|               |           |
|---------------|-----------|
| <b>Values</b> | 1 to 8191 |
|---------------|-----------|

*md-index*

specifies the MD index



**Values** 1 to 4294967295

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*data-size*

specifies the packet size in bytes, expressed as a decimal integer

**Values** 0 to 1500

**Default** 0

*fc-name*

specifies the forwarding class for CFM test traffic. The *fc-name* is mapped to the dot1p priority that is set in the CFM frame forwarding class. See [Table 8: Priority mapping based on message type and MEP direction](#) for the Dot1p Priority-to-FC mapping.

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

**Default** nc

**profile {in | out}**

specifies the profile state for CFM test traffic; this parameter is not used

*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 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

*timeout*

specifies the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** parameter overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded. The **timeout** value must be less than the **interval** value.

**Values** 1 to 10

**Default** 5

*interval*

specifies the minimum amount of time, in seconds, that must expire before the next message request is sent. The **interval** parameter is used to override the default request message send interval. If the **interval** is set to 1 s, and the **timeout** value is set to 10 s,

then the maximum time between message requests is 10 s and the minimum is 1 s. The **timeout** value must be less than the **interval** value.

**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*}  
[**profile** {*in* | *out*}]] [**count** *send-count*] [**size** *data-size*] [**timeout** *timeout*] [**interval** *interval*]

### Context

config>saa>test>type

### Description

This command configures an Ethernet CFM two-way delay test in SAA.

### Parameters

*mac-address*

specifies a unicast MAC address

**Values** xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values** 1 to 8191

*md-index*

specifies the MD index

**Values** 1 to 4294967295

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*fc-name*

specifies the forwarding class for CFM test traffic. The *fc-name* is mapped to the dot1p priority that is set in the CFM frame forwarding class. See [Table 8: Priority mapping based on message type and MEP direction](#) for the Dot1p Priority-to-FC mapping.

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

**Default** nc

**profile {in | out}**

specifies the profile state for CFM test traffic; this parameter is not used

*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 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

*timeout*

specifies the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** parameter overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded. The **timeout** value must be less than the **interval** value.

**Values** 1 to 10

**Default** 5

*interval*

specifies the minimum amount of time, in seconds, that must expire before the next message request is sent. The **interval** parameter is used to override the default request message send interval. If the interval is set to 1 s, and the timeout value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. The **timeout** value must be less than the **interval** value.

**Values** 1 to 10

**Default** 5

## eth-cfm-two-way-slm

### Syntax

**eth-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*]

### Context

config>saa>test>type

## Description

This command specifies an Ethernet CFM two-way SLM test in SAA.

## Parameters

*mac-address*

specifies a unicast MAC address

**Values** xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

*mep-id*

specifies the target MEP ID

**Values** 1 to 8191

*md-index*

specifies the MD index

**Values** 1 to 4294967295

*ma-index*

specifies the MA index

**Values** 1 to 4294967295

*fc-name*

specifies 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

**Default** nc

**profile in | out**

specifies the profile state of the MPLS echo request encapsulation

**Default** in

*send-count*

the number of messages to send, expressed as a decimal integer. The message interval value must be expired before the next message request is sent.

**Values** 1 to 1000

**Default** 1

*data-size*

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*

the timeout parameter in seconds. This value is the length of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded. The timeout value must be less than or equal to the interval.

**Values** 1 to 10

**Default** 5

*interval*

the time, in seconds between probes within a test run

**Values** 1 to 10

**Default** 5

icmp-ping

Syntax

**icmp-ping** *ip-address* | *dns-name* [**rapid**] [**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*] [**profile** {**in** | **out**}]

Context

config>saa>test>type

Description

This command configures an ICMP ping test.

Parameters

*ip-address*

identifies the far-end IP address to which to send the **icmp-ping** request message

*dns-name*

identifies 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

**Values** 63 characters maximum

**rapid**

changes the units for the interval from seconds to hundredths of seconds

*time-to-live*

specifies the TTL value for the MPLS label, expressed as a decimal integer

**Values** 1 to 128

**Default** 64

*type-of-service*

specifies the service type

**Values** 0 to 255

**Default** 0

*bytes*

specifies the request packet size in bytes, expressed as a decimal integer

**Values** 0 to 16384

**Default** 56

*pattern*

specifies the pattern that will be used to fill the data portion in a ping packet. If no pattern is specified, position information will be filled instead.

**Values** 0 to 65535

**source** *ip-address*

specifies the IP address to be used

*seconds*

defines the minimum amount of time, expressed as a decimal integer, that must expire before the next message request is sent

This parameter is used to override the default request message send interval. If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values** 1 to 10000

**Default** 1

**next-hop** *ip-address*

displays only the static routes with the specified next-hop IP address

*interface-name*

specifies the name of an IP 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

*requests*

specifies the number of times to perform an OAM ping probe operation. Each OAM echo message request must either time out or receive a reply before the next message request is sent.

**Values** 1 to 100000

**Default** 5

**do-not-fragment**

sets the DF (Do not fragment) bit in the ICMP ping packet

*router-instance*

specifies the router name or service ID

**Values** *router-name:* Base, management  
*service-id:* 1 to 2147483647

**Default** Base

*service-name*

the service name, up to 64 characters

*timeout*

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be 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 will be silently discarded.

This value is used to override the default timeout value.

**Values** 1 to 10

**Default** 5

**fc** *fc-name*

specifies the forwarding class for ICMP echo-request packets, which controls the marking of packets based on the configured SAP egress or network QoS policy. The packets use the egress data queue for the specified forwarding class. If the **fc** option is not specified, the ICMP echo-request packets use the nc forwarding class by default.

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

**Default** nc

**profile {in | out}**

specifies the profile state of packets assigned to the specified forwarding class

**Default** in

icmp-trace

Syntax

**icmp-trace** [*ip-address* | *dns-name*] [**ttl** *time-to-live*] [**wait** *milli-seconds*] [**source** *ip-address*] [**tos** *type-of-service*] [**router** *router-instance* | **service-name** *service-name*]

Context

config>saa>test>type

Description

This command configures an ICMP traceroute test.

Parameters

*ip-address*

the far-end IP address to which to send the **icmp-trace** request message

*dns-name*

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

**Values** 63 characters maximum

*time-to-live*

the TTL value for the MPLS label, expressed as a decimal integer

**Values** 1 to 255

*milli-seconds*

the time, in milliseconds, to wait for a response to a probe, expressed as a decimal integer

**Values** 1 to 60000

**Default** 5000

**source** *ip-address*

specifies the IP address to be used

*type-of-service*

specifies the service type

**Values** 0 to 255

*router-instance*

specifies the router name or service ID

**Values** *router-name:* Base, management  
*service-id:* 1 to 2147483647



| Default | Base |
|---------|------|
|---------|------|

*service-name*

the service name, up to 64 characters

## 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*]]

**lsp-ping sr-isis prefix** *ip-prefix/prefix-length* [**igp-instance** *igp-instance*] [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

**lsp-ping sr-ospf prefix** *ip-prefix/prefix-length* [**igp-instance** *igp-instance*] [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

**lsp-ping sr-te** *lsp-name* [**path** *path-name*] [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

- options common to all **lsp-ping** cases: [**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

### Description

This command performs in-band LSP connectivity tests 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 waits for 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 **detail** parameter is available only from the **oam** context.

### Parameters

*lsp-name*

specifies a unique LSP name, up to 64 characters

*path-name*

specifies the name for the LSP path, up to 32 characters

**bgp-label prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the target BGP IPv4 label route

**path-destination** *ip-address*

specifies the IP address of the path destination from the range 127/8. When the LDP FEC prefix is IPv6, the user must enter a 127/8 IPv4 mapped IPv6 address, that is, in the range ::ffff:127/104.

*if-name*

specifies the name of an IP interface. The name must already exist in the **config>router>interface** context.

**next-hop** *ip-address*

specifies the next-hop IP address to send the MPLS echo request message to

**lsp-ping prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the destination node

**sr-isis prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the target node SID of the SR-ISIS tunnel

*igp-instance*

specifies the IGP instance

**Values** 0 to 31

**sr-ospf prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the target node SID of the SR-OSPF tunnel

*fc-name*

indicates 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 control the mapping back to the internal forwarding class used by the far-end 7705 SAR that receives the message request. The egress mappings of the egress network interface on the far-end 7705 SAR control the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface control the mapping of the message reply back at the originating 7705 SAR.

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

**Default** be

**profile {in | out}**

specifies the profile state of the MPLS echo request encapsulation

**Default** out

*interval*

specifies the minimum amount of time that must expire before the next message request is sent

If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

This parameter is used to override the default request message send interval.

**Values** 1 to 10

**Default** 1

#### *send-count*

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 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

#### *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 9702

**Default** 1

#### *src-ip-address ip-address*

specifies the IP address to be used when an OAM packet must be generated from an address other than the node system interface address

#### *timeout*

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be 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 will be silently discarded.

This value is used to override the default timeout value.

**Values** 1 to 10

**Default** 5

#### *label-ttl*

specifies the TTL value for the MPLS label, expressed as a decimal integer

**Values** 1 to 255

**Default** 255

**detail**

displays detailed information

## lsp-trace

**Syntax**

**lsp-trace** *lsp-name* [**path** *path-name*]

**lsp-trace bgp-label prefix** *ip-prefix/prefix-length* [**path-destination** *ip-address* [**interface** *if-name* | **next-hop** *ip-address*]]

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

**lsp-trace sr-isis prefix** *ip-prefix/prefix-length* [**igp-instance** *igp-instance*] [**path-destination** *ip-address* [{**interface** *if-name* | **next-hop** *ip-address*]}]

**lsp-trace sr-ospf prefix** *ip-prefix/prefix-length* [**igp-instance** *igp-instance*] [**path-destination** *ip-address* [{**interface** *if-name* | **next-hop** *ip-address*]}]

**lsp-trace sr-te** *lsp-name* [**path** *path-name*] [**path-destination** *ip-address* [{**interface** *if-name* | **next-hop** *ip-address*]}]

- options common to all **lsp-trace** cases: [**detail**] [**downstream-map-tlv** *downstream-map-tlv*] [**fc** *fc-name* [**profile** {**in** | **out**}]] [**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

**Description**

This command displays the hop-by-hop path for an LSP traceroute using the protocol and data structures defined in RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*.

The LSP 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.

In an LSP traceroute, 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 waits for a TTL exceeded response or the MPLS echo reply packet from the device terminating the LSP. The devices that reply to the MPLS echo request packets with the TTL exceeded and the MPLS echo reply are displayed.

The downstream mapping TLV allows the sender and responder nodes to exchange and validate interface and label stack information for each downstream hop in an LDP FEC path, an RSVP LSP, a BGP labeled IPv4 route, an SR-ISIS node SID, or an SR-OSPF node SID. If the responder node has multiple equal-cost next hops for the LDP FEC, BGP labeled IPv4 prefix, SR-ISIS node SID, or SR-OSPF node SID, it replies in the downstream mapping TLV with the downstream information of each outgoing interface that is part of the ECMP next hop set for the prefix. The downstream mapping TLV can be further used to exercise a specific path of the ECMP set using the **path-destination** option.

The **detail** parameter is available only from the **oam** context.

## Parameters

### *lsp-name*

specifies a unique LSP name, up to 64 characters

### *path-name*

specifies the name for the LSP path, up to 32 characters

### **bgp-label prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the target BGP IPv4 label route

### **path-destination** *ip-address*

specifies the IP address of the path destination from the range 127/8. When the LDP FEC prefix is IPv6, the user must enter a 127/8 IPv4 mapped IPv6 address, that is, in the range ::ffff:127/104.

### *if-name*

specifies the name of an IP interface. The name must already exist in the **config>router>interface** context.

### **next-hop** *ip-address*

specifies the next-hop IP address to send the MPLS echo request message to

### **lsp-trace prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the destination node

### **sr-isis prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the target node SID of the SR-ISIS tunnel

### **sr-ospf prefix** *ip-prefix/prefix-length*

specifies the address prefix and prefix length of the target node SID of the SR-OSPF tunnel

### *igp-instance*

specifies the IGP instance, 0 to 31

### *downstream-map-tlv*

specifies which format of the downstream mapping TLV to use in the LSP trace packet

**Values**

- ddmap:** sends a detailed downstream map TLV for the enhanced TLV format specified in RFC 6424
- dsmmap:** sends a downstream map TLV for the original target FEC stack TLV for BGP labeled IPv4/32 prefixes as defined in RFC 4379
- none:** no map TLV is sent

**Default** inherited from the global configuration of the downstream mapping TLV in the [mpls-echo-request-downstream-map](#) command

### *fc-name*

indicates 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 control the mapping back to the internal forwarding class used by the far-end 7705 SAR that receives the message

request. The egress mappings of the egress network interface on the far-end 7705 SAR control the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface control the mapping of the message reply back at the originating 7705 SAR.

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

**Default** be

**profile {in | out}**

specifies the profile state of the MPLS echo request encapsulation

**Default** out

**interval**

specifies the minimum amount of time that must expire before the next message request is sent

If the **interval** is set to 1 s, and the **timeout** value is set to 10 s, the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

This parameter is used to override the default request message send interval.

**Values** 1 to 10

**Default** 1

**max-label-ttl**

specifies the maximum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer

**Values** 1 to 255

**Default** 30

**min-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

**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 particular TTL

**Values** 1 to 255

**Default** 5

*probes-per-hop*

specifies the number of OAM requests sent for a particular TTL value, expressed as a decimal integer

**Values** 1 to 10

**Default** 1

**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 9702

**Default** 1 – the system sends the minimum packet size, depending on the type of LSP. No padding is added.

**src-ip-address** *ip-address*

specifies the IP address to be used when an OAM packet must be generated from an address other than the node system interface address

*timeout*

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be 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 will be silently discarded.

This value is used to override the default timeout value.

**Values** 1 to 60

**Default** 3

**detail**

displays detailed information

**mac-ping****Syntax**

**mac-ping service** *service-id* **destination** *dst-ieee-address* [**source** *src-ieee-address*] [**fc** *fc-name*] [**profile** {**in** | **out**}] [**size** *octets*] [**ttl** *vc-label-ttl*] [**count** *send-count*] [**send-control**] [**return-control**] [**interval** *interval*] [**timeout** *timeout*]

**Context**

oam

config>saa>test>type

## Description

The MAC ping utility is used to determine the existence of an egress SAP binding of a given 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, then 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 plane.

A MAC ping reply can be sent using the control plane or the data 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 an FDB and without any SAPs cannot have an egress MAC address binding, so it is not a node where replies in the data plane will be 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), then this SHG membership will be used as if the packet originated from this SHG. In all other cases, SHG 0 (zero) will be used. If the MAC trace originated from a non-zero SHG, the packets will not go out to the same SHG.

## Parameters

### *service-id*

the service ID or name of the service to diagnose or manage

**Values** 1 to 2147483647 or *service-name*

### *dst-ieee-address*

the destination MAC address for the OAM MAC request

### *src-ieee-address*

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-name*

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



*octets*

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 size packet necessary to send the request is used.

**Values** 1 to 9702

**Default** No OAM packet padding

*vc-label-ttl*

the TTL value in the VC label for the OAM MAC request, expressed as a decimal integer

**Values** 1 to 255

**Default** 255

*send-count*

the number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either 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

**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

*interval*

the interval parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the interval is set to 1 s and the timeout value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values** 1 to 10

**Default** 1

*timeout*

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 will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

**Values** 1 to 10

**Default** 5

## mac-populate

### Syntax

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

### Context

oam

### Description

This command populates the FDB with an OAM-type MAC entry indicating the node is the egress node for the MAC address, and it optionally floods the OAM MAC association throughout the service. The MAC address can be bound to a particular SAP (the **target-sap**) or can be associated with the control plane in that any data destined for the MAC address is forwarded to the control plane (CSM). As a result, if the service on the node has neither an FDB nor an egress SAP, then it is not allowed to initiate a **mac-populate** command.

The MAC address that is populated in the FDB in the provider network is given a type OAM, so that it can be treated distinctly from regular dynamically learned or statically configured MACs. 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 the **mac-populate** command forces the MAC in the table to be type OAM in case it already exists as a dynamic, static, or an OAM-induced learned MAC with some other type of 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 FDB 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** command or with an FDB clear operation.

When a 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-id*

the service ID or name of the service to diagnose or manage

**Values** 1 to 2147483647 or *service-name*

### *ieee-address*

the MAC address to be populated

### **flood**

sends the OAM MAC populate to all upstream nodes

**Default** MAC populate only the local FDB

### *seconds*

the age for the OAM MAC, expressed as a decimal integer

**Values** 1 to 65535

**Default** No OAM packet padding

### **force**

converts the MAC to an OAM MAC even if it currently is another type of MAC

**Default** do not overwrite type

### *sap-id*

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 plane; 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 CSM. The originating SHG is 0 (zero). When the **target-sap** *sap-id* value is specified, the originating SHG is the SHG of the **target-sap**.

**Default** associate OAM MAC with the control plane (CPU)

### **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-purge

## Syntax

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

## Context

oam

## Description

This command removes an OAM-type MAC entry from the FDB and optionally floods the OAM MAC removal throughout the service. A **mac-purge** command 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 a packet with the following fields: the Reply Flags is set to 0 (since no reply is expected), and the Reply Mode and Reserved fields are set to 0. The Ethernet header has the source set to the (system) MAC address and 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 that 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 FDB for forwarding, but it is retained in the FDB 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).

The **force** option causes the specified OAM-type MAC entry to be purged from the FDB even if the entry was created by another node.

## Parameters

*service-id*

the service ID or name of the service to diagnose or manage

**Values** 1 to 2147483647 or *service-name*

*ieee-address*

the MAC address to be purged (all zeros and multicast not allowed)

**flood**

sends the OAM MAC purge to all upstream nodes

**Default** MAC purge only the local FDB

**send-control**

send the **mac-purge** request using the control plane

**Default** request is sent using the data plane

**register**

reserve the MAC for OAM testing

**Default** do not register OAM MAC

**force**

force the specified MAC entry to be purged, regardless of where the entry originated

## mac-trace

### Syntax

**mac-trace service** *service-id* **destination** *ieee-address* [**source** *ieee-address*] [**fc** *fc-name* [**profile** {*in* | *out*}]] [**size** *octets*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**probe-count** *send-count*] [**send-control**] [**return-control**] [**interval** *interval*] [**timeout** *timeout*]

### Context

oam

config>saa>test>type

### Description

This command displays the hop-by-hop path for a destination MAC address within a VPLS. The MAC 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 address. The MAC trace command uses Nokia OAM packets with increasing TTL values to determine the hop-by-hop route to a destination MAC.

In a MAC trace, 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 waits for 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), then this SHG membership will be used as if the packet originated from this SHG. In all other cases, SHG 0 (zero) will be used. If the MAC ping originated from a non-zero SHG, the packets will not go out to the same SHG.

### Parameters

*service-id*

the service ID or name of the service to diagnose or manage

**Values** 1 to 2147483647 or *service-name*

*ieee-address*

the destination MAC address to be traced (all zeros not allowed)

*fc-name*

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

**Default** be

*octets*

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 size packet necessary to send the request is used.

**Values** 1 to 9702

**Default** no OAM packet padding

*min-ttl vc-label-ttl*

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

**Values** 1 to 255

**Default** 1

*max-ttl vc-label-ttl*

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

*send-count*

the number of MAC OAM requests sent for a particular TTL value, expressed as a decimal integer

**Values** 1 to 100

**Default** 1

*interval*

the interval parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the interval is set to 1 s, and the timeout value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values** 1 to 10

**Default** 1

#### *timeout*

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 will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

**Values** 1 to 10

**Default** 5

## p2mp-lsp-ping

### Syntax

**p2mp-lsp-ping** {**ldp** *p2mp-identifier* [**sender-addr** *ip-address*] [**leaf-addr** *ip-address* [...up to 5 max]]} [**fc** *fc-name* [**profile** {**in** | **out**}]] [**size** *octets*] [**timeout** *timeout*] [**detail**]

### Context

oam

### Description

This command performs an in-band connectivity test for an LDP point-to-multipoint LSP. An echo request message is sent on the active point-to-multipoint instance and is replicated in the data path over all branches of the point-to-multipoint LSP instance. By default, all egress LER nodes that are leaves of the point-to-multipoint LSP instance will reply to the echo request message.

An LDP point-to-multipoint generic identifier that includes the source IP address of the root node can be used to uniquely identify an LDP point-to-multipoint LSP in a network. The LDP *p2mp-identifier* is a mandatory parameter needed for the LSP ping test. The LDP P2MP ID specified when configuring a tunnel interface on the root node must be used as the *p2mp-identifier* to test a particular LSP.

The user can reduce the scope of the echo reply messages by explicitly entering a list of addresses for the egress LER nodes that are required to reply. A maximum of five addresses can be specified in a single run of the **p2mp-lsp-ping** command. An LER node parses the list of egress LER addresses, and if its address is included in the list, it will send back an echo reply message.

Without the **detail** option, the output of the command provides a high-level summary of error codes and success codes received. With the **detail** option, the output of the command shows a line for each replying node (similar to the output of the LSP ping for a point-to-point LSP).

The output display is delayed until all responses are received or the timer configured for the **timeout** parameter has expired. No other CLI commands can be entered while waiting for the display. The CLI break sequence <Ctrl-C> aborts the ping operation.

## Parameters

### *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 the CSM 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 bits is dictated by the LSP-to-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-to-EXP mappings of the incoming interface.

When an MPLS echo reply packet is generated in the CSM 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 bits is dictated by the LSP-to-EXP mappings on the outgoing interface. The ToS byte is not modified. The following table summarizes this behavior.

Table 21: P2MP-LSP-ping request and reply packet behavior

| Forwarding direction                | Packet behavior                                                                                                                                                                                                                                                                                                               |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CSM (sender node)                   | Echo request packet: <ul style="list-style-type: none"> <li>packet {tos=1, fc1, profile1}</li> <li>fc1 and profile1 are as entered by the user in the <b>oam</b> command or are default values</li> <li>tos1 as per mapping of {fc1, profile1} to IP precedence in network egress QoS policy of outgoing interface</li> </ul> |
| Outgoing interface (sender node)    | Echo request packet: <ul style="list-style-type: none"> <li>packet queued as {fc1, profile1}</li> <li>ToS field=tos1 not re-marked</li> <li>EXP=exp1, as per mapping of {fc1, profile1} to EXP in the network egress QoS policy of the outgoing interface</li> </ul>                                                          |
| Incoming interface (responder node) | Echo request packet: <ul style="list-style-type: none"> <li>packet {tos1, exp1}</li> <li>exp1 mapped to {fc2, profile2} as per classification in the network QoS policy of the incoming interface</li> </ul>                                                                                                                  |
| CSM (responder node)                | Echo reply packet: <ul style="list-style-type: none"> <li>packet {tos=1, fc2, profile2}</li> </ul>                                                                                                                                                                                                                            |
| Outgoing interface (responder node) | Echo reply packet: <ul style="list-style-type: none"> <li>packet queued as {fc2, profile2}</li> </ul>                                                                                                                                                                                                                         |



| Forwarding direction             | Packet behavior                                                                                                                                                                                                                                                      |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>ToS field= tos1 not re-marked (reply in-band or out-of-band)</li> <li>EXP=exp2, if reply is in-band, re-marked as per mapping of {fc2, profile2} to EXP in the network egress QoS policy of the outgoing interface</li> </ul> |
| Incoming interface (sender node) | Echo reply packet: <ul style="list-style-type: none"> <li>packet {tos1, exp2}</li> <li>exp2 mapped to {fc1, profile1} as per classification in the network QoS policy of the incoming interface</li> </ul>                                                           |

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

**Default** be

#### *p2mp-identifier*

identifier of an LDP point-to-multipoint LSP to ping

**Values** 1 to 4294967295

#### *ip-address*

specifies the list of egress LER system addresses that are required to reply to an LSP ping echo request message

#### **profile {in | out}**

the profile of the LSP ping echo request message

**Default** out

#### **sender-addr** *ip-address*

specifies any local IP sender address for the mLDP

#### *octets*

the size in octets, expressed as a decimal integer, of the MPLS echo request packet, including the IP header but not the label stack. An **oam** command does not fail if the size entered is lower than the minimum number of octets required to build the packet for the echo request message. The payload is automatically padded with zeros to meet the minimum size.

**Values** 1 to 9702

**Default** 1

#### *timeout*

the timeout parameter, in seconds. This value is used to override the default *timeout* value and is the length of time that the router will wait for an echo reply message from all leaves of the point-to-multipoint LSP after sending the echo request message. When the timeout expires, the requesting router assumes that the missing replies will not be received. Any echo reply message received after the request times out will be silently discarded.

**Values**     1 to 120

**Default**    10

**detail**

displays detailed information the connectivity test for an LDP point-to-multipoint LS P

sdp-ping

**Syntax**

**sdp-ping** *orig-sdp-id* [**resp-sdp** *resp-sdp-id*] [**fc** *fc-name* [**profile** {**in** | **out**}]] [**size** *octets*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]

**Context**

oam  
config>saa>test>type

**Description**

This command tests SDPs for unidirectional or round-trip connectivity and performs SDP MTU path tests. The **sdp-ping** command accepts an originating SDP-ID and an optional responding SDP-ID. The size, number of requests sent, message time out and message send interval can be specified. All sdp-ping requests and replies are sent with PLP OAM-label encapsulation, as a service-id is not specified. For round-trip connectivity testing, the **resp-sdp** keyword must be specified. If resp-sdp is not specified, a unidirectional SDP test is performed.

To terminate an **sdp-ping** in progress, use the CLI break sequence Ctrl-c.

An **sdp-ping** response message indicates the result of the **sdp-ping** message request. When multiple response messages apply to a single SDP Echo Request/Reply sequence, the response message with the highest precedence will be displayed. The following table displays the response messages sorted by precedence.

Table 22: SDP ping response messages

| Result of request                                                | Displayed response message | Precedence |
|------------------------------------------------------------------|----------------------------|------------|
| Request timeout without reply                                    | Request Timeout            | 1          |
| Request not sent due to non-existent <i>orig-sdp-id</i>          | Orig-SDP Non-Existent      | 2          |
| Request not sent due to administratively down <i>orig-sdp-id</i> | Orig-SDP Admin-Down        | 3          |
| Request not sent due to operationally down <i>orig-sdp-id</i>    | Orig-SDP Oper-Down         | 4          |

| Result of request                                       | Displayed response message     | Precedence |
|---------------------------------------------------------|--------------------------------|------------|
| Request terminated by user before reply or timeout      | Request Terminated             | 5          |
| Reply received, invalid <i>origination-id</i>           | Far End: Originator-ID Invalid | 6          |
| Reply received, invalid <i>responder-id</i>             | Far End: Responder-ID Error    | 7          |
| Reply received, non-existent <i>resp-sdp-id</i>         | Far End: Resp-SDP Non-Existent | 8          |
| Reply received, invalid <i>resp-sdp-id</i>              | Far End: Resp-SDP Invalid      | 9          |
| Reply received, <i>resp-sdp-id</i> 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 local and remote information described in the following table will be displayed. Local and remote information is dependent upon SDP-ID existence and reception of reply.

Table 23: Single response connectivity

| Field                                   | Description                                                                                                                                                                                                                                                                    | Values                               |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Request Result                          | The result of the <b>sdp-ping</b> 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 <b>orig-sdp</b>                                                                                                                                                                                                                            | orig-sdp-id                          |
| Originating SDP-ID Administrative State | The local administrative state of the originating SDP-ID. If the SDP-ID has been shut down, Admin-Down is displayed. If the originating SDP-ID is in the <b>no shutdown</b> state, Admin-Up is displayed. If the <i>orig-sdp-id</i> does not exist, Non-Existent is displayed. | Admin-Up                             |
|                                         |                                                                                                                                                                                                                                                                                | Admin-Down                           |
|                                         |                                                                                                                                                                                                                                                                                | Non-Existent                         |

| Field                                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Values                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Originating SDP-ID Operating State     | The local operational state of the originating SDP-ID. If <i>orig-sdp-id</i> does not exist, N/A will be displayed.                                                                                                                                                                                                                                                                                                                                                                            | Oper-Up               |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Oper-Down             |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | N/A                   |
| Originating SDP-ID Path MTU            | The local <b>path-mtu</b> for <i>orig-sdp-id</i> . If <i>orig-sdp-id</i> 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 <b>sdp-ping</b> request. If <b>resp-sdp</b> is not specified, the responding 7705 SAR will not use an SDP-ID as the return path and N/A will be displayed.                                                                                                                                                                                                                                                                          | resp-sdp-id           |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | N/A                   |
| Responding SDP-ID Path Used            | Displays whether the responding 7705 SAR used the responding SDP-ID to respond to the <b>sdp-ping</b> request. If <i>resp-sdp-id</i> 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 will be displayed. If the far end does not use the responding SDP-ID as the return path, No will be displayed. If <b>resp-sdp</b> is not specified, N/A will be displayed.                              | Yes                   |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No                    |
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | N/A                   |
| Responding SDP-ID Administrative State | The administrative state of the responding SDP-ID. When <i>resp-sdp-id</i> is administratively down, Admin-Down will be displayed. When <i>resp-sdp-id</i> is administratively up, Admin-Up will be displayed. When <i>resp-sdp-id</i> exists on the far-end 7705 SAR but is not valid for the originating 7705 SAR, Invalid is displayed. When <i>resp-sdp-id</i> does not exist on the far-end 7705 SAR, Non-Existent is displayed. When <b>resp-sdp</b> 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 <i>service-id</i> . 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 <b>path-mtu</b> for <i>resp-sdp-id</i> . If <i>resp-sdp-id</i> 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 <b>far-end</b> 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                   |

| Field                               | Description                                                                                                                                                                                                  | Values                       |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 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 <b>far-end</b> address configured for the <i>orig-sdp-id</i> .                                                                  | orig-sdp-far-end-addr        |
|                                     |                                                                                                                                                                                                              | dest-ip-addr                 |
|                                     |                                                                                                                                                                                                              | N/A                          |
| Actual Far End Address              | The returned remote IP address. If a response is not received, the displayed value is N/A. If the far-end service IP interface is down or non-existent, a message reply is not expected.                     | resp-ip-addr                 |
|                                     |                                                                                                                                                                                                              | N/A                          |
| Responders Expected Far End Address | The expected source of the originator's SDP-ID from the perspective of the remote 7705 SAR 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 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*

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 SDP tunnel encapsulation used to reach the far end: GRE, 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** will attempt to send the next request if required).

**Values** 1 to 17407

*resp-sdp-id*

specifies the return SDP-ID to be used by the far-end 7705 SAR for the message reply for round-trip SDP connectivity testing. If *resp-sdp-id* does not exist on the far-end 7705 SAR, terminates on another 7705 SAR different from the originating 7705 SAR, or another issue prevents the far-end 7705 SAR from using *resp-sdp-id*, the SDP echo reply will be sent using generic 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.

This is an optional parameter.

**Values** 1 to 17407

**Default** null – use the non-SDP return path for message reply

*fc-name*

indicates 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 control the mapping back to the internal forwarding class used by the far-end 7705 SAR that receives the message request. The egress mappings of the egress network interface on the far-end 7705 SAR control the forwarding class markings on the return reply message.

The DSCP or LSP-EXP mappings on the receive network interface control the mapping of the message reply back at the originating 7705 SAR. This is displayed in the response message output upon receipt of the message reply.

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

**Default** be

**profile {in | out}**

specifies the profile state of the SDP encapsulation

**Default** out

*octets*

the size of the packet 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 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 9702

**Default** 40

*send-count*

the number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either 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

*timeout*

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be 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 will be silently discarded.

This value is used to override the default timeout value.

**Values** 1 to 10

**Default** 5

*interval*

specifies 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, then 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.

This parameter is used to override the default request message send interval.

**Values** 1 to 10

**Default** 1

**Output**

The following outputs are examples of SDP ping information.

**Output example: single response round-trip connectivity test**

```
A:router1> oam sdp-ping 10 resp-sdp 22 fc ef
Err SDP-ID Info Local Remote

SDP-ID: 10 22
Administrative State: Up Up
Operative State: Up Up
Path MTU: 4470 4470
Response SDP Used: Yes
==> IP Interface State: Up
Actual IP Address: 10.10.10.11 10.10.10.10
Expected Peer IP: 10.10.10.10 10.10.10.11
```

```

Forwarding Class ef ef
Profile Out Out

Request Result: Sent - Reply Received
RTT: 30ms

```

### Output example: multiple response round-trip connectivity test

```

A:router1> oam sdp-ping 6 resp-sdp 101 size 1514 count 5
Request Response RTT

1 Success 10ms
2 Success 15ms
3 Success 10ms
4 Success 20ms
5 Success 5ms
Sent: 5 Received: 5
Min: 5ms Max: 20ms Avg: 12ms

```

## 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* [**profile** {**in** | **out**}]] [**size** *octets*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**ttl** *vc-label-ttl*]

### Context

oam

config>saa>test>type

### Description

This command configures a virtual circuit connectivity verification (VCCV) ping test. A VCCV ping test checks connectivity of a VLL in-band. It checks to verify that the destination (target) PE is the egress for the Layer 2 FEC. It provides for a cross-check between the data plane and the control plane. The test is in-band, 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. VCCV ping reuses an LSP ping message format and can be used to test a VLL configured over an MPLS, GRE, or IP SDP.

VCCV ping can be initiated on the terminating provider edge (T-PE) router or the switching provider edge (S-PE) router. The 7705 SAR can function as an S-PE or T-PE. If initiated on the S-PE, the **reply-mode** parameter must be used with the **ip-routed** value. The ping from the T-PE can have values or the values can be omitted.

VCCV ping can be initiated on a node with MC-LAG or MC-APS configured on it. If the node is in standby mode, and ICB is configured on the service, the **reply-mode** parameter must be used with the **ip-routed** value.

If a VCCV ping is initiated from a T-PE to a neighboring S-PE (one segment only), only the *sdp-id:vc-id* parameter must be used. However, if the ping is across two or more segments, the *sdp-id:vc-id*, **src-ip-address** *ip-addr*, **dst-ip-address** *ip-addr*, **ttl** *vc-label-ttl* and **pw-id** *pw-id* parameters must be used, where:

- the **src-ip-address** is the system IP address of the router preceding the destination router



- the *pw-id* is the VC ID of the last pseudowire segment
- the *vc-label-ttl* must have a value equal to or greater than the number of pseudowire segments

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 will not be 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*

identifies the virtual circuit of the pseudowire being tested. The VC ID must exist on the local router and the far-end peer must indicate that it supports VCCV to allow the user to send a **vccv-ping** message.

This is a mandatory parameter.

|               |         |                 |
|---------------|---------|-----------------|
| <b>Values</b> | sdp-id: | 1 to 17407      |
|               | vc-id:  | 1 to 2147483647 |

### **src-ip-address** *ip-addr*

specifies the source IP address

### **dst-ip-address** *ip-addr*

specifies the destination IP address

### *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*.

|               |                 |
|---------------|-----------------|
| <b>Values</b> | 0 to 4294967295 |
|---------------|-----------------|

### **reply-mode {ip-routed | control-channel}**

specifies the method for sending the reply message to the far-end 7705 SAR

This is a mandatory parameter.

|               |                                                                                    |
|---------------|------------------------------------------------------------------------------------|
| <b>Values</b> | <b>ip-routed</b> – indicates a reply mode out-of-band using UDP IPv4               |
|               | <b>control-channel</b> – indicates a reply mode in-band using VCCV control channel |

|                |                 |
|----------------|-----------------|
| <b>Default</b> | control-channel |
|----------------|-----------------|

### *fc-name*

indicates 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 control the mapping back to the internal forwarding class used by the far-end 7705 SAR that receives the message request. The egress mappings of the egress network interface on the far-end router control the forwarding class markings on the return reply message.

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

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

**Default** be

**profile {in | out}**

specifies the profile state of the MPLS echo request encapsulation

**Default** out

**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 9702

**Default** 88

**send-count**

the number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either 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

**timeout**

specifies the amount of time that the router will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be 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 will be silently discarded.

This value is used to override the default timeout value.

**Values** 1 to 10

**Default** 5

**interval**

specifies 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, then 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.

This parameter is used to override the default request message send interval.

**Values** 1 to 10

**Default** 1***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.

**Values** 1 to 255**Output**

The following outputs are examples of VCCV ping information.

**Output example****Ping from T-PE to T-PE:**

```
*A:ALU-dutb_a# oam vccv-ping 1:1 src-ip-address 192.0.2.0 dst-ip-address 192.0.2.1
pw-id 1
ttl 3
VCCV-PING 1:1 88 bytes MPLS payload
Seq=1, reply from 192.0.2.3 via Control Channel
 udp-data-len=32 rtt=10ms rc=3 (EgressRtr)

---- VCCV PING 1:1 Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min = 10.0ms, avg = 10.0ms, max = 10.0ms, stddev < 10ms
```

**Ping from T-PE to S-PE:**

```
*A:ALU-dut-b_a# oam vccv-ping 1:1
VCCV-PING 1:1 88 bytes MPLS payload
Seq=1, reply from 192.0.2.4 via Control Channel
 udp-data-len=32 rtt<10ms rc=8 (DSRtrMatchLabel)

---- VCCV PING 1:1 Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min < 10ms, avg < 10ms, max < 10ms, stddev < 10ms

*A:ALU-dut-b_a#
oam vccv ping 1:1 src-ip-address 192.0.2.5 dst-ip-address 192.0.2.6 ttl 2 pw-
id 200
VCCV-PING 1:1 88 bytes MPLS payload
Seq=1, reply from 192.0.2.7 via Control Channel
 udp-data-len=32 rtt<10ms rc=8 (DSRtrMatchLabel)

---- VCCV PING 1:1 Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min < 10ms, avg < 10ms, max < 10ms, stddev < 10ms
```

**Ping from S-PE (on single or multi-segment):**

```
*A:ALU-dut-b_a# oam vccv-ping 4:200 reply-mode ip-routed
VCCV-PING 4:200 88 bytes MPLS payload
Seq=1, reply from 192.0.2.7 via IP
 udp-data-len=32 rtt<10ms rc=8 (DSRtrMatchLabel)

---- VCCV PING 4:200 Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min < 10ms, avg < 10ms, max < 10ms, stddev < 10ms

*A:ALU-dut-b_a# oam vccv-ping 4:200 reply-mode ip-routed src-
```

```

ip address 192.0.2.8 dst ip-address 192.0.2.9 ttl 2 pw-id 1
VCCV-PING 4:200 88 bytes MPLS payload
Seq=1, reply from 192.0.2.10 via IP
 udp-data-len=32 rtt<10ms rc=3 (EgressRtr)

---- VCCV PING 4:200 Statistics ----
1 packets sent, 1 packets received, 0.00% packet loss
round-trip min < 10ms, avg < 10ms, max < 10ms, stddev < 10ms

```

## vccv-trace

### Syntax

**vccv-trace** *sdp-id:vc-id* [**size** *octets*] [**min-ttl** *min-vc-label-ttl*] [**max-ttl** *max-vc-label-ttl*] [**max-fail** *no-response-count*] [**probe-count** *probe-count*] [**reply-mode** {**ip-routed** | **control-channel**}] [**timeout** *timeout-value*] [**interval** *interval-value*] [**fc** *fc-name*][**profile** {**in** | **out**}] [**detail**]

### Context

oam

config>saa>test>type

### 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 terminating PE (T-PE) or at a switching PE (S-PE). VCCV trace 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 TTL values, 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) includes the next-hop S-PE targeted LDP session source address in the Remote PE Address field of the PW FEC TLV. Each S-PE that terminates and processes the message will include the FEC 128 TLV corresponding to the PW segment to its downstream node in the MPLS echo reply message. 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 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.

VCCV trace can be initiated on a node with MC-LAG or MC-APS configured on it. If the node is in standby mode, and ICB is configured on the service, the **reply-mode** parameter must be used with the **ip-routed** value.

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 should be configured accordingly. However, the T-PE or S-PE node will still probe all hops up to **min-ttl** in order to correctly build the FEC of the desired subset of segments.

### Parameters

*sdp-id:vc-id*

specifies the VC ID of the pseudowire being tested. The VC ID must exist on the local 7705 SAR and the far-end peer must indicate that it supports VCCV to allow the user to send a VCCV ping message.

**Values** sdp-id: 1 to 17407  
vc-id: 1 to 4294967295

*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 9702

**Default** 88

*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. 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-vc-label-tt*

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. 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

*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 given TTL value.

**Values** 1 to 255

**Default** 5

*probe-count*

specifies the number of VCCV trace echo request messages to send per TTL value

**Values** 1 to 10

**Default** 1

**reply-mode {ip-routed | control-channel}**

specifies the method for sending the reply message to the far-end 7705 SAR. This is a mandatory parameter.

**Values**    **ip-routed** – indicates a reply mode out-of-band using UDP IPv4  
**control-channel** – indicates a reply mode in-band using the VCCV control channel

When a VCCV-trace message is originated from an S-PE node, the user should use the IPv4 reply mode because the replying node does not know how to set the TTL to reach the sending SPE node. If the user attempts this, a warning is issued to use the IPv4 reply mode.

**Default**    control-channel

#### *timeout-value*

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 7705 SAR will wait for a message reply after sending the message request. If the timeout expires, the requesting 7705 SAR assumes that the message response will not be 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 will be silently discarded.

**Values**    1 to 60

**Default**    3

#### *interval-value*

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 s and the timeout value is set to 10 s, then the maximum time between message requests is 10 s and the minimum is 1 s. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values**    1 to 255

**Default**    1

#### *fc-name*

specifies the forwarding class of the VCCV trace echo request encapsulation. The **fc** and **profile** parameters are 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 control the mapping back to the internal forwarding class used by the far-end router that receives the message request. The egress mappings of the egress network interface on the far-end router control the forwarding class markings on the return reply message. The LSP-EXP mappings on the receive network interface control the mapping of the message reply back at the originating router.

**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

**detail**

displays detailed information

**Output**

The following outputs are examples of VCCV trace information.

**Output example**

```
*A:138.120.214.60# oam vccv-trace 1:33
VCCV-TRACE 1:33 with 88 bytes of MPLS payload
1 1.1.63.63 rtt<10ms rc=8(DSRtrMatchLabel)
2 1.1.62.62 rtt<10ms rc=8(DSRtrMatchLabel)
3 1.1.61.61 rtt<10ms rc=3(EgressRtr)
```

Trace with detail:

```
*A:ALU2>oam vccv-trace 1:33 detail
VCCV-TRACE 1:33 with 88 bytes of MPLS payload
1 1.1.63.63 rtt<10ms rc=8(DSRtrMatchLabel)
Next segment: VcId=34 VcType=AAL5SDU Source=1.1.63.63 Remote=1.1.62.62
2 1.1.62.62 rtt<10ms rc=8(DSRtrMatchLabel)
Next segment: VcId=35 VcType=AAL5SDU Source=1.1.62.62 Remote=1.1.61.61
3 1.1.61.61 rtt<10ms rc=3(EgressRtr)

*A:ALU2>oam vccv-trace#
```

**vprn-ping****Syntax**

**vprn-ping** [*service-id*] **service** *service-name* **source** *ip-address* **destination** *ip-address* [**fc** *fc-name*] [**profile** {in | out}] [**size** *size*] [**ttl** *vc-label-ttl*] [**count** *send-count*] [**return-control**] [**timeout** *timeout*] [**interval** *seconds*]

**Context**

oam

config>saa>test>type

**Description**

This command performs a VPRN ping.

**Parameters**

*service-id*

the VPRN service ID to diagnose or manage

**Values** 1 to 2147483647

*service-name*

the service name, up to 64 characters

**source** *ip-address*

the IP prefix for the source IP address

**destination** *ip-address*

the IP prefix for the destination IP address

*size*

the OAM request packet size in octets, expressed as a decimal integer

**Values** 1 to 9702

*vc-label-ttl*

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.

*seconds*

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, then 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*

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 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

*timeout*

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 will wait for a message reply after sending the message request. If the timeout expires, the requesting



router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

**Values** 1 to 100

**Default** 5

*fc-name*

the forwarding class of the MPLS echo request encapsulation

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

**Default** be

**profile {in | out}**

the profile state of the MPLS echo request encapsulation

**Default** out

Output

The following output is an example of VPRN ping information.

Output example

```
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#
```

vprn-trace

Syntax

**vprn-trace** [*service-id*] **service** *service-name* **source** *ip-address* **destination** *ip-address* [**fc** *fc-name* [**profile** {in | out}] [**size** *size*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**probe-count** *send-count*] [**return-control**] [**timeout** *timeout*] [**interval** *seconds*]

Context

oam  
config>saa>test>type

Description

This command performs a VPRN trace.

## Parameters

### *service-id*

the VPRN service ID to diagnose or manage

**Values** 1 to 2147483647

### *service-name*

the service name, up to 64 characters

### **source** *ip-address*

the IP prefix for the source IP address

### **destination** *ip-address*

the IP prefix for the destination IP address

### *size*

the OAM request packet size in octets, expressed as a decimal integer

**Values** 1 to 9702

### **min-ttl** *vc-label-ttl*

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*

the maximum TTL value in the VC label for the trace test, expressed as a decimal integer

**Values** 1 to 255

**Default** 4

### **return-control**

specifies the OAM reply to a data plane OAM request be sent using the control plane instead of the data plane

**Default** OAM reply sent using the data plane.

### *send-count*

the number of OAM requests sent for a particular TTL value, expressed as a decimal integer

**Values** 1 to 10

**Default** 1

### *seconds*

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, then the maximum time between message requests is 10 seconds and the minimum is 1 second. This depends upon the receipt of a message reply corresponding to the outstanding message request.

**Values** 1 to 10

**Default** 1

#### *timeout*

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 will wait for a message reply after sending the message request. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

**Values** 1 to 10

**Default** 3

#### *fc-name*

the forwarding class of the MPLS echo request encapsulation

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

**Default** be

#### **profile {in | out}**

the profile state of the MPLS echo request encapsulation

**Default** out

## Output

The following output is an example of VPRN trace information.

### Output example

```
A:PE_1# oam vprn-trace 25 source 10.4.128.1 destination 10.16.128.0
TTL Seq Reply Node-id Rcvd-on Reply-Path RTT

[Send request TTL: 1, Seq. 1.]
1 1 1 10.128.0.4 cpm In-Band 0ms
Requestor 10.128.0.1 Route: 0.0.0.0/0
Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
Next Hops: [1] ldp tunnel
Route Targets: [1]: target:65100:1
Responder 10.128.0.4 Route: 10.16.128.0/24
Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
Next Hops: [1] ldp tunnel
Route Targets: [1]: target:65001:100

[Send request TTL: 2, Seq. 1.]
2 1 1 10.128.0.3 cpm In-Band 0ms
Requestor 10.128.0.1 Route: 0.0.0.0/0
Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
Next Hops: [1] ldp tunnel
```

```

Route Targets: [1]: target:65100:1
Responder 10.128.0.3 Route: 10.16.128.0/24
Vpn Label: 0 Metrics 0 Pref 0 Owner local
Next Hops: [1] ifIdx 2 nextHopIp 10.16.128.0
[Send request TTL: 3, Seq. 1.]
[Send request TTL: 4, Seq. 1.]
...

```

## enable-icmp-vse

### Syntax

**[no] enable-icmp-vse**

### Context

config>system

### Description

This command is a global command that enables and disables one-way timestamping of outbound SAA ICMP ping packets. Enabling one-way timestamping on a 7705 SAR node requires **enable-icmp-vse** to be set on both the near-end and far-end nodes. The current status can be seen on the **show>system>information** CLI display.

The **-vse** part of the command means vendor-specific extension.

The **no** form of this command disables one-way timestamping.

### Default

no enable-icmp-vse

## 3.8.2.1.8 Y.1564 diagnostics

## testhead

### Syntax

**testhead test-name [owner test-owner] testhead-profile profile-id [frame-payload frame-payload-id] sap sap-id [acceptance-criteria acceptance-criteria-id [color-aware {enable | disable}] [performance-monitoring {enable | disable}]]**  
**testhead test-name owner test-owner stop**

### Context

oam

### Description

This command initiates an ITU-T Y.1564 test for throughput and bandwidth testing of Ethernet point-to-point virtual circuits. The test is run using sets of threshold and payload values that are configured under

[testhead-profile](#) and [frame-payload](#). You can run tests with up to four parallel flows by specifying up to four frame payload IDs in order to create IMIX-type traffic patterns. After a test is complete, the system raises an SNMP trap.

Before initiating a test, you must also enable an Ethernet loopback with the [loopback](#) command, in order to send the test packets back to the source for measuring and analyzing. No checks are performed to verify that a remote SAP loopback is enabled

## Parameters

*test-name*

the Y.1564 test name, up to 32 characters in length

*test-owner*

the owner of a Y.1564 test, up to 32 characters in length

*profile-id*

the test head profile to be used for this test

**Values** 1 to 32

*frame-payload-id*

a list of up to four *frame-payload-ids* defined under one *testhead-profile* template; For example, 1-2, 4

**Values** 1 to 8

*sap-id*

the local SAP identifier to associate with the Y.1564 test head

*acceptance-criteria-id*

specifies which acceptance criteria group to include with the test head

**Values** 1 to 8

**color-aware**

configures the Y.1564 test to be color-aware. If enabled, the test compares the packet, jitter, and loss results to the in-profile and out-of-profile threshold settings. If disabled, the test compares packet, jitter, and loss results to their respective generic threshold values.

**performance-monitoring**

enables or disables performance monitoring tests. The test head generates time-stamped marker packets for measuring end-to-end, round-trip delay and jitter. These packets are injected along with standard filler packets used for throughput testing and can drastically skew test results, especially in tests with low bandwidth and large frame sizes.

**Default** enable

**stop**

ends an ITU-T Y.1564 test before it is complete

testhead-marker-packet-src-mac

Syntax

testhead-marker-packet-src-mac mac-address

Context

config>test-oam

Description

This command configures the source MAC address for Y.1564 test head marker packets. The default value is all zeros. It is recommended that users provision this values to a unique value for the tested network, since the packet will not traverse Layer 2 networks.

Parameters

|             |                                                                          |
|-------------|--------------------------------------------------------------------------|
| mac-address |                                                                          |
|             | a unicast destination MAC address                                        |
| Values      | xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number |
| Default     | all zeros                                                                |

testhead-profile

Syntax

testhead-profile profile-id [create]

Context

config>test-oam

Description

This command creates an ITU-T Y.1564 test head profile. The test head acts like a template that can be configured with groupings of threshold and frame payload values in order to create a variety of IYU-T Y.1564 tests. On adapter cards, one test head is supported per card. On the 7705 SAR-A, 7705 SAR-Ax, 7705 SAR-H, 7705 SAR-Hc, 7705 SAR-M, and 7705 SAR-Wx, one test head is supported per node. On the 7705 SAR-X, one test head is supported on MDA 2 and one on MDA 3.

Parameters

|            |
|------------|
| profile-id |
| 1 to 32    |

## acceptance-criteria

### Syntax

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

**no acceptance-criteria**

### Context

config>test-oam>testhead-profile

### Description

This command configures a group of acceptance criteria thresholds, such as packet loss and jitter, to be associated with an ITU-T Y.1564 test head.

The **no** form of this command deletes the acceptance criteria group and all threshold values configured under it.

### Parameters

*acceptance-criteria-id*

assigns an ID number to a group of acceptance criteria

**Values** 1 to 8

## cir-threshold

### Syntax

**cir-threshold** *cir-threshold*

**no cir-threshold**

### Context

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

### Description

This command configures the CIR threshold associated with the ITU-T Y.1564 test head.

### Default

no cir-threshold

### Parameters

*cir-threshold*

the CIR threshold in kilobits per second

**Values** 0 to 1000000

## jitter-rising-threshold

### Syntax

**jitter-rising-threshold** *threshold*

**no jitter-rising-threshold**

### Context

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

### Description

This command configures the jitter rising threshold value. The threshold value is compared to the jitter rising value reported by a Y.1564 test and a failure is reported if the jitter rising value is greater than or equal to the configured threshold.

If an in-profile or out-of-profile jitter rising threshold is configured, that threshold value is used instead for comparison when an ITU-T Y.1564 test head color-aware test is run.

The no form of the command disables jitter rising threshold comparison after a Y.1564 test.

### Default

no jitter-rising-threshold

### Parameters

*threshold*

the jitter rising threshold, in microseconds

**Values** 0 to 2147483000

## jitter-rising-threshold-in

### Syntax

**jitter-rising-threshold-in** *in-profile-threshold*

**no jitter-rising-threshold-in**

### Context

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

### Description

This command configures the in-profile jitter rising threshold value. If an in-profile or out-of-profile jitter rising threshold is configured, that threshold value is used for comparison when a Y.1564 test head color-aware test is run, instead of the jitter-rising-threshold value. When a non-color-aware test is performed, these values are ignored.

The **no** form of this command disables jitter rising threshold comparison after a Y.1564 test.



**Default**

no jitter-rising-threshold-in

**Parameters**

*in-profile-threshold*

the in-profile rising threshold jitter value, in microseconds

**Values** 0 to 2147483000

## jitter-rising-threshold-out

**Syntax**

**jitter-rising-threshold-out** *out-profile-threshold*

**no jitter-rising-threshold-out**

**Context**

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

**Description**

This command configures the out-of-profile jitter rising threshold value. If an in-profile or out-of-profile jitter rising threshold is configured, that threshold value is used for comparison when a Y.1564 test head color-aware test is run, instead of the jitter-rising-threshold value. When a non-color-aware test is performed, these values are ignored.

The **no** form of this command disables jitter rising threshold comparison after a Y.1564 test.

**Default**

no jitter-rising-threshold-out

**Parameters**

*out-profile-threshold*

the out-of-profile rising threshold jitter value, in microseconds

**Values** 0 to 2147483000

## latency-rising-threshold

**Syntax**

**latency-rising-threshold** *threshold*

**no latency-rising-threshold**

**Context**

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

## Description

This command configures the latency rising threshold value. The threshold value is compared to the latency rising value reported by a Y.1564 test, and a failure is reported if the latency rising value is greater than or equal to the configured threshold.

If an inbound or outbound latency rising threshold is configured, that threshold value is used instead for comparison when a Y.1564 test head color-aware test is run.

The **no** form of this command disables latency rising threshold comparison after a Y.1564 test.

## Default

no latency-rising-threshold

## Parameters

*threshold*

the latency rising threshold, in microseconds

**Values** 0 to 2147483000

## latency-rising-threshold-in

## Syntax

**latency-rising-threshold-in** *in-profile-threshold*

**no latency-rising-threshold-in**

## Context

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

## Description

This command configures the in-profile latency rising threshold value. If an in-profile or out-of-profile latency rising threshold is configured, that threshold value is used for comparison when a Y.1564 test head color-aware test is run, instead of the latency-rising-threshold value. When a non-color-aware test is performed, these values are ignored.

The **no** form of this command disables latency rising threshold comparison after a Y.1564 test.

## Default

no latency-rising-threshold-in

## Parameters

*in-profile-threshold*

the in-profile latency rising threshold, in microseconds

**Values** 0 to 2147483000

## latency-rising-threshold-out

### Syntax

**latency-rising-threshold-out** *out-profile-threshold*

**no latency-rising-threshold-out**

### Context

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

### Description

This command configures the out-of-profile latency rising threshold value. If an in-profile or out-of-profile latency rising threshold is configured, their threshold value is used for comparison when a Y.1564 test head color-aware test is run, instead of the latency-rising-threshold value. When a non-color-aware test is performed, these values are ignored.

The **no** form of this command disables latency rising threshold comparison after a Y.1564 test.

### Default

no latency-rising-threshold-out

### Parameters

*out-profile-threshold*

the out-of-profile latency rising threshold, in microseconds

**Values** 0 to 2147483000

## loss-rising-threshold

### Syntax

**loss-rising-threshold** *threshold*

**no loss-rising-threshold**

### Context

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

### Description

This command configures the loss rising threshold value. The threshold value is compared to the loss rising value reported by a Y.1564 test, and a failure is reported if the loss rising value is greater than or equal to the configured threshold.

If an in-profile or out-of-profile loss rising threshold is configured, that threshold value is used instead for comparison when a Y.1564 test head color-aware test is run.

The **no** form of this command disables loss rising threshold comparison after a Y.1564 test.

**Default**

no loss-rising-threshold

**Parameters**

*threshold*

the loss rising threshold, in increments of 0.0001%

**Values** 1 to 1000000 (0.0001% to 100%)

## loss-rising-threshold-in

**Syntax**

**loss-rising-threshold-in** *in-profile-threshold*

**no loss-rising-threshold-in**

**Context**

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

**Description**

This command configures the in-profile loss rising threshold value. If an in-profile or out-of-profile loss rising threshold is configured, that threshold value is used for comparison when a Y.1564 test head color-aware test is run, instead of the loss-rising-threshold value. When a non-color-aware test is performed, these values are ignored.

The **no** form of this command disables loss rising threshold comparison after a Y.1564 test.

**Default**

no loss-rising-threshold-in

**Parameters**

*in-profile-threshold*

the in-profile loss rising threshold, in increments of 0.0001%

**Values** 1 to 1000000 (0.0001% to 100%)

## loss-rising-threshold-out

**Syntax**

**loss-rising-threshold-out** *out-profile-threshold*

**no loss-rising-threshold-out**

**Context**

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

## Description

This command configures the out-of-profile loss rising threshold value. If an in-profile or out-of-profile loss rising threshold is configured, that threshold value is used for comparison when a Y.1564 test head color-aware test is run. When a non-color-aware test is performed, these values are ignored.

The **no** form of this command disables loss rising threshold comparison after a Y.1564 test.

## Default

no loss-rising-threshold-out

## Parameters

*out-profile-threshold*

the out-of-profile loss rising threshold, in increments of 0.0001%

**Values** 1 to 1000000 (0.0001% to 100%)

## pir-threshold

## Syntax

**pir-threshold** *pir-threshold*

**no pir-threshold**

## Context

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

## Description

This command configures the PIR threshold associated with the ITU-T Y.1564 test head.

## Default

no pir-threshold

## Parameters

*pir-threshold*

the PIR threshold in kilobits per second

**Values** 0 to 1000000

## description

## Syntax

**description** *description-string*

**no description**

## Context

config>test-oam>testhead-profile

## Description

This command creates a text description of a Y.1564 test head.

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

## Default

n/a

## Parameters

*description-string*

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

## frame-payload

## Syntax

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

**no frame-payload** *payload-id*

## Context

config>test-oam>testhead-profile

## Description

This command configures a frame payload profile for an ITU-T Y.1564 test head and assigns it a payload ID and payload type.

The **no** form of this command removes a payload from the test head.

## Default

n/a

## Parameters

*payload-id*

1 to 8

**payload-type**

applies a template that defines the test packet format

## data-pattern

### Syntax

**data-pattern** *hex-string*

**no data-pattern**

### Context

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

### Description

This command configures the data pattern for an ITU-T Y.1564 frame payload profile.

The data-pattern defines the packet PDU, and is used to fill the packet PDU with repeating numbers of patterns up to the max PDU supported by the packet type as defined by the .

The **no** form of this command removes the data pattern specification from the frame payload profile.

### Default

no data-pattern

### Parameters

*hex-string*

specifies the data pattern for the frame payload, maximum 64 hexadecimal nibbles

**Values** 0x0 to 0xffffffff

## description

### Syntax

**description** *description-string*

**no description**

### Context

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

### Description

This command creates a text description for a Y.1564 frame payload profile.

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

### Default

n/a

## Parameters

### *description-string*

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

## dscp

## Syntax

[no] **dscp** *dscp-name*

## Context

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

## Description

This command configures the ITU-T Y.1564 frame payload profile DSCP name.

The **no** form of this command removes the DSCP name.

## Default

n/a

## Parameters

### *dscp-name*

a text string of up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (such as #, \$, or spaces), the entire string must be enclosed within double quotes.

## dst-ip

## Syntax

**dst-ip** **ipv4** *ipv4-address*

**no** **dst-ip**

## Context

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

## Description

This command configures a destination IPv4 address for the ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the IPv4 address.

## Default

no dst-ip



## Parameters

*ipv4-address*

the destination IPv4 address for the Y.1564 packets

**dst-mac**

## Syntax

**dst-mac** *ieee-address*

**no dst-mac**

## Context

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

## Description

This command configures a destination MAC address for the ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the MAC address.

## Default

no dst-mac

## Parameters

*ieee-address*

the destination MAC address for the Y.1564 packets

**Values**    xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

**dst-port**

## Syntax

**dst-port** *dst-port-number*

**no dst-port**

## Context

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

## Description

This command configures a destination port number for the ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the port number.

**Default**

no dst-port

**Parameters**

*dst-port-number*

the destination port number for the Y.1564 packets, expressed in decimal, hexadecimal, or binary notation

**Values** 0 to 65535

**ethertype****Syntax**

**ethertype** *0x0600..0xffff*

**no ethertype**

**Context**

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

**Description**

This command configures the expected Ethertype for the ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the configured Ethertype.

**Default**

no ethertype

**Parameters**

*0x0600..0xffff*

specifies the Ethertype to expect

**frame-size****Syntax**

**frame-size** *frame-size*

**no frame-size**

**Context**

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

**Description**

This command configures the frame size to be used for the ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the frame size restriction.

**Default**

no frame-size

**Parameters**

*frame-size*

the frame size, in bytes

**Values** 64 to 9732

ip-proto

**Syntax**

**ip-proto** *ip-protocol-number*

**no ip-proto**

**Context**

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

**Description**

This command adds an IP protocol to an ITU-T Y.1564 frame payload profile.

When a payload type is specified as IPv4, this command allows you to specify the upper layer protocol that the frame carries.

The **no** form of this command removes the IP protocol from the ITU-T Y.1564 test head frame payload.

**Default**

no ip-proto

**Parameters**

*ip-protocol-number*

the IP protocol number

**Values** 0 to 255

ip-tos

**Syntax**

**ip-tos** *type-of-service*

**no ip-tos**

**Context**

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

**Description**

This command specifies an IP service type for an ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the configured service type.

**Default**

no ip-tos

**Parameters**

*type-of-service*

the type of service

**Values** 0 to 255

ip-ttl

**Syntax**

**ip-ttl** *ttl-value*

**no ip-ttl**

**Context**

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

**Description**

This command configures a time-to-live value for an ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the time-to-live value.

**Default**

no ip-ttl

**Parameters**

*ttl-value*

the time-to-live value for the ITU-T Y.1564 test head frame, expressed as a decimal integer

**Values** 1 to 255

## rate

### Syntax

**rate** *rate-in-kbs*

**no rate**

### Context

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

### Description

This command configures the frame rate for an ITU-T Y.1564 frame payload profile.

When configure the rate values, you must take into account the fabric overhead as per the SAP ingress | egress-queue provisioning rules.

The **no** form of this command removes the configured rate value.

### Default

no rate

### Parameters

*rate-in-kbs*

the ITU-T Y.1564 frame rate, in kilobits per second

**Values** 10 to 1000000

## src-ip

### Syntax

**src-ip** **ipv4** *ipv4-address*

**no src-ip**

### Context

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

### Description

This command configures the source IP address for an ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the source IP address.

### Default

no src-ip

## Parameters

*ipv4-address*

the source IP address of the frame payload

src-mac

## Syntax

**src-mac** *ieee-address*

**no src-mac**

## Context

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

## Description

This command configures the source MAC address for an ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the source MAC address.

## Default

no src-mac

## Parameters

*ieee-address*

the source MAC address for the ITU-T Y.1564 packets

**Values**    xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx, where xx is a hexadecimal number

src-port

## Syntax

**src-port** *src-port-number*

**no src-port**

## Context

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

## Description

This command configures the source port number for an ITU-T Y.1564 frame payload profile.

The **no** form of this command removes the port number.

**Default**

no src-port

**Parameters**

*src-port-number*

the source port number of the ITU-T Y.1564 frame payload, expressed as a decimal, hexadecimal, or binary notation

**Values** 1 to 65535

vlan-tag-1

**Syntax**

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

**no** **vlan-tag-1**

**Context**

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

**Description**

This command configures the first VLAN associated with the ITU-T Y.1564 frame payload profile. The **no** form of this command removes the VLAN.

**Default**

no vlan-tag-1

**Parameters**

*vlan-id*

the associated VLAN ID

**Values** 0 to 4094

*tpid*

the Tag Protocol Identifier expressed in decimal or hexadecimal notation

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

*dot1p-value*

the dot1p priority bits value for the ITU-T Y.1564 test head frame payload. Setting the value to 0 is equivalent to removing the dot1p value.

**Values** 0 to 7

## vlan-tag-2

### Syntax

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

**no** **vlan-tag-2**

### Context

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

### Description

This command configures the second VLAN associated with the ITU-T Y.1564 frame payload profile.

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

### Default

no vlan-tag-2

### Parameters

*vlan-id*

the associated VLAN ID

**Values** 0 to 4094

*tpid*

the Tag Protocol Identifier expressed in decimal or hexadecimal notation

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

*dot1p-value*

the dot1p priority bits value for the ITU-T Y.1564 test head frame payload. Setting the value to 0 is equivalent to removing the dot1p value.

**Values** 0 to 7

## rate

### Syntax

**rate** **cir** *cir-rate-in-kbs* [**pir** *pir-rate-in-kbs*]

**no** **rate**

### Context

config>test-oam>testhead-profile



## Description

This command enables the CIR and PIR rates for an ITU-T Y.1564 test head profile.

When no acceptance criteria are configured, the CIR and PIR values are used to determine if the test passes or fails. In order for the test to pass, the measured throughput must be within 1% of the configured PIR value (for color-aware tests) or CIR value (for non-color-aware tests).

The **no** form of this command removes the configured rate values.

## Default

no rate

## Parameters

*cir-in-kbs*

The CIR throughput value for color-aware tests, in kilobits per second

**Values** 0 | 10 to 1000000

*pir-in-kbs*

The PIR throughput value for non-color-aware tests, in kilobits per second

**Values** 10 to 1000000

## test-completion-trap-enable

## Syntax

[no] **test-completion-trap-enable**

## Context

config>test-oam>testhead-profile

## Description

This command enables a trap that is sent to the operator when the ITU-T Y.1564 test is complete. By default, the system raises an SNMP trap after an ITU-T Y.1564 test.

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

## Default

test-completion-trap-enable

## test-duration

## Syntax

**test-duration** {[hours *hours*] [minutes *minutes*] [seconds *seconds*]}

**no test-duration**

## Context

config>test-oam>testhead-profile

## Description

This command configures the duration of the ITU-T Y.1564 test.

The **no** form of this command removes the duration limitation from the test head.

## Default

no test-duration

## Parameters

*hours*

the test duration in hours

**Values** 0 to 24

*minutes*

the test duration in minutes

**Values** 0 to 60

*seconds*

the test duration in seconds

**Values** 0 to 60

## loopback

## Syntax

**loopback** {line | internal} {timer *seconds* | persistent} [swap-src-dst-mac]

**no loopback**

## Context

config>service>epipe>sap

## Description

This command configures a timed loopback on an Ethernet pseudowire SAP and is required to complete an ITU-T Y.1564 test.

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

## Default

no loopback

**Parameters**

- line**  
places the associated Ethernet pseudowire SAP into line loopback mode
- internal**  
places the associated Ethernet pseudowire SAP into internal loopback mode
- seconds**  
the loopback time, in seconds  
**Values** 0 | 30 to 86400
- persistent**  
configures the loopback as persistent, or latched, and enables it indefinitely until deactivated by a user
- swap-src-dst-mac**  
swaps source and destination MAC addresses for Ethernet line loopbacks

**3.8.2.1.9 TWAMP commands**

twamp

**Syntax**

twamp

**Context**

config>test-oam

**Description**

This command enables TWAMP functions. See the **clear>test-oam>twamp>server** command description for information about how to disable TWAMP functions.

**Default**

TWAMP is disabled

server

**Syntax**

server

**Context**

config>test-oam>twamp

## Description

This command configures the TWAMP server.

## Default

TWAMP server is disabled

## enforce-test-session-start-time

## Syntax

**[no] enforce-test-session-start-time**

## Context

config>test-oam>twamp>server

## Description

This command enables or disables checking of the TWAMP test session start time against the server time.

By default, the TWAMP server compares the arrival time of TWAMP test packets with the signaled start time in the Request-TW-Session message and the server time. If a test packet arrives before the negotiated test session start time, the packet is discarded.

The **no** form of the command enables the server to process all TWAMP test packets without checking the test session start time against the server time.

## Default

enforce-test-session-start-time

## inactivity-timeout

## Syntax

**inactivity-timeout** *timer*

**no inactivity-timeout**

## Context

config>test-oam>twamp>server

## 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 time, the connection is closed and all in-progress tests are terminated.

The **no** form of the command sets the timeout to its default value.

## Default

inactivity-timeout 900

Parameters

|                |                                                    |
|----------------|----------------------------------------------------|
| <i>timer</i>   | the duration of the inactivity timeout, in seconds |
| <b>Values</b>  | 60 to 3600                                         |
| <b>Default</b> | 900                                                |

max-conn-server

Syntax

max-conn-server *count*  
no max-conn-server

Context

config>test-oam>twamp>server

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 the command sets the maximum number to its default value.

Default

max-conn-server 32

Parameters

|                |                                           |
|----------------|-------------------------------------------|
| <i>count</i>   | the maximum number of control connections |
| <b>Values</b>  | 0 to 64                                   |
| <b>Default</b> | 32                                        |

max-sess-server

Syntax

max-sess-server *count*  
no max-sess-server

Context

config>test-oam>twamp>server

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 the command sets the maximum number to its default value.

Default

max-sess-server 32

Parameters

*count*  
the maximum number of concurrent test sessions

|         |          |
|---------|----------|
| Values  | 0 to 128 |
| Default | 32       |

prefix

Syntax

**prefix** *ip-prefix/prefix-length* [**create**]  
**no prefix** *ip-prefix/prefix-length*

Context

config>test-oam>twamp>server

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 to conduct tests), the client must establish the control connection using an IP address that is part of a configured prefix.

Default

no prefix

Parameters

*ip-prefix/prefix-length*  
the IP address

description

Syntax

**description** *description-string*

## no description

### Context

config>test-oam>twamp>server>prefix

### Description

This command creates a text description of an IP prefix used by a TWAMP server. The prefix description can be changed at any time, even while the server is running.

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

### Default

no description

### Parameters

*description-string*

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

## max-conn-prefix

### Syntax

**max-conn-prefix** *count*

**no max-conn-prefix**

### Context

config>test-oam>twamp>server>prefix

### Description

This command configures the maximum number of 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 the command sets the maximum number to its default value.

### Default

max-conn-prefix 32

### Parameters

*count*

the maximum number of control connections

**Values** 0 to 64

Default 32

max-sess-prefix

Syntax

max-sess-prefix *count*  
no max-sess-prefix

Context

config>test-oam>twamp>server>prefix

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 the command sets the maximum number to its default value.

Default

max-sess-prefix 32

Parameters

*count*  
the maximum number of concurrent test sessions

Values 0 to 128

Default 32

ref-inactivity-timeout

Syntax

ref-inactivity-timeout *timer*  
no ref-inactivity-timeout

Context

config>test-oam>twamp>server

Description

This command configures the reflector inactivity timeout for all TWAMP test connections. If no TWAMP test frame is received for the *timer* duration, then the existing TWAMP test connections are closed.

The **no** form of the command sets the timer to its default value.



**Default**

ref-inactivity-timeout 900

**Parameters**

*timer*

the duration of the **ref-inactivity timeout**, in seconds

**Values** 60 to 3600

**Default** 900

twamp-light

**Syntax**

twamp-light

**Context**

config>test-oam>twamp

**Description**

This command enables the context for configuring TWAMP Light functionality.

**Default**

disabled

inactivity-timeout

**Syntax**

inactivity-timeout *seconds*

no inactivity-timeout

**Context**

config>test-oam>twamp>twamp-light

**Description**

This command configures the length of time that a stale state is maintained on the session reflector. A stale state is test data that has not been refreshed or updated by newly arriving queries for a specific test for a configured length of time. Any single reflector can maintain an Up state for a maximum of 12 000 tests. If the maximum value is exceeded, the session reflector does not have memory to allocate to new tests; therefore, stale test data should be deleted to ensure that there is room for new tests.

The **no** form of the command sets the timer to its default value.

**Default**

inactivity-timeout 100

**Parameters**

*time*

the number of seconds that a stale state is maintained

**Values** 10 to 100

**Default** 100

source-udp-port-pools

**Syntax**

**source-udp-port-pools**

**Context**

config>test-oam>twamp>twamp-light

**Description**

This command enables the context to configure the source UDP port pool allocation for TWAMP Light or STAMP applications.

**Default**

n/a

port

**Syntax**

**port** *port-number*

**Context**

config>test-oam>twamp>twamp-light>src-udp-pools

**Description**

This command configures the TWAMP Light reserved source UDP ports to be mapped to a specific TWAMP Light or STAMP application.

**Default**

n/a

**Parameters***port-number*

the TWAMP Light reserved source UDP port number

**Values** 64374 to 64383**pool-type****Syntax****pool-type** *pool-type***Context**

config&gt;test-oam&gt;twamp&gt;twamp-light&gt;src-udp-pools&gt;port

**Description**

This command maps the specified source UDP port to a TWAMP Light application pool and gives the application permission to configure the source UDP port.

A pool type cannot be changed if its current application (either an OAM-PM session or link measurement template) is configured to use the specified port, regardless of the administrative or operational state. The configuration reference linking to the source UDP prevents the change.

**Default**

oam-pm

**Parameters***pool-type*

specifies the application pool to use with this port

**Values** oam-pm, link-measurement**3.8.2.1.10 Link measurement template commands****link-measurement****Syntax****link-measurement****Context**

config&gt;test-oam

## Description

This command enables the context to configure various link measurement template attributes that are inherited on associated IP interfaces for delay reporting to the routing engine.

## measurement-template

### Syntax

**measurement-template** *template-name* [create]

**no measurement-template** *template-name*

### Context

config>test-oam>link-meas

### Description

This command configures a measurement template identifier that can be assigned to the IP interface by name.

Configuration modifications can be made to the measurement template without disabling the template and while IP interfaces are actively referencing the measurement template. See "Modifying measurement template configuration" for more information about which modifications will cause the test on associated IP interfaces to terminate and restart.

The **no** form of this command removes the template name. A measurement template can be removed if no interfaces are referencing the template.

### Default

n/a

### Parameters

*template-name*

specifies the measurement template name, up to 64 characters

**create**

keyword used to create a measurement template. The **create** keyword requirement can be enabled or disabled in the **environment create** context.

## aggregate-sample-window

### Syntax

**aggregate-sample-window**

### Context

config>test-oam>link-meas>template

**Description**

This command enables the context to configure the aggregate sample window parameters to be used when the measurement template is assigned to an IP interface. The aggregate sample window is the collection of sample windows.

**Default**

n/a

**multiplier**

**Syntax**

**multiplier** *sample-window-durations*

**Context**

config>test-oam>link-meas>template>asw

**Description**

This command configures the number of sample windows in an aggregate sample window.

**Default**

12

**Parameters**

*sample-window-durations*  
the number of sample windows

**Values** 1 to 12

**threshold**

**Syntax**

**threshold**

**Context**

config>test-oam>link-meas>template>asw  
config>test-oam>link-meas>template>sw

**Description**

This command enables the context to configure the delay measurement threshold values for the sample windows.

## absolute

### Syntax

**absolute** *microseconds*

**no absolute**

### Context

config>test-oam>link-meas>template>asw>thr

config>test-oam>link-meas>template>sw>thr

### Description

This command specifies the delta, in microseconds, that a new delay measurement must differ from the previously reported measurement to be reported directly to the routing engine.

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

### Default

0

### Parameters

*microseconds*

specifies the difference, in microseconds. A value of 0 (zero) indicates that the absolute threshold is not used for reporting.

**Values** 0 to 100000

## relative

### Syntax

**relative** *percent*

**no relative**

### Context

config>test-oam>link-meas>template>asw>thr

config>test-oam>link-meas>template>sw>thr

### Description

This command configures the percentage value of change, positive or negative, compared to the previously reported measurement. If this percentage value is reached in either direction, the new value is conveyed to the routing engine for further handling and stored as the delay measurement last reported. If the percentage value is not configured, this threshold is disabled.

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

**Default**

0

**Parameters***percent*

specifies the percentage of change. A value of 0 (zero) indicates that the relative threshold is not used for reporting.

**Values**    0 to 100 for aggregate sample windows  
              0 to 500 for sample windows

**window-integrity****Syntax****window-integrity** *percent***no window-integrity****Context**

config&gt;test-oam&gt;link-meas&gt;template&gt;asw

**Description**

This command specifies the integrity of the aggregate sample window. The configured percentage translates to a required sample window count that must be included in the aggregate sample window. The number of required samples is computed as follows:

$(\text{Used sample windows} \times 100) / \text{Aggregate sample window multiplier}$

A used sample window is a sample window that produces a delay measurement over 0.

If the number of samples in the aggregate sample window are equal to or greater than the computed number of required samples, the aggregate sample window has integrity and the result is compared to configured aggregate sample window thresholds. If the count is less than the computed number of required samples, the aggregate sample window does not have integrity. The value is not considered as representative and is not used for threshold comparison.

If this parameter is not configured, integrity checking is disabled and all results are compared to the configured thresholds.

The **no** form of this command disables integrity checking.

**Default**

0

**Parameters***percent*

specifies the percentage of successful sent and received request-response pairs. A value of 0 indicates any amount of integrity is acceptable.

**Values** 0 to 100

## delay

### Syntax

**delay** {*delay-measurement-type*}

### Context

config>test-oam>link-meas>template

### Description

This command configures the type of delay measurement statistic used in both the sample window and aggregate sample window.

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

### Default

min

### Parameters

*delay-measurement-type*

specifies the value to use for comparison and reporting

**Values** min | max | avg

**min** – use the minimum value of a series of measurements

**max** – use the maximum value of a series of measurements

**avg** – compute the average value of a series of measurements

## description

### Syntax

**description** *description-string*

**no description**

### Context

config>test-oam>link-meas>template

### Description

This command configures a text description that is stored in the configuration file. The text string is associated with a configuration context to identify the content in the configuration file.

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



**Default**

n/a

**Parameters**

*description-string*

the description character string. Allowed values are any string, up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (such as #, ?, space), the entire string must be enclosed within double quotes.

**interval****Syntax**

**interval** *seconds*

**Context**

config>test-oam>link-meas>template

**Description**

This command configures the length of time between test packet transmissions.

**Default**

1

**Parameters**

*seconds*

the elapsed time between transmission of test packets for the specified template

**Values** 1 to 10

**last-reported-delay-hold****Syntax**

**last-reported-delay-hold** *seconds*

**no last-reported-delay-hold**

**Context**

config>test-oam>link-meas>template

**Description**

This command configures an aging timer that specifies the time to wait before flushing the last reported delay metric before the associated link measurement test entered an operationally down state.

This timer starts a countdown to zero when an administrative function causes the operational state of the test on that specific interface to transition from up to down. If the timer expires before the operational state transitions back to up, the previously reported value is flushed. When this happens, The Delay Measurement Last Reported field indicates "Cleared", the timestamp indicates the time of the clear event, and The Triggered By field indicates "Expired". If the administrative state recovers to operationally up before the expiration of the timer, the previous reported value is not flushed.

The aging timer does not apply to failure conditions that do not affect the administrative state of the interface, for example interface failure or routing changes.

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

## Default

86400

## Parameters

*seconds*

specifies the delay measurement retention time, in seconds, after the interface on which it was collected is administratively disabled. If the configured value is reached, the last reported measurement is cleared.

A configured value of 0 indicates that the previous reported value is cleared without additional wait time.

**Values** 0 to 86400

## reporting

## Syntax

**[no] reporting**

## Context

config>test-oam>link-meas>template

## Description

This command specifies whether results collected in a sample window or aggregate sample window that reach a configured threshold are reported to the routing engine.

The **no** form of this command disables reporting. Values reaching thresholds are not reported to the routing engine and any previous value reported from a measurement window is cleared. However, sample window and aggregate sample window information and computed values will continue to be stored on the node until overwritten.

## Default

reporting

## sample-window

### Syntax

**sample-window**

### Context

config>test-oam>link-meas>template

### Description

This command enables the context to configure sample window parameters to be used when the **measurement-template** is assigned to an IP interface. The sample window is the collection of individual probe results, over a defined period.

### Default

n/a

## multiplier

### Syntax

**multiplier** *interval-durations*

### Context

config>test-oam>link-meas>template>sw

### Description

This command configures the number of probe results that should be in the sample window. The duration of the sample window is the [interval](#) value multiplied by the **multiplier**.

For example, a multiplier of 10 and an interval of 5 results in one probe being transmitted every 5 seconds for 50 seconds. Consequently, 10 probe results are expected within the 50 second duration that the sample window is "In-progress".

### Default

10

### Parameters

*interval-durations*

the number of intervals in a sample window

**Values** 1 to 900

## window-integrity

### Syntax

**window-integrity** *percent*

**no window-integrity**

### Context

config>test-oam>link-meas>template>sw

### Description

This command specifies the integrity of the sample window. A percentage value (calculated below) indicates when the sample window has enough samples to be considered representative for that window (integrity).

$(\text{successful\_samples} \times 100) / \text{multiplier}$

Successful samples are delays > 0 in that window (lost/failed probes do not count).

If the number of samples in the sample window are equal to or greater than the computed number of required samples, the sample window has integrity and the sample window result is compared to the configured sample window thresholds.

If the count is less than the computed number of required samples, the sample window does not have integrity and the sample window results are not compared to configured sample window thresholds.

If this parameter is not configured, integrity checking is disabled and all results are compared to the configured thresholds.

The **no** form of this command disables integrity checking.

### Default

0

### Parameters

*percent*

specifies the percentage of successful sent and received request-response pairs. A value of 0 indicates any amount of integrity acceptable.

**Values** 0 to 100

## shutdown

### Syntax

**[no] shutdown**

### Context

config>test-oam>link-meas>template

## Description

This command administratively disables the measurement template.

The **measurement-template** can be referenced even if it is disabled. The template must be administratively enabled to transmit probes on any associated IP interface. The template configuration can be modified even if it is administratively enabled. The template can be administratively disabled even if interfaces are actively registered with the template. When the template configuration is modified, all registered IP interfaces start from the initial state and enter a first reporting scenario. This is true even if the template is administratively disabled and enabled, and no configuration changes are made.

The **no** form of this command administratively enables the measurement template.

## Default

shutdown

twamp-light

## Syntax

twamp-light

## Context

config>test-oam>link-meas>template

## Description

This command enables the context to configure TWAMP Light test values.

## Default

n/a

allow-ipv6-udp-checksum-zero

## Syntax

[no] allow-ipv6-udp-checksum-zero

## Context

config>test-oam>link-meas>template>twl

## Description

This command configures the acceptance of IPv6 packets with UDP checksums of 0. This optional configuration allows the router to process arriving IPv6 TWAMP Test packets that contain IPv6 UDP checksum of 0x0000. The UDP port specific to this TWAMP Light test bypasses the default discard IPv6 UDP checksum 0x0000. If this optional command is not configured, packets that arrive with the IPv6 UDP checksum 0x0000 are discarded.

The **no** form of this command reverts to the default value, discarding packets that arrive with an IPv6 UDP checksum of 0x0000.

**Default**

no allow-ipv6-udp-checksum-zero

**dest-udp-port****Syntax**

**dest-udp-port** *port-number*

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command configures the destination UDP port used by the link measurement tests.

**Default**

862

**Parameters**

*port-number*

specifies the destination UDP port copied into the UDP header of each Echo request packet launched for each link measurement test belonging to the specified template

**Values** 1 to 65535

**dscp****Syntax**

**dscp** *dscp-name*

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command configures the DSCP to be copied into the IP header of each TWAMP Light echo request packet launched for the test.

**Default**

nc1

**Parameters**

*dscp-name*

the DSCP code point to be used

**Values** be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63

fc

**Syntax**

fc *fc-name*

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command configures the forwarding class for the TWAMP Light packet.

**Default**

h1

**Parameters**

*fc-name*

specifies the forwarding class

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

ipv6-destination-discovery

**Syntax**

ipv6-destination-discovery

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command enables the context to configure IPv6 discovery of a directly-connected IPv6 peer address.

**Default**

n/a

## discovery-interval

### Syntax

**discovery-interval** *seconds*

### Context

config>test-oam>link-meas>template>twl>ipv6-dest-disc

### Description

This command configures the frequency at which IPv6 peer discovery packets are transmitted when the [discovery-timer](#) is active.

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

### Default

10

### Parameters

*seconds*

the transmission frequency of the discovery packet

**Values** 1 to 10

## discovery-timer

### Syntax

**discovery-timer** *seconds*

### Context

config>test-oam>link-meas>template>twl>ipv6-dest-disc

### Description

This command configures the amount of time to remain in initial discovery phase. During the initial discovery phase, the node transmits peer discovery packets at the interval configured with [discovery-interval](#) until a peer is discovered or the **discovery-timer** expires, at which point, the probe interval changes to the value configured for the [update-interval](#).

The discovery timer begins when IPv6 protocols is enabled under the **config>router>if>if-attribute>delay>dynamic>twamp-light>ipv6** context. If a peer has not been discovered during the discovery phase, disabling and enabling the IPv6 protocols restarts the discovery process.

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

### Default

60



## Parameters

*seconds*

specifies the amount of time to remain in discovery phase

**Values** 1 to 1800

## shutdown

## Syntax

[no] shutdown

## Context

config>test-oam>link-meas>template>twl>ipv6-dest-disc

## Description

This command administratively disables IPv6 destination address discovery.

The **no** this command administratively enables IPv6 destination address discovery.

## Default

shutdown

## update-interval

## Syntax

update-interval *seconds*

## Context

config>test-oam>link-meas>template>twl>ipv6-dest-disc

## Description

When a peer is discovered during the discovery phase or when the [discovery-timer](#) expires, the node sends IPv6 discovery packets at the configured **update-interval**, to continue monitoring the address of the peer.

When set to zero, the peer address is not monitored after the initial discovery phase.

## Default

600

## Parameters

*seconds*

specifies the frequency used for probe packets

**Values** 0 to 3600

## pad-tlv-size

### Syntax

**pad-tlv-size** *octets*

**no pad-tlv-size**

### Context

config>test-oam>link-meas>template>twl

### Description

This command configures the size of an optional TLV to add to the STAMP PDU. This increases the size of the STAMP PDU by the size of the added TLV. The PAD TLV includes an all-zeros pattern.

The **no** form of this command removes the TLV padding from the STAMP PDU.

### Default

no pad-tlv-size

### Parameters

*octets*

specifies the length of the TLV, in octets

**Values** 4 to 9714

## profile

### Syntax

**profile** *quality-of-service-profile*

### Context

config>test-oam>link-meas>template>twl

### Description

This command configures the QoS profile, which determines whether packets transmitted over all sessions using this template should be treated as in or out of profile as they move through the local node.

### Default

in

**Parameters**

*quality-of-service-profile*  
specifies the QoS profile used when launching the link measurement test belonging to the specified template

**Values**    in, out

return-path

**Syntax**

return-path

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command enables the context to configure the return-path TLV for the test packet.

**Default**

n/a

link

**Syntax**

[no] link

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command configures the router to include a return path sub-TLV link. The sub-TLV link instructs a Session-Reflector configured for STAMP to use the receiving link for the transmission of the response packet from the reflector to the Session-Sender. The destination of the reflected packet must be installed in the forwarding table and reachable through the IP interface, or the packet is dropped by the Session-Reflector.

The **no** form of this command configures the router to exclude the return path sub-TLV link.

**Default**

no link

## src-udp-port

### Syntax

**src-udp-port** *port-number*

**no src-udp-port**

### Context

config>test-oam>link-meas>template>twl

### Description

This command configures a source UDP port to be used by the link measurement tests linked to this template.

Unless required, Nokia suggests that the link measurement dynamically select an available source UDP port from the dynamic range. Before a UDP port in the configurable range can be configured as a source it must be owned by the application. Use the **config>test-oam>twamp>twamp-light>src-udp-pools>port>pool-type** command to map the port range to the application.

To use a source port in this range for link-measurement, the selected port number must have a pool type configured as **link-measurement**.

The **no** form of the command removes the port number from the link measurement template.

### Default

ntp

### Parameters

*port-number*

specifies the source UDP port number

**Values** 64374 to 64383

## timestamp-format

### Syntax

**timestamp-format** *timestamp-format*

### Context

config>test-oam>link-meas>template>twl

### Description

This command configures the format of the timestamp used in the TWAMP Light PDU. This configuration places the requested timestamp format in the packet using the appropriate epoch. This is unrelated to any time distribution protocol being used to synchronize time between clocks.

**Default**

ntp

**Parameters**

*timestamp-format*

the timestamp format to be used in the TWAMP Light PDU

**Values** ntp, ptp

**t**

**Syntax**

**t** *time-to-live*

**Context**

config>test-oam>link-meas>template>twl

**Description**

This command configures the Time-to-Live (TTL) value in the TWAMP Light test packet.

**Default**

1

**Parameters**

*time-to-live*

specifies the value to be used in the TTL field

**Values** 1 to 255

**u**

**Syntax**

**unidirectional-measurement** *measurement-type*

**Context**

config>test-oam>link-meas>template

**Description**

This command specifies the method used to compute the unidirectional delay value.

**Default**

derived

## Parameters

*measurement-type*

the method to compute a unidirectional delay measurement

**Values**    **actual | derived**

**actual** — use the forward delay as the unidirectional measurement. The forward delay is calculated using T2-T1 timestamps.

**derived** — compute the unidirectional measurement using the round trip delay divided by two. This option should be used when the nodal clocks are not synchronized using an accurate time synchronization method or protocol, like PTP.

### 3.8.2.1.11 Global downstream mapping commands

#### mpls-echo-request-downstream-map

## Syntax

**mpls-echo-request-downstream-map {dsmap | ddmmap}**

## Context

config>test-oam

## Description

This command specifies the downstream mapping TLV format to use in all LSP trace packets and LDP tree-trace packets originated on the node. The configured global value becomes the default downstream mapping TLV for all newly created LSP trace and LDP tree-trace tests. It has no effect on existing tests and can be overridden on a specific test by setting the **downstream-map-tlv** parameter in the [lsp-trace](#) or [ldp-tree-trace](#) commands.

The downstream mapping TLV allows the sender and responder nodes to exchange and validate interface and label stack information for each downstream hop in an LDP FEC path, an RSVP LSP, a BGP labeled IPv4 route, an SR-ISIS node SID, or an SR-OSPF node SID. If the responder node has multiple equal-cost next hops for the LDP FEC, BGP labeled IPv4 prefix, SR-ISIS node SID, or SR-OSPF node SID, it replies in the downstream mapping TLV with the downstream information of each outgoing interface that is part of the ECMP next hop set for the prefix. The downstream mapping TLV can be further used to exercise a specific path of the ECMP set using the **path-destination** option in the **lsp-ping** or **lsp-trace** commands.

By default, the system uses the DSMAP TLV.

## Default

dsmap

Parameters

- dsmap

configures all LSP tree and LDP tree trace packets to use the original target FEC stack TLV for BGP labeled IPv4/32 prefixes as defined in RFC 4379
- ddmap

configures all LSP tree and LDP tree trace packets to use the enhanced TLV format specified in RFC 6424

3.8.2.1.12 LDP diagnostics



**Note:** LDP tree trace works best with label-IP (**lbl-ip**) hashing enabled, rather than label-only (**lbl-only**) hashing. These options are set with the **lsr-load-balancing** command. For information about the **lsr-load-balancing** command, see the 7705 SAR Basic System Configuration Guide, "System Command Reference" and the 7705 SAR Router Configuration Guide, "IP Router Command Reference".

ldp-tree trace

Syntax

**ldp-tree trace** prefix *ip-prefix/mask* [**max-ttl** *max-label-ttl*] [**max-path** *max-paths*] [**timeout** *timeout*] [**retry-count** *retry-count*] [**fc** *fc-name* [**profile** {*in* | *out*}]] [**downstream-map-tlv** {**dsmap** | **ddmap**}]

Context

oam

Description

This command configures LDP tree trace parameters in order to perform OAM manual tree trace tests on demand. Tree trace tests are used to discover all possible ECMP paths of an LSP.

Parameters

- ip-prefix/mask*

the address prefix and subnet mask of the destination node
- max-label-ttl**

the maximum time-to-live value in the MPLS label for the LSP trace test, expressed as a decimal integer

Values

1 to 255

Default

30
- max-paths**

the maximum number of paths for an LDP tree trace test

Values

1 to 255

**Default** 128

*timeout*

the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** parameter overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

**Values** 1 to 60

**Default** 3

*retry-count*

the maximum number of consecutive MPLS echo requests that do not receive a reply before the trace operation fails for a given TTL

**Values** 1 to 225

**Default** 5

*fc-name*

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 control the mapping back to the internal forwarding class used by the far-end 7705 SAR that receives the message request. The egress mappings of the egress network interface on the far-end 7705 SAR control the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface control the mapping of the message reply at the originating 7705 SAR.

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

**Default** be

**profile {in | out}**

the profile state of the MPLS echo request encapsulation

**Default** out

**downstream-map-tlv {dsmap | ddmmap}**

specifies which format of the downstream mapping TLV to use in the LSP trace packet. Use **dsmap** for the original target FEC stack TLV for BGP labeled IPv4/32 prefixes as defined in RFC 4379 or **ddmmap** for the enhanced TLV format specified in RFC 6424. If this parameter is not set, the value will be inherited from the global downstream mapping TLV value.

**Default** inherited from the global configuration of the downstream mapping TLV in the [mpls-echo-request-downstream-map](#) command



## ldp-treetrace

### Syntax

**[no] ldp-treetrace**

### Context

config>test-oam

### Description

This command enables the context to configure LDP tree trace parameters in order to perform OAM manual tree trace tests. Tree trace commands at this level configure periodic proactive tree trace and set path discovery and path probing parameters.

## fc

### Syntax

**fc** *fc-name* [profile {in | out}]

**no fc**

### Context

config>test-oam>ldp-treetrace

### Description

This command configures forwarding class name and profile parameters. The parameters 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 control the mapping back to the internal forwarding class used by the far-end 7705 SAR that receives the message request. The egress mappings of the egress network interface on the far-end 7705 SAR control the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface control the mapping of the message reply at the originating 7705 SAR.

### Parameters

*fc-name*

the forwarding class of the MPLS echo request packets.

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

**Default** be

**profile {in | out}**

the profile state of the MPLS echo request encapsulation

**Default**    out

path-discovery

**Syntax**  
**path-discovery**

**Context**  
config>test-oam>ldp-treetrace

**Description**  
This command enables the context to configure path discovery parameters for ECMP paths of an LSP.

interval

**Syntax**  
**interval** *minutes*  
**no interval**

**Context**  
config>test-oam>ldp-treetrace>path-discovery

**Description**  
This command configures the time to wait before repeating the LDP tree auto-discovery process.

**Default**  
60

**Parameters**  
*minutes*  
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*  
**no max-path**

**Context**

config>test-oam>ldp-treetrace>path-discovery

**Description**

This command configures the maximum number of paths that can be discovered for a selected IP address FEC.

**Default**

128

**Parameters**

*max-paths*

the maximum number of paths for the tree discovery

**Values** 1 to 128

max-ttl

**Syntax**

**max-ttl** *ttl-value*

**no max-ttl**

**Context**

config>test-oam>ldp-treetrace>path-discovery

**Description**

This command configures the maximum time-to-live value in the MPLS label for an LSP trace request during the tree discovery.

**Default**

30

**Parameters**

*ttl-value*

the maximum TTL value for an LSP trace request during the tree discovery

**Values** 1 to 255

policy-statement

**Syntax**

**policy-statement** *policy-name* [*policy-name...*(up to 5 max)]

**no policy-statement****Context**

config>test-oam>ldp-treetrace>path-discovery

**Description**

This command specifies policies to filter LDP imported address FECs.

**Default**

no policy-statement

**Parameters**

*policy-name*

the route policy name to filter LDP imported address FECs. Allowed values are any string up to 32 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (such as #, \$, or spaces), 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>test-oam>ldp-treetrace>path-discovery

**Description**

This command configures the maximum number of consecutive timeouts before the path probe fails.

**Default**

3

**Parameters**

*retry-count*

the maximum number of timeouts

**Values** 1 to 255

## timeout

### Syntax

**timeout** *timeout*

**no timeout**

### Context

config>test-oam>ldp-treetrace>path-discovery

### Description

This command configures the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** command overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

### Default

30

### Parameters

*timeout*

the maximum amount of time that the router will wait for a message reply

**Values** 1 to 60

## path-probing

### Syntax

**path-probing**

### Context

config>test-oam>ldp-treetrace

### Description

This command enables the context to configure path probing parameters for ECMP paths of an LSP.

## interval

### Syntax

**interval** *minutes*

**no interval**

**Context**

config>test-oam>ldp-treetrace>path-probing

**Description**

This command configures the time to wait before repeating a probe (ping) on an ECMP-discovered path of an LSP.

**Default**

1

**Parameters**

*minutes*  
the number of minutes to wait between probing ECMP paths  
**Values** 1 to 60

retry-count

**Syntax**

retry-count *retry-count*  
no retry-count

**Context**

config>test-oam>ldp-treetrace>path-probing

**Description**

This command configures the maximum number of consecutive timeouts before the path probe fails.

**Default**

3

**Parameters**

*retry-count*  
the maximum number of timeouts  
**Values** 1 to 255

timeout

**Syntax**

timeout *timeout*  
no timeout

## Context

config>test-oam>ldp-treetrace>path-probing

## Description

This command configures the maximum amount of time, in seconds, that the router will wait for a message reply after sending the message request. The **timeout** command overrides the default timeout value. If the timeout expires, the requesting router assumes that the message response will not be received. Any response received after the request times out will be silently discarded.

## Default

1

## Parameters

*timeout*

the maximum amount of time that the router will wait for a message reply

**Values** 1 to 3

### 3.8.2.1.13 OAM SAA commands

saa

## Syntax

**saa** *test-name* [**owner** *test-owner*] {**start** | **stop**}

## Context

oam

## Description

This command starts or stops an SAA test.

## Parameters

*test-name*

specifies the name of the SAA test to be run. The test name must already be configured in the **config>saa>test** context.

*test-owner*

specifies the owner of an SAA operation, up to 32 characters in length

**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 or if the test is in a shutdown state. An error message and log event will be generated to indicate a failed attempt to start an SAA test run.

**stop**

stops a test in progress. A log message will be generated to indicate that an SAA test run has been aborted.

### 3.8.2.1.14 OAM-PM commands

#### oam-pm

**Syntax**

**oam-pm**

**Context**

config

**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**]

**no bin-group** *bin-group-number*

**Context**

config>oam-pm

**Description**

This command allows the operator to configure 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 1lower-bound 5000us and ifdv-bin-count 2 bin 1lower-bound 5000us)

The **no** form of this command disables the OAM Performance Monitoring bin group.



## Parameters

### *bin-group-number*

Specifies an 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*

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**

Keyword that creates the bin group.

## bin-type

## Syntax

**bin-type** {fd | fdr | ifdv}

## Context

config>oam-pm>bin-group

## Description

This command is the start of the hierarchy where the specific delay metric bin structure is defined.

## Parameters

### **fd**

Keyword to enter the frame delay bin threshold configuration.

### **fdr**

Keyword to enter the frame delay range bin threshold configuration.

### **ifdv**

Keyword to enter the inter-frame delay variation bin thresholds configuration

## bin

### Syntax

**bin** *bin-number*

### Context

config>oam-pm>bin-group>bin-type

### Description

Commands in this context configure the thresholds for the specified bin.

### Parameters

***bin-number***

Specifies 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

### Description

This command allows the operator to specify 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 the bin-number times 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 configure 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 this command removes the user configured threshold value and applies the default for the bin.

### Parameters

***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

## 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

### 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* value 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** form of this command removes thresholding for this delay metric. The complete command must be configured in order to remove the specific threshold.

### Parameters

#### **forward**

Specifies the threshold is applied to the forward direction bin.

#### **backward**

Specifies the threshold is applied to the backward direction bin.

#### **round-trip**

Specifies the threshold is applied to the roundtrip direction bin.

#### **bin-number**

Specifies the number of the bin that the threshold is applied to. This bin and all higher bins are monitored to determine if the sum total results in these bins have reached or crossed the configured threshold.

**Values** 0 to 9

***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-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 exist 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

**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 enters 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 occur 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.

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 that the exclusion is applied to. 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

### 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.

### 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 in order 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, entering 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, entering 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, entering 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

## description

**Syntax**

**description** *description-string*

**no description**

**Context**

config>oam-pm>bin-group

config>oam-pm>session

**Description**

This command configures a text description that is stored in the configuration file. The text string is associated with a configuration context to 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 string, up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, ?, space), the entire string must be enclosed within double quotes.

## shutdown

### Syntax

[no] shutdown

### Context

config>oam-pm>bin-group

config>oam-pm>session>ip>twamp-light

config>oam-pm>session>measurement-interval>event-mon

### 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.

## session

### Syntax

**session** *session-name* [test-family [ ethernet | ip ] [session-type {proactive | on-demand}] create]

**no session** *session-name*

### Context

config>oam-pm

### Description

This command creates the individual session containers that houses 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. 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. The only exception to this is the description value.

The **no** form of this command deletes the session.

### Parameters

**session-name**

Specifies the session name, up to 32 characters.

**test-family**

Indicates the type family and sets the context for the individual parameters.

- Values**    **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.

- Values**    **proactive** — Sets the type to always on, with an immediate start and no stop.  
              **on-demand** — Sets the type to on-demand, with an immediate start and no stop, or a stop based on the offset.

**Default**    proactive

**create**

Creates the PM session.

bin-group

**Syntax**

- bin-group** *bin-group-number*  
**no bin-group**

**Context**

config>oam-pm>session

**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 that was used to create the specific **bin-group** that is referenced for this session.

- Values**    1 to 255  
**Default**    1



ip

Syntax

ip

Context

config>oam-pm>session

Description

Commands in this context configure the IP-specific source and destination information, the priority, and the IP test tools on the launch point.

dest-udp-port

Syntax

**dest-udp-port** *udp-port-number*  
**no dest-udp-port**

Context

config>oam-pm>session>ip

Description

This command defines the destination UDP port on outbound TWAMP Light packets sent from the session controller. The destination UDP port must match the UDP port value 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 setting.

Parameters

***udp-port-number***  
Specifies the UDP source port.  
**Values** 1 to 65535

destination

Syntax

**destination** *ip-address*  
**no destination**

Context

config>oam-pm>session>ip

Description

This command defines the destination IP address that is assigned to the TWAMP Light packets. The destination address must be included in the prefix list on the session reflector within the configured context in order to allow the reflector to process the inbound TWAMP Light packets.

The **no** form of this command removes the destination parameters.

Parameters

*ip-address*

Specifies the IP address of the IP peer to which the packet is directed.

| Values        |                                     |
|---------------|-------------------------------------|
| ipv4-address: | a.b.c.d                             |
| ipv6-address: | x:x:x:x:x:x:x (eight 16-bit pieces) |
|               | x:x:x:x:x:d.d.d.d                   |
| x:            | [0 to FFFF]H                        |
| d:            | [0 to 255]D                         |

do-not-fragment

Syntax

[no] do-not-fragment

Context

config>oam-pm>session>ip

Description

This command configures the Do Not Fragment (DF) bit in the IPv4 header of the TWAMP Light test packet to prevent fragmentation. This is only applicable to IPv4. IPv6 does not include the bit as part of the specificalton. This parameter is ignored but not blocked when the address is IPv6.

The **no** form of this command allows packet fragmentation.

dscp

Syntax

dscp dscp-name

dscp resolve

Context

config>oam-pm>session>ip

Description

This command can be used to explicitly configure the DSCP value to the specified *dscp-name*, or to use the configured **fc** and **profile** values to derive the DSCP value from the egress network QoS policy 1.

Default

dcsp resolve

Parameters

*dscp-name*

Specifies the Diffserv code point name

- Values**
- be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63
- resolve**
- specifies to use the configured **fc** and **profile** values to derive the DSCP value from the egress network QoS policy 1.

fc

Syntax

fc *fc-name*  
no fc

Context

config>oam-pm>session>ip

Description

This command sets 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 name.

|         |                                |
|---------|--------------------------------|
| Values  | be, l2, af, l1, h2, ef, h1, nc |
| Default | be                             |

forwarding

Syntax

```
forwarding {next-hop ip-address | interface interface-name | bypass-routing}
no forwarding
```

Context

```
config>oam-pm>session>ip forwarding
```

Description

This command influences 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 options and enables the default forwarding logic.

Parameters

*ip-address*

Specifies the IP address of the next hop on the path.

|        |               |                                     |
|--------|---------------|-------------------------------------|
| Values | ipv4-address: | a.b.c.d                             |
|        | ipv6-address: | x:x:x:x:x:x:x (eight 16-bit pieces) |
|        |               | x:x:x:x:x:d.d.d.d                   |
|        | x:            | [0 to FFFF]H                        |
|        | d:            | [0 to 255]D                         |

*interface-name*

Specifies the name, up to 32 characters, to refer to 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.

*bypass-routing*

Specifies to send the packet to a host on a directly attached network, bypassing the routing table.

profile

Syntax

```
profile {in | out}
```

**no profile**

### Context

```
config>oam-pm>session>ip
```

### Description

This command defines whether the TWAMP Light PDU packet should be treated as in-profile or out-of-profile. The default has been selected because the forwarding class defaults to best effort.

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

### Default

profile out

### Parameters

**in**

Specifies that the TWAMP Light PDU packet is sent as in-profile.

**out**

Specifies that the TWAMP Light PDU packet is sent as out-of-profile.

**router**

### Syntax

**router** *router-instance*

**router service-name** *service-name*

**no router**

### Context

```
config>oam-pm>session>ip
```

### Description

This command numerically references the source context from which the TWAMP Light packet is launched. The **router-instance** *router-instance* configuration, under the same context as the **router** command, is the preferred method for referencing. This method references the launch context by name, and not number, or alias that converts **service-name** to a number.

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

### Parameters

**router-instance**

Specifies the numerical reference to the router instance or service. Well known router-name "Base" is allowed for convenience, but mapped numerically.

**Values** {*router-name* | *vprn-svc-id*}

*router-name:*      Base  
*vprn-svc-id:*      1 to 2147483647

The parameter *router-instance* is preferred for specifying the router or service.

**service-name**

Specifies the alias function that allows the service-name to be used converted and stored as service ID, up to 64 characters. The parameter *router-instance* is preferred for specifying the router or service.

source

**Syntax**

**source** *ip-address*  
**no source**

**Context**

config>oam-pm>session>ip

**Description**

This command defines 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 processed by the TWAMP Light application. Only source addresses configured as part of TWAMP tests can process the reflected TWAMP packets from the session reflector.  
The **no** form of this command removes the source address parameters.

**Parameters**

**source**  
Indicates the launch point.

**ip-address**  
Specifies the source IP address that the session controller (launch point) uses for the test.

| Values        |                                                            |
|---------------|------------------------------------------------------------|
| ipv4-address: | a.b.c.d                                                    |
| ipv6-address: | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:x.d.d.d.d |
| x:            | [0 to FFFF]H                                               |
| d:            | [0 to 255]D                                                |

## source-udp-port

### Syntax

**source-udp-port** *udp-port-number*

**no source-udp-port**

### Context

config>oam-pm>session>ip

### Description

This command should only be used when the source UDP port for the session-sender twamp-test packet must be specified.

The **no** form of this command means the session-sender automatically assigns the source UDP port from the available dynamic (private) UDP range.

### Parameters

*udp-port-number*

Specifies the UDP source port.

**Values** 64374 to 64383

## ttl

### Syntax

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

**no ttl**

### Context

config>oam-pm>session>ip

### Description

This command defines the value of the TTL field of the packet header.

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

### Default

ttl 225

### Parameters

*time-to-live*

Specifies the value to be used in the TTL field.

**Values** 1 to 255

**Default** 255

## twamp-light

### Syntax

**twamp-light** [**test-id** *test-id*] [**create**]

**no twamp-light**

### Context

config>oam-pm>session>ip

### 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.

### Parameters

#### *test-id*

Specifies the value of the 4-byte local test identifier not sent in the TWAMP Light packets.

**Values** 0 to 2147483647 | **auto**

**auto** - automatically assigns a *test-id*

#### **create**

Creates the test.

## interval

### Syntax

**interval** *milliseconds*

**no interval**

### Context

config>oam-pm>session>ip>twamp-light

### Description

This command defines the message period, or probe spacing, for transmitting a TWAMP Light frame.

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

### Default

interval 1000



Parameters

*milliseconds*

Specifies the number of milliseconds between TWAMP Light frame transmission.

**Values** 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 10000

**Default** 1000

loss

Syntax

loss

Context

config>oam-pm>session>ip>twamp-light

Description

Commands in this context configure loss parameters for the TWAMP-Light test.

flr-threshold

Syntax

flr-threshold *percentage*

no flr-threshold

Context

(config>oam-pm>session>ip>twamp-light>loss

Description

This command defines the frame loss threshold used to determine whether the delta-t is available or unavailable. An individual delta-t with a frame loss threshold equal to or higher than the configured threshold is marked unavailable. An individual delta-t with a frame loss threshold lower than the configured threshold is marked as available.

The **no** form of this command restores the default value of 50%.

Default

flr-threshold 50

Parameters

*percentage*

Specifies the percentage of the threshold.

**Values** 0 to 100

**Default** 50

## hli-force-count

### Syntax

[no] hli-force-count

### Context

config>oam-pm>session>ip>twamp-light>loss

### Description

This command allows High Loss Interval (HLI) and Consecutive High Loss Interval (CHLI) counters to increment regardless of availability. Without this command, HLI and CHLI counters can only increment during times of availability, which includes undetermined availability. During times of complete packet loss, the forward direction HLI is marked as high loss. The backward direction is not marked as high loss during times of complete packet loss.

The **no** form of this command configures HLI and CHLI counters to increment during times of availability only.

## timing

### Syntax

timing frames-per-delta-t *frames* consec-delta-t *deltas* chli-threshold *threshold*

no timing

### Context

config>oam-pm>session>ip>twamp-light>loss

### Description

This command defines various availability parameters but not the probe interval. A single TWAMP-Light frame is used to collect both delay and loss metrics; the interval is common to both and as such not unique per metric type. Any TWAMP light test that is attempting to become active validates the configuration of the timing parameter regardless of which statistics are being recorded.

The **no** form of this command restores the default values for all timing parameters and use those values to compute availability and set the loss frequency.

### Default

timing frames-per-delta-t 1 consec-delta-t 10 chli-threshold 5

## Parameters

### *frames*

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. This value defaults to a different value than single probe per metric approaches.

**Values** 1 to 50

**Default** 1

### *deltas*

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 occurs when the consec-delta-t are now in a new state. The sliding window cannot exceed 100 seconds.

**Values** 2 to 10

**Default** 10

### *threshold*

Specifies the number of consecutive high loss intervals (unavailable delta-t) that when equal to or exceeded increments 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, by default, is only incremented during times of availability.

**Values** 1 to 9

**Default** 5

## loss-events

### Syntax

**loss-events**

### Context

config>oam-pm>session>ip>twamp-light

### Description

This context allows the operator to define the loss events and thresholds that are to be tracked.

## avg-flr-event

### Syntax

**avg-flr-event** {**forward** | **backward**} **threshold** *raise-threshold-percentage* [**clear** *clear-threshold-percentage*]

**no avg-flr-event** {**forward** | **backward**}

### Context

config>oam-pm>session>ip>twamp-light>loss-events

### Description

This command sets the frame loss ratio threshold configuration to be 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 the *clear-threshold-percent* value 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-percent* value 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** form of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

### Default

no avg-flr-event forward

no avg-flr-event backward

### Parameters

#### **forward**

Specifies the threshold is applied to the forward direction value.

#### **backward**

Specifies the threshold is applied to the backward direction value.

#### ***raise-threshold-percentage***

Specifies the rising percentage that determines when the event is to be generated.

**Values** 0.001 to 100.000

#### ***clear-threshold-percentage***

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 that the 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>ip>twamp-light>loss-events
```

### 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 the optional **clear** *clear-threshold* parameter 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 regardless of any previous window. Each unique event can only be raised once within measurement interval. If the optional **clear** *clear-threshold* parameter 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 raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** form of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

### Default

```
no chli-event forward
no chli-event backward
no chli-event aggregate
```

### Parameters

#### **forward**

Specifies the threshold is applied to the forward direction count.

#### **backward**

Specifies the threshold is applied to the backward direction count.

#### **aggregate**

Specifies the threshold is applied to the aggregate count (sum of forward and backward).

#### **raise-threshold**

Specifies the 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-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 that 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>ip>twamp-light>loss-events

### **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 optional **clear *clear-threshold*** parameter 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 regardless of any previous window. Each unique event can only be raised once within measurement interval. If the optional **clear *clear-threshold*** parameter 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 raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** form of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

### **Default**

no hli-event forward  
 no hli-event backward  
 no hli-event aggregate

### **Parameters**

#### **forward**

Specifies the threshold is applied to the forward direction count.

#### **backward**

Specifies the threshold is applied to the backward direction count.

**aggregate**

Specifies the threshold is applied to the aggregate count (sum of forward and backward).

**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-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 that the HLI counter must be 0.

## unavailability-event

**Syntax**

**unavailability-event** {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

**no unavailability-event** {**forward** | **backward** | **aggregate**}

**Context**

config>oam-pm>session>ip>twamp-light>loss-events

**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 optional **clear** *clear-threshold* parameter 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 regardless of any previous window. Each unique event can only be raised once within measurement interval. If the optional **clear** *clear-threshold* parameter 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 raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.

The **no** form of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

**Default**

no unavailability-event forward

no unavailability-event backward

no unavailability-event aggregate

## Parameters

### **forward**

Specifies the threshold is applied to the forward direction count.

### **backward**

Specifies the threshold is applied to the backward direction count.

### **aggregate**

Specifies the threshold is applied to the aggregate count (sum of forward and backward).

### **raise-threshold**

Specifies a numerical value compared to the unavailability counter that is the rising threshold that determines when the event is to be generated, when value reached.

**Values** 1 to 864000

### **clear-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 that 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>ip>twamp-light>loss-events

## 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 optional **clear clear-threshold** parameter 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 regardless of any previous window. Each unique event can only be raised once within measurement interval. If the optional **clear clear-threshold** parameter 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 raised until a measurement interval completes and the clear threshold has not been exceeded. A clear event is raised under that condition.



The **no** form of this command removes the event threshold for frame loss ratio. The direction must be included with the **no** command.

### Default

no undet-availability-event forward  
no undet-availability-event backward  
no undet-availability-event aggregate

### Parameters

#### **forward**

Specifies the threshold is applied to the forward direction count.

#### **backward**

Specifies the threshold is applied to the backward direction count.

#### **aggregate**

Specifies the threshold is applied to the aggregate count (sum of forward and backward).

#### **raise-threshold**

Specifies the rising threshold that determines when the event is to be generated, when value reached.

**Values** 1 to 864000

#### **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 that the undetermined availability counter must be 0.

## undet-unavailability-event

### Syntax

**undet-unavailability-event** {**forward** | **backward** | **aggregate**} **threshold** *raise-threshold* [**clear** *clear-threshold*]

**no undet-unavailability-event** {**forward** | **backward** | **aggregate**}

### Context

config>oam-pm>session>ip>twamp-light>loss-events

### 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* parameter 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** form 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 the threshold is applied to the forward direction count.

### **backward**

Specifies the threshold is applied to the backward direction count.

### **aggregate**

Specifies the threshold is applied to the aggregate count (sum of forward and backward).

### **raise-threshold**

Specifies the rising threshold that determines when the event is to be generated, when value reached.

**Values** 1 to 864000

### **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 that the undetermined availability counter must be 0.

## pad-size

## Syntax

**pad-size** *octets*  
**no pad-size**

## Context

```
config>oam-pm>session>ip>twamp-light
```

## Description

This command defines the amount by which the TWAMP Light packet is 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, the pad size must be configured to a minimum of 27 bytes.

The **no** form of this command removes all padding.

## Default

```
pad-size 0
```

## Parameters

### **octets**

Specifies the value, in octets, to pad the TWAMP Light packet.

**Values** 0 to 2000

**Default** 0

## record-stats

## Syntax

```
record-stats {delay | loss | delay-and-loss}
```

```
no record-stats
```

## Context

```
config>oam-pm>session>ip>twamp-light
```

## Description

This option provides the ability to determine which statistics are recorded. The TWAMP-Light PDU can report on both delay and loss using a single packet. The operator may choose which statistics they would like to report. Only delay recording is on by default. All other metrics are ignored. In order to change what is being recorded and reported, the TWAMP-Light session must be shutdown. This is required because the single packet approach means the base statistics are shared between the various datasets. Issuing a **no shutdown** command clears previous all non-volatile memory for the session and allocate new memory blocks. All the parameters under this context are mutually exclusive.

The **no** version of the command restores the default "delay" only.

## Default

```
record-stats delay
```

**Parameters****delay**

Specifies report on delay using a single packet..

**loss**

Specifies to report on loss using a single packet..

**delay-and-loss**

Specifies to report on both delay and loss using a single packet.

**test-duration****Syntax**

**test-duration** *seconds*

**no test-duration**

**Context**

config>oam-pm>session>ip>twamp-light

**Description**

This command defines the length of time the test runs before stopping automatically. This optional command is only valid 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 has been 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 value and allows the TWAMP Light test to execute until it is stopped manually.

**Parameters****seconds**

Specifies the length of time, in seconds, that the TWAMP Light test runs.

**Values** 1 to 86400

**meas-interval****Syntax**

**meas-interval** {1-mins | 5-mins | 15-mins | 1-hour | 1-day} [create]

**no meas-interval** {1-mins | 5-mins | 15-mins | 1-hour | 1-day}

**Context**

config>oam-pm>session

## Description

This command establishes the parameters of the individual measurement intervals utilized 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

### ***meas-interval***

the duration of the measurement interval

**Values** 1-min, 5-mins, 15-mins, 1-hour, 1-day

### **create**

Creates the measurement interval.

## accounting-policy

## Syntax

**accounting-policy** *acct-policy-id*

**no accounting-policy**

## Context

config>oam-pm>session>meas-interval

## Description

This command allows the operator to assign an accounting policy (configured under the **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
```

## 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 divide the hour into four equal sections 00, 15, 30, 45. Clock-aligned 1-hour measurement intervals start at 00. Clock-aligned 1-day measurement intervals start at midnight. Test relative start times launches 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.

The **no** form of this command sets the boundary to the default clock-aligned.

## Default

boundary-type clock-aligned

## Parameters

### clock-aligned

aligns the start of the measurement interval with the time of day clock

### test-relative

aligns the start of the measurement interval with the start of the test

## clock-offset

## Syntax

**clock-offset** *seconds*

**no clock-offset**

## Context

```
config>oam-pm>session>meas-interval
```

## 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 120 seconds shifts the start times of the measurement intervals by two minutes from their default alignments with respect to the time of day clock.

The **no** form of this command sets the offset to 0.

## 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

**Default**    0

event-mon

Syntax

event-mon

Context

config>oam-pm>session>meas-intvl

Description

This command enables 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

[no] delay-events

Context

config>oam-pm>session>meas-intvl>event-mon

Description

This command enables the monitoring of all configured delay events beginning at the start of the next measurement interval.

The **no** form of this command disables the monitoring, logging, and recording of all new delay events for this session. Any existing events are maintained until the active measurement window has completed. The state of delay event monitoring can be changed without having to shut down all the tests in the session.

loss-events

Syntax

[no] loss-events

## Context

```
config>oam-pm>session>meas-intvl>event-mon
```

## Description

This enables 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. If the function is removed 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 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 shut down all the tests in the session.

The **no** form of this command disables the monitoring of all configured loss events.

## intervals-stored

## Syntax

```
intervals-stored intervals
```

```
no intervals-stored
```

## Context

```
config>oam-pm>session>meas-interval
```

## 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 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 are renumbered to maintain the described order. Use caution 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 event that both intervals are required, the sum total of both intervals cannot exceed 96. The **1-hour** and **1-day** measurement intervals utilize their own ranges.

If this command is omitted when configuring the measurement interval, the default value is used.

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

## Default

```
intervals-stored 1
```

## Parameters

***intervals***

Specifies the number of measurement intervals.



|         |                  |
|---------|------------------|
| Values  | 5-mins: 1 to 96  |
|         | 15-mins: 1 to 96 |
|         | 1-hour: 1 to 24  |
|         | 1-day: 1         |
| Default | 5-mins: 32       |
|         | 15-mins: 32      |
|         | 1-hour: 8        |
|         | 1-day: 1         |

3.8.2.2 Show commands



**Note:** The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

```
eth-cfm
```

**Syntax**  
eth-cfm

**Context**  
show

**Description**  
This command enables the context to display CFM information.

```
association
```

**Syntax**  
association [*ma-index*] [**detail**]

**Context**  
show>eth-cfm

**Description**  
This command displays dot1ag and Y.1731 association information.

**Parameters**  
*ma-index*  
specifies the MA index

Values 1 to 4294967295

detail

displays detailed information for the association

Output

The following output is an example of eth-cfm association information, and [Table 24: ETH-CFM association field descriptions](#) describes the fields.

Output example

```
*A:ALU-1>show>eth-cfm# association
=====
Dot1ag CFM Association Table
=====
Md-index Ma-index Name CCM-interval Bridge-id

1 1 kanata_MA 10 2
1 2 2 10 20
=====

*A:ALU-1>show>eth-cfm#

*A:ALU-1>show>eth-cfm# association detail

Domain 1 Associations:

Md-index : 1 Ma-index : 1
Name Format : charString CCM-interval : 10
Name : kanata_MA
Bridge-id : 2 MHF Creation : defMHFnone
PrimaryVlan : 2 Num Vids : 0

Domain 2 Associations:

Md-index : 2 Ma-index : 2
Name Format : icc-based CCM-interval : 100ms
Name : 1234567890123
Bridge-id : 2 MHF Creation : defMHFnone
PrimaryVlan : 2 Num Vids : 0
Remote Mep Id : 2

*A:ALU-1>show>eth-cfm#
```

Table 24: ETH-CFM association field descriptions

| 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. |

| Label         | Description                                    |
|---------------|------------------------------------------------|
| Name Format   | Displays the format for the MA name            |
| MHF Creation  | Not applicable                                 |
| PrimaryVlan   | Displays the VLAN ID                           |
| Num Vids      | Displays the number of VLAN IDs                |
| Remote Mep Id | Displays the MEP identifier for the remote MEP |

## cfm-stack-table

### Syntax

#### cfm-stack-table

**cfm-stack-table port** [*port-id* [**vlan** *vlan-id*]] [**level** 0...7] [**direction** {up | down}]

**cfm-stack-table sdp** [*sdp-id[:vc-id]*] [**level** 0...7] [**direction** {up | down}]

**cfm-stack-table virtual** [*service-id*] [**level** 0...7]

### Context

show>eth-cfm

### Description

This command displays stack-table information.

### Parameters

*port-id*

displays the CFM stack table information for the specified bridge port or aggregated port on which MEPs are configured

**Values** *slot/mdal/port[.channel]*

*vlan-id*

displays the CFM stack table information for the port with the associated VLAN ID

**Values** 0 to 4094

*sdp-id[:vc-id]*

displays the CFM stack table information for the specified SDP binding for the bridge

**Values** *sdp-id* 1 to 17407  
*vc-id* 1 to 4294967295

0...7

displays the CFM stack table information for the specified MD level

**Values** 0 to 7

*service-id*

displays the CFM stack table information for the specified *service-id*

**Values** 0 to 2147483647

**up | down**

displays the CFM stack table information for the specified direction that the MEP faces on the bridge port

Output

The following output is an example of ETH-CFM stack table information, and [Table 25: ETH-CFM stack table field descriptions](#) describes the fields.

Output example

```
*A:ALU-1>show>eth-cfm# cfm-stack-table
=====
CFM SAP Stack Table
=====
Sap Level Dir Md-index Ma-index Mep-id Mac-address

1/5/1 5 Down 1 1 1
=====

=====
CFM SDP Stack Table
=====
Sdp Level Dir Md-index Ma-index Mep-id Mac-address

1:11 5 Down 1 1 2 a4:58:ff:00:00:00
=====

=====
CFM Virtual Stack Table
=====
Service Level Dir Md-index Ma-index Mep-id Mac-address

No Matching Entries
=====
*A:ALU-1>show>eth-cfm#
```

Table 25: ETH-CFM stack table field descriptions

| Label           | Description                                   |
|-----------------|-----------------------------------------------|
| Sap             | Displays the SAP identifier                   |
| Sdp             | Displays the spoke SDP identifier             |
| Service         | Displays the service identifier               |
| Level           | Displays the MD level of the domain           |
| Dir (direction) | Displays the direction of OAMPDU transmission |

| Label       | Description                         |
|-------------|-------------------------------------|
| Md-index    | Displays the MD 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

Description

This command displays domain information.

Parameters

*md-index*

displays the index of the MD to which the MEP is associated, or 0, if none

**Values**    1 to 4294967295

*ma-index*

displays the index to which the MA is associated, or 0, if none

**Values**    1 to 4294967295

**all-associations**

displays all associations to the MD

**detail**

displays detailed domain information

Output

The following output is an example of eth-cfm domain information, and [Table 26: ETH-CFM domain field descriptions](#) describes the fields.

Output example

```
*A:ALU-1>show>eth-cfm# domain
=====
CFM Domain Table
=====
Md-index Level Name Format

1 5 kanata_MD charString
2 1 none
```

```

=====
*A:ALU-1>show>eth-cfm# domain detail
=====
Domain 1
Md-index : 1 Level : 5
Permission : sendIdNone MHF Creation : defMHFnone
Name Format : charString Next Ma Index : 2
Name : kanata_MD
=====
Domain 2
Md-index : 2 Level : 1
Permission : sendIdNone MHF Creation : defMHFnone
Name Format : none Next Ma Index : 1
=====

*A:ALU-1>show>eth-cfm# domain all-associations
=====
CFM Association Table
=====
Md-index Ma-index Name CCM-interval Bridge-id

1 1 kanata_MA 10 2
2 2 1234567890123 100ms 2
=====

*A:ALU-1>show>eth-cfm# domain all-associations detail
=====
Domain 1
Md-index : 1 Level : 5
Permission : sendIdNone MHF Creation : defMHFnone
Name Format : charString Next Ma Index : 2
Name : kanata_MD

Domain 1 Associations:
Md-index : 1 Ma-index : 1
Name Format : string CCM-interval : 10
Name : kanata_MA
Bridge-id : 2 MHF Creation : defMHFnone
PrimaryVlan : 2 Num Vids : 0
Remote Mep Id : 1
=====
Domain 2
Md-index : 2 Level : 1
Permission : sendIdNone MHF Creation : defMHFnone
Name Format : none Next Ma Index : 1

Domain 2 Associations:
Md-index : 2 Ma-index : 2
Name Format : icc-based CCM-interval : 100ms
Name : 1234567890123
Bridge-id : 2 MHF Creation : defMHFnone
PrimaryVlan : 2 Num Vids : 0
Remote Mep Id : 2
=====
*A:ALU-1>show>eth-cfm#

```

Table 26: ETH-CFM domain field descriptions

| Label                      | Description                                                                                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Domain</b>              |                                                                                                                                  |
| Md-index                   | Displays the MD index of the domain                                                                                              |
| Level                      | Displays the MD level of the domain                                                                                              |
| Permission                 | Not applicable                                                                                                                   |
| MHF Creation               | Not applicable                                                                                                                   |
| Name Format                | Displays the format for the MD name                                                                                              |
| Next Ma Index              | Displays the value of the next MA index                                                                                          |
| Name                       | Displays the name of the MD                                                                                                      |
| <b>Domain Associations</b> |                                                                                                                                  |
| 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                                                                                                      |
| 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.    |
| MHF Creation               | Not applicable                                                                                                                   |
| PrimaryVlan                | Displays the VLAN ID configured under the <b>config&gt;eth-cfm&gt;domain&gt;association&gt;bridge-identifier&gt;vlan</b> 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**]

**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 single-ended-loss-test [remote-peer mac-address]
mep mep-id domain md-index association ma-index dual-ended-loss-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

## Description

This command displays information for Ethernet OAM tests and entities related to MEPs, including:

- MEPs
- loopback
- linktrace
- remote MEPs
- Ethernet signal test
- delay and delay variation measurements (one-way and two-way)
- loss measurements (single-ended and dual-ended)

## Parameters

*mep-id*

specifies the target MEP ID

**Values** 1 to 8191

*md-index*

displays the index of the MD to which the MEP is associated, or 0, if none

**Values** 1 to 4294967295

*ma-index*

displays the index of the MA to which the MEP is associated, or 0, if none

**Values** 1 to 4294967295

*mac-address*

displays the MAC address of the remote peer MEP

**Values** xx:xx:xx:xx:xx:xx or  
xx-xx-xx-xx-xx-xx,  
where xx is a hexadecimal number

**loopback**

displays loopback information for the specified MEP



**linktrace**

displays linktrace information for the specified MEP

**remote-mepid**

displays specified remote *mep-id* information for the specified MEP

**all-remote-mepids**

displays all remote *mep-id* information for the specified MEP

**remote-peer**

displays specified remote *mep-id* information for the specified MEP

**eth-test-results**

displays ETH-Test result information for the specified MEP and remote peer

**one-way-delay-test**

displays one-way test information for the specified MEP and remote peer

**two-way-delay-test**

displays two-way test information for the specified MEP and remote peer

**single-ended-loss-test**

displays single-ended-loss test information for the specified MEP and remote peer

**dual-ended-loss-test**

displays dual-ended-loss test information for the specified MEP and remote peer

**two-way-slm-test**

displays two-way-slm-test information for the specified MEP and remote peer

**Output**

The following outputs are examples of Ethernet OAM tests for MEPs:

- MEPs, Loopback, and Linktrace ([Output example](#), [Table 27: ETH-CFM MEP, loopback, and linktrace field descriptions](#))
- Remote MEPs ([Output example](#), [Table 28: ETH-CFM MEP remote MEP field descriptions](#))
- ETH-Test results ([Output example](#), [Table 29: ETH-CFM MEP ETH-Test field descriptions](#))
- Delay measurements (one-way and two-way) ([Output example \(one-way\)](#) and [Output example \(two-way\)](#), [Table 30: ETH-CFM MEP delay measurement test field descriptions](#))
- Loss test (single-ended and dual-ended) ([Output example \(single-ended\)](#) and [Output example \(two-way\)](#), [Table 31: ETH-CFM MEP loss measurement test field descriptions](#))

**Output example**

```
*A:ALU-1>show>eth-cfm# mep 2 domain 1 association 1 loopback linktrace

Mep Information

Md-index : 2 Direction : Down
Ma-index : 20 Admin : Enabled
MepId : 200 CCM-Enable : Enabled
IfIndex : 46333952 PrimaryVid : 200
FngState : fngReset
LowestDefectPri : macRemErrXcon HighestDefect : none
Defect Flags : None
```

```

Mac Address : 00:25:ba:30:2e:1f CcmLtmPriority : 7
CcmTx : 188 CcmSequenceErr : 0
DmrRepliesTx : 0
LmrRepliesTx : 0 Dual-Loss Thresh : 1.20%
Dual-Loss Test : Enabled Dual-Loss AlarmClr: 0.80%
Eth-Ais : Disabled
Eth-Tst : Disabled
CcmLastFailure Frame:
None
XconCcmFailure Frame:
None

```

#### Mep Loopback Information

```

LbRxReply : 0 LbRxBadOrder : 0
LbRxBadMsdu : 0 LbTxReply : 0
LbSequence : 1 LbNextSequence : 1
LbStatus : False LbResultOk : False
DestIsMepId : False DestMepId : 0
DestMac : 00:00:00:00:00:00 SendCount : 0
VlanDropEnable : True VlanPriority : 7
Data TLV:
None

```

#### Mep Linktrace Message Information

```

LtRxUnexplained : 0 LtNextSequence : 1
LtStatus : False LtResult : False
TargIsMepId : False TargMepId : 0
TargMac : 00:00:00:00:00:00 TTL : 64
EgressId : 00:00:a4:58:ff:00:00:00 SequenceNum : 1
LtFlags : useFDBOnly

```

#### Mep Linktrace Replies

```

SequenceNum : 1 ReceiveOrder : 1
Ttl : 63 Forwarded : False
LastEgressId : 00:00:00:21:05:6e:5a:f1 TerminalMep : True
NextEgressId : 00:00:00:21:05:4d:a8:b2 Relay : rlyHit
ChassisIdSubType : unknown value (0)
ChassisId:
None
ManAddressDomain:
None
ManAddress:
None
IngressMac : 00:21:05:4d:a8:b2 Ingress Action : ingOk
IngrPortIdSubType : unknown value (0)
IngressPortId:
None
EgressMac : 00:00:00:00:00:00 Egress Action : egrNoTlv
EgrPortIdSubType : unknown value (0)
EgressPortId:
None
Org Specific TLV:
None

```

```

*A:ALU-1>show>eth-cfm#

```

Table 27: ETH-CFM MEP, loopback, and linktrace field descriptions

| Label                  | Description                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mep Information</b> |                                                                                                                                        |
| Md-index               | Displays the MD index of the domain                                                                                                    |
| Direction              | Displays the direction of OAMPDU transmission                                                                                          |
| Ma-index               | Displays the MA index of the association                                                                                               |
| Admin                  | Displays the administrative status of the MEP                                                                                          |
| MepId                  | Displays the MEP identifier                                                                                                            |
| CCM-Enable             | Displays the status of the CCM (enabled or disabled)                                                                                   |
| IfIndex                | Displays the index of the interface                                                                                                    |
| PrimaryVid             | Displays the identifier of the primary VLAN                                                                                            |
| FngState               | Indicates the different states of the Fault Notification Generator                                                                     |
| LowestDefectPri        | Displays the lowest priority defect (a configured value) that is allowed to generate a fault alarm                                     |
| HighestDefect          | Identifies the highest defect that is present (for example, if defRDICCM and defXconCCM are present, the highest defect is defXconCCM) |
| Defect Flags           | Displays the number of defect flags                                                                                                    |
| Mac Address            | Displays the MAC address of the MEP                                                                                                    |
| CcmLtmPriority         | Displays the priority value transmitted in the linktrace messages (LTM)s and CCMs for this MEP. The MEP must be configured on a VLAN.  |
| CcmTx                  | Displays the number of continuity check messages (CCMs) sent. The count is taken from the last polling interval (every 10 s).          |
| CcmSequenceErr         | Displays the number of CCM errors                                                                                                      |
| Eth-1DM Threshold      | Displays the one-way-delay threshold value                                                                                             |
| DmrRepliesTx           | Displays the number of delay measurement replies transmitted                                                                           |
| LmrRepliesTx           | Displays the number of loss measurement replies transmitted                                                                            |

| Label                           | Description                                                                                                                                                                                                                                                                             |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dual-Loss-Test                  | Displays the state of the dual-ended loss test (enabled or disabled)                                                                                                                                                                                                                    |
| Dual-Loss Threshold             | Displays the alarm threshold for frame loss measurement                                                                                                                                                                                                                                 |
| Dual-Loss AlarmClr              | Displays the clearing alarm threshold for frame loss measurement                                                                                                                                                                                                                        |
| Eth-Ais                         | Displays the state of the ETH-AIS test (enabled or disabled)                                                                                                                                                                                                                            |
| Eth-Test                        | Displays the state of the ETH-Test (enabled or disabled)                                                                                                                                                                                                                                |
| Eth-Test dataLength             | Displays the data length of the MEP                                                                                                                                                                                                                                                     |
| Eth-Test Threshold              | Displays the bit-error threshold setting                                                                                                                                                                                                                                                |
| Eth-Test Pattern                | Displays the test pattern configured for the MEP                                                                                                                                                                                                                                        |
| Eth-Test Priority               | Displays the priority of frames with ETH-Test information                                                                                                                                                                                                                               |
| CcmLastFailure Frame            | Displays the frame that caused the last CCM failure                                                                                                                                                                                                                                     |
| XconCcmFailure Frame            | Displays the frame that caused the XconCCMFailure                                                                                                                                                                                                                                       |
| <b>Mep Loopback Information</b> |                                                                                                                                                                                                                                                                                         |
| LbRxReply                       | Displays the number of received loopback (LB) replies                                                                                                                                                                                                                                   |
| LbRxBadOrder                    | Displays the number of received loopback messages that are in a bad order                                                                                                                                                                                                               |
| LbRxBadMsdu                     | Displays the number of loopback replies that have been received with the wrong destination MAC address (MSDU = MAC Service Data Unit)                                                                                                                                                   |
| LbTxReply                       | Displays the number of loopback replies transmitted out this MEP                                                                                                                                                                                                                        |
| LbTxReply (Total)               | Displays the total number of LBRs (loopback replies) transmitted from this MEP                                                                                                                                                                                                          |
| LbTxReplyNoTLV                  | Displays the number of LBRs (loopback replies) transmitted from this MEP with no TLV. Because only LBMs with no TLVs are used for throughput testing, the LbTxReply (Total), LbTxReplyNoTLV, and LbTxReplyWithTLV counters can help debug problems if throughput testing is not working |
| LbTxReplyWithTLV                | Displays the number of LBRs (loopback replies) transmitted from this MEP with TLV                                                                                                                                                                                                       |
| LbSequence                      | Displays the sequence number in the loopback message                                                                                                                                                                                                                                    |

| Label                                    | Description                                                                                                            |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| LbNextSequence                           | Displays the next loopback sequence                                                                                    |
| LbStatus                                 | Displays the loopback status as True or False:<br>True – loopback is in progress<br>False – no loopback is in progress |
| LbResultOk                               | Displays the result of the loopback test                                                                               |
| DestIsMepId                              | Identifies whether the destination interface has a MEP-ID (true or false)                                              |
| DestMepId                                | Displays the MEP-ID of the destination interface                                                                       |
| DestMac                                  | Displays the MAC address of the destination interface                                                                  |
| SendCount                                | Indicates the number of loopback messages sent                                                                         |
| VlanDropEnable                           | Identifies whether the VLAN drop is enabled (true or false)                                                            |
| VlanPriority                             | Displays the VLAN priority                                                                                             |
| Data TLV                                 | Displays the data TLV information                                                                                      |
| <b>Mep Linktrace Message Information</b> |                                                                                                                        |
| LtRxUnexplained                          | Displays the number of unexplained linktrace messages (LTM) that have been received                                    |
| LtNextSequence                           | Displays the sequence number of the next linktrace message                                                             |
| LtStatus                                 | Displays the status of the linktrace                                                                                   |
| LtResult                                 | Displays the result of the linktrace                                                                                   |
| TargIsMepId                              | Identifies whether the target interface has a MEP-ID (true or false)                                                   |
| TargMepId                                | Displays the MEP-ID of the target interface                                                                            |
| TargMac                                  | Displays the MAC address of the target interface                                                                       |
| TTL                                      | Displays the TTL value                                                                                                 |
| EgressId                                 | Displays the egress ID of the linktrace message                                                                        |
| SequenceNum                              | Displays the sequence number of the linktrace message                                                                  |
| LtFlags                                  | Displays the linktrace flags                                                                                           |
| <b>Mep Linktrace Replies</b>             |                                                                                                                        |

| Label            | Description                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SequenceNum      | Displays the sequence number returned by a previous transmit linktrace message, indicating which linktrace message response will be returned                                                                                                                                                                                                                                                                            |
| ReceiveOrder     | Displays the order in which the linktrace initiator received the linktrace replies                                                                                                                                                                                                                                                                                                                                      |
| Ttl              | Displays the TTL field value for a returned linktrace reply                                                                                                                                                                                                                                                                                                                                                             |
| Forwarded        | Indicates whether the linktrace message was forwarded by the responding MEP                                                                                                                                                                                                                                                                                                                                             |
| LastEgressId     | <p>Displays the last egress identifier returned in the linktrace reply egress identifier TLV of the linktrace reply</p> <p>The last egress identifier identifies the MEP linktrace initiator that initiated, or the linktrace responder that forwarded, the linktrace message for which this linktrace reply is the response.</p> <p>This is the same value as the egress identifier TLV of that linktrace message.</p> |
| TerminalMep      | Indicates whether the forwarded linktrace message reached a MEP enclosing its MA                                                                                                                                                                                                                                                                                                                                        |
| NextEgressId     | Displays the next egress identifier returned in the linktrace reply egress identifier TLV of the linktrace reply. The next egress identifier identifies the linktrace responder that transmitted this linktrace reply and can forward the linktrace message to the next hop. This is the same value as the egress identifier TLV of the forwarded linktrace message, if any.                                            |
| Relay            | Displays the value returned in the Relay Action field                                                                                                                                                                                                                                                                                                                                                                   |
| ChassisIdSubType | Displays the format of the chassis ID returned in the Sender ID TLV of the linktrace reply, if any. This value is meaningless if the chassis ID has a length of 0                                                                                                                                                                                                                                                       |
| ChassisId        | Displays the chassis ID returned in the Sender ID TLV of the linktrace reply, if any. The format is determined by the value of the ChassisIdSubType.                                                                                                                                                                                                                                                                    |
| ManAddressDomain | <p>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</p> <p>Received in the linktrace reply Sender ID TLV from that system</p>                                                                                                                                                                           |
| ManAddress       | Displays the TAddress that can be used to access the SNMP agent of the system transmitting the CCM                                                                                                                                                                                                                                                                                                                      |

| Label                | Description                                                                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | Received in the CCM Sender ID TLV from that system                                                                                                                            |
| IngressMac           | Displays the MAC address returned in the ingress MAC address field                                                                                                            |
| Ingress Action       | Displays the value returned in the Ingress Action field of the linktrace message                                                                                              |
| IngressPortIdSubType | Displays the format of the ingress port ID                                                                                                                                    |
| IngressPortId        | Displays the ingress port ID; the format is determined by the value of the IngressPortIdSubType                                                                               |
| EgressMac            | Displays the MAC address returned in the egress MAC address field                                                                                                             |
| Egress Action        | Displays the value returned in the Egress Action field of the linktrace message                                                                                               |
| EgressPortIdSubType  | Displays the format of the egress port ID                                                                                                                                     |
| EgressPortId         | Displays the egress port ID; the format is determined by the value of the EgressPortIdSubType                                                                                 |
| Org Specific TLV     | Displays all organization-specific TLVs returned in the linktrace reply, if any<br>Includes all octets including and following the TLV length field of each TLV, concatenated |

### Output example

```
*A:ALU-1>show eth-cfm mep 1 domain 103 association 99 all-remote-mepids
=====
Eth-CFM Remote-Mep Table
=====
R-mepId Rx CC Rx Rdi Port-Tlv If-Tlv Peer Mac Addr CCM status since

2 True False Up Up 8a:d9:ff:00:00:00 02/17/2009 16:27:48
3 True False Up Up 8a:da:01:01:00:02 02/17/2009 16:27:48
=====

*A:ALU-1>
*A:ALU-1>show eth-cfm mep 1 domain 103 association 99 remote-mepid 3
=====
Eth-CFM Remote-Mep Table
=====
R-mepId Rx CC Rx Rdi Port-Tlv If-Tlv Peer Mac Addr CCM status since

3 True False Up Up 8a:da:01:01:00:02 02/17/2009 16:27:48
=====
*A:ALU-1>
```

Table 28: ETH-CFM MEP remote MEP field descriptions

| Label            | Description                                                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------|
| R-mepId          | Displays the remote MEP identifier                                                                                             |
| Rx CC            | Displays the state of received CCMs (True or False):<br>True – CCMs are received<br>False – CCMs are not received              |
| Rx Rdi           | Displays the state of received RDIs (True or False):<br>True – RDIs are received<br>False – RDIs are not received              |
| Port-Tlv         | Displays the contents of the port status TLV in the CCM (Up, Blocked, or Absent), as defined in the 802.1ag specification      |
| If-Tlv           | Displays the contents of the interface status TLV in the CCM (Up, Blocked, or Absent), as defined in the 802.1ag specification |
| Peer Mac Addr    | Displays the MAC address of the peer (remote) entity                                                                           |
| CCM status since | Displays the date and time when continuity check messages began to be sent                                                     |

**Output example**

```

*A:ALU-1>show eth-cfm mep 1 domain 103 association 99 eth-test-results
=====
Eth CFM ETH-Test Result Table
=====

```

| Peer Mac Addr     | FrameCount<br>ByteCount | Current<br>ErrBits<br>CrcErrs | Accumulate<br>ErrBits<br>CrcErrs |
|-------------------|-------------------------|-------------------------------|----------------------------------|
| 22:34:56:78:9a:bc | 1                       | 0                             | 0                                |
|                   | 100                     | 0                             | 0                                |
| 32:34:56:78:9a:bc | 1                       | 0                             | 0                                |
|                   | 100                     | 0                             | 0                                |
| 42:34:56:78:9a:bc | 1                       | 0                             | 0                                |
|                   | 100                     | 0                             | 0                                |

```

=====
*A:ALU-1>show eth-cfm mep 1 domain 103 association 99 eth-test-results remote-
peer 22:34:56:78:9a:bc
=====
Eth CFM ETH-Test Result Table
=====

```

| Peer Mac Addr     | FrameCount<br>ByteCount | Current<br>ErrBits<br>CrcErrs | Accumulate<br>ErrBits<br>CrcErrs |
|-------------------|-------------------------|-------------------------------|----------------------------------|
| 22:34:56:78:9a:bc | 1                       | 0                             | 0                                |



```

=====
100 0 0
=====
*A:ALU-1>

```

Table 29: ETH-CFM MEP ETH-Test field descriptions

| Label              | Description                                                                 |
|--------------------|-----------------------------------------------------------------------------|
| Peer Mac Addr      | Displays the MAC address of the peer (remote) entity                        |
| FrameCount         | Displays the number of test frames sent between the MEP and the peer entity |
| ByteCount          | Displays the number of bytes sent between the MEP and the peer entity       |
| Current ErrBits    | Displays the number of bit errors in the current test                       |
| Current CrcErrs    | Displays the number of CRC errors in the current test                       |
| Accumulate ErrBits | Displays the accumulated number of bit errors in the current test           |
| Accumulate CrcErrs | Displays the accumulated number of CRC errors in the current test           |

#### Output example (one-way)

```

*A:ALU-1>show eth-cfm mep 1 domain 103 association 99 one-way-delay-test
=====
Eth CFM One-way Delay Test Result Table
=====
Peer Mac Addr Delay (us) Delay Variation (us)

8a:d8:01:01:00:01 759606 2840
aa:bb:cc:dd:ee:ff 760256 760256
=====

*A:ALU-1>show eth-cfm mep 1 domain 103 association 99 one-way-delay-test remote-
peer 8a:d8:01:01:00:01
=====
Eth CFM One-way Delay Test Result Table
=====
Peer Mac Addr Delay (us) Delay Variation (us)

8a:d8:01:01:00:01 759606 2840
=====
*A:ALU-1>

```

#### Output example (two-way)

```

*A:ALU-1>show eth-cfm mep 2 domain 103 association 99 two-way-delay-test
=====
Eth CFM Two-way Delay Test Result Table
=====
Peer Mac Addr Delay (us) Delay Variation (us)

00:16:4d:54:49:db 10190 13710
=====

```

```

=====
*A:ALU-1>
*A:ALU-1>show eth-cfm mep 2 domain 103 association 99 two-way-delay-test remote-peer
00:16:4D:54:49:DB
=====
Eth CFM Two-way Delay Test Result Table
=====
Peer Mac Addr Delay (us) Delay Variation (us)

00:16:4d:54:49:db 10190 13710
=====
*A:ALU-1>

```

Table 30: ETH-CFM MEP delay measurement test field descriptions

| Label                | Description                                                             |
|----------------------|-------------------------------------------------------------------------|
| Peer Mac Addr        | Displays the MAC address of the peer (remote) entity                    |
| Delay (us)           | Displays the measured delay (in microseconds) for the DM test           |
| Delay Variation (us) | Displays the measured delay variation (in microseconds) for the DV test |

**Output example (single-ended)**

```

*A:ALU-1>show eth-cfm mep 1 domain 1 association 1 single-ended-loss-test remote-
peer 00:1a:f0:00:00:01
=====
Eth CFM Single-Ended Test Result Table
=====
Far-End Mac Addr: 00:1a:f0:00:00:00 Duration (sec): 5

Latest Frame Counters In Previous LMR In Current LMR Delta
TxLocal : 123456 123466 10
RxFarEnd : 123450 123460 10
TxFarEnd : 123450 123460 10
RxLocal : 123456 123465 9

Accumulated Frames Near-End Far-End
Total Tx : 30 36
Total Rx : 35 30
Total Loss : 1 0
Loss Ratio(%) : 2.78 0.00
=====
*A:ALU-1>

```

**Output example (dual-ended)**

```

*A:ALU-1>show eth-cfm mep 1 domain 1 association 1 dual-ended-loss-test remote-
peer 00:1a:f0:00:00:01
=====
Eth CFM Dual-Ended Test Result
=====
Far-End Mac Addr: 00:1a:f0:00:00:01 Duration (sec): 21347
CcmRxCount : 60632
Latest Frame Counters In Previous CCM In Current CCM Delta

```

```

TxLocal : 3999 4000 1
RxFarEnd : 3999 4000 1
TxFarEnd : 0 0 0
RxLocal : 0 0 0

Accumulated Frames Near-End Far-End
Total Tx : 5066117155 741
Total Rx : 0 6720979
Total Loss : 741 5059396176
Loss Ratio(%) : 100.00 99.86
=====
*A:ALU-1>

```

Table 31: ETH-CFM MEP loss measurement test field descriptions

| Label                 | Description                                                                                                                                                                                                                                                                                                                                           |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Far-End Mac Addr      | Displays the MAC address of the far-end (remote) router                                                                                                                                                                                                                                                                                               |
| Duration (sec)        | Displays the duration that the current test has been running<br>Reset via the <b>clear&gt;eth-cfm&gt;dual-ended-loss-test</b> command                                                                                                                                                                                                                 |
| CCMRxCount            | Displays the total number of received CCMs                                                                                                                                                                                                                                                                                                            |
| Latest Frame Counters | Indicates that the number of frames counted are the latest values: <ul style="list-style-type: none"> <li>For single-ended tests – the values are for the previous LMR, the current LMR, and the difference between them</li> <li>For dual-ended tests – the values are the previous CCM, the current CCM, and the difference between them</li> </ul> |
| TxLocal               | Displays the latest number of frames transmitted from the local router                                                                                                                                                                                                                                                                                |
| RxFarEnd              | Displays the latest number of frames received at the remote router                                                                                                                                                                                                                                                                                    |
| TxFarEnd              | Displays the latest number of frames transmitted from the remote router                                                                                                                                                                                                                                                                               |
| RxLocal               | Displays the latest number of frames received by the local router                                                                                                                                                                                                                                                                                     |
| Accumulated Frames    | Indicates that the frame counter values under this heading are the accumulated values for the near-end (local) and far-end (remote) routers                                                                                                                                                                                                           |
| Total Tx              | Displays the total number of frames transmitted during the test                                                                                                                                                                                                                                                                                       |
| Total Rx              | Displays the total number of frames received during the test                                                                                                                                                                                                                                                                                          |

| Label          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total Loss     | Displays the total number of frames lost during the test                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Loss Ratio (%) | <p>Displays the loss ratio, defined as follows:</p> <ul style="list-style-type: none"> <li>Loss Ratio (NE) = Total Loss (NE) # Total Tx (FE) x 100%</li> </ul> <p>Example (single-ended):</p> <ul style="list-style-type: none"> <li>NE loss ratio = (1 # 36) x 100% = 2.78%</li> <li>FE loss ratio = (0 # 30) x 100% = 0.00%</li> </ul> <p>Example (dual-ended):</p> <ul style="list-style-type: none"> <li>NE loss ratio = (741 # 741) x 100% = 100%</li> <li>FE loss ratio = (5059396176 # 5066117155) x 100% = 99.86%</li> </ul> |

## system-config

### Syntax

**system-config**

### Context

show>eth-cfm

### Description

This command displays ETH-CFM system-level information.

### Output

The following output is an example of ETH-CFM system-level configuration information, and [Table 32: ETH-CFM system configuration field descriptions](#) describes the fields.

#### Output example

```
*A:Sar18 Dut-B>show# eth-cfm system-config
=====
CFM System Configuration
=====
Synthetic Loss Measurement
 Inactivity Timer : 100 second(s)

ETH-CFM System Configuration Limits

Component Current Usage System Limit

Maintenance Domain (MD) 0 50
Maintenance Association (MA) 0 1000
Maintenance Endpoint (MEP) 0 512
 One-second MEP 0 512
 Sub-second MEP 0 100
```

```

Alarm Indication Signal (AIS) 0 200
LMM Stats Enabled 0 2000
LBM Concurrent Tests 0 10
 Multicast LB Tests 0 1
LTM Concurrent Tests 0 10

=====
*A: Sar18 Dut-B>show#

```

Table 32: ETH-CFM system configuration field descriptions

| Label                                      | Description                                                         |
|--------------------------------------------|---------------------------------------------------------------------|
| <b>CFM System Configuration</b>            |                                                                     |
| <b>Synthetic Loss Measurement</b>          |                                                                     |
| Inactivity Timer                           | Displays the value of the SLM test inactivity timer                 |
| <b>ETH-CFM System Configuration Limits</b> |                                                                     |
| <b>Component</b>                           |                                                                     |
| Current Usage                              | Displays the number of items currently in use for the component     |
| System Limit                               | Displays the system limit for the component                         |
| Maintenance Domain (MD)                    | Displays the number of MDs                                          |
| Maintenance Association (MA)               | Displays the number of MAs                                          |
| Maintenance Endpoint (MEP)                 | Displays the number of MEPs                                         |
| One-second MEP                             | Displays the number of 1-second MEPs                                |
| Sub-second MEP                             | Displays the number of subsecond MEPs                               |
| Alarm Indication Signal (AIS)              | Displays the number of MEPs enabled for AIS receive or transmit     |
| LMM Stats Enabled                          | Not applicable                                                      |
| LBM Concurrent Tests                       | Displays the number of loopback message tests running concurrently  |
| Multicast LB Tests                         | Not applicable                                                      |
| LTM Concurrent Tests                       | Displays the number of linktrace message tests running concurrently |

oam-pm

Syntax

oam-pm

Context

show

Description

Commands in this context show Operations, Administration, and Maintenance Performance Management information.

bin-group

Syntax

bin-group *bin-group-number* [detail]

Context

show>oam-pm bin-group

Description

Show the configuration data for one or all OAM Performance Monitoring bin groups.

Parameters

*bin-group-number*

Specifies an OAM Performance Monitoring bin group.

Values 1 to 255

detail

Keyword to display additional exclusion and event monitoring information for the bin group.

Platforms

All

Output

The following output is an example of OAM-PM bin group information.

Output Example

```
show oam-pm bin-group

Configured Lower Bounds for Delay 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                | 1       | 500      | 250  |
|                                                                         |                                |            | 2                | 500     | 1000     | 500  |
|                                                                         |                                |            | 3                | 1000    | 1500     | 1000 |
|                                                                         |                                |            | 4                | 2000    | 2000     | 1500 |
|                                                                         |                                |            | 5                | 3000    | 2500     | 2000 |
|                                                                         |                                |            | 6                | 4000    | 3000     | 2500 |
|                                                                         |                                |            | 7                | 5000    | 3500     | 3000 |
|                                                                         |                                |            | 8                | 5500    | 4000     | 3500 |
|                                                                         |                                |            | 9                | 6500    | 4500     | 4000 |
| -----                                                                   |                                |            |                  |         |          |      |
| 3                                                                       |                                | Up         | 0                | 0       | 0        | 0    |
|                                                                         |                                |            | 1                | 1       | 500      | 250  |
|                                                                         |                                |            | 2                | 500     | 1000     | 500  |
|                                                                         |                                |            | 3                | 1000    | 1500     | 1000 |
|                                                                         |                                |            | 4                | 2000    | 2000     | 1500 |
|                                                                         |                                |            | 5                | 3000    | 2500     | 2000 |
|                                                                         |                                |            | 6                | 4000    | 3000     | 2500 |
|                                                                         |                                |            | 7                | 5000    | 3500     | 3000 |
|                                                                         |                                |            | 8                | 5500    | 4000     | 3500 |
|                                                                         |                                |            | 9                | 6500    | 4500     | 4000 |
| -----                                                                   |                                |            |                  |         |          |      |
| * indicates that the corresponding row element may have been truncated. |                                |            |                  |         |          |      |
|                                                                         |                                |            |                  |         |          |      |
| show oam-pm bin-group 3 detail                                          |                                |            |                  |         |          |      |
| -----                                                                   |                                |            |                  |         |          |      |
| Configured Lower Bounds for Delay Tests, in microseconds                |                                |            |                  |         |          |      |
| -----                                                                   |                                |            |                  |         |          |      |
| Group Description                                                       |                                | Admin Bin  | FD(us)           | FDR(us) | IFDV(us) |      |
| -----                                                                   |                                |            |                  |         |          |      |
| 3                                                                       |                                | Up         | 0                | 0       | 0        | 0    |
|                                                                         |                                |            | 1                | 1       | 500      | 250  |
|                                                                         |                                |            | 2                | 500     | 1000     | 500  |
|                                                                         |                                |            | 3                | 1000    | 1500     | 1000 |
|                                                                         |                                |            | 4                | 2000    | 2000     | 1500 |
|                                                                         |                                |            | 5                | 3000    | 2500     | 2000 |
|                                                                         |                                |            | 6                | 4000    | 3000     | 2500 |
|                                                                         |                                |            | 7                | 5000    | 3500     | 3000 |
|                                                                         |                                |            | 8                | 5500    | 4000     | 3500 |
|                                                                         |                                |            | 9                | 6500    | 4500     | 4000 |
| -----                                                                   |                                |            |                  |         |          |      |
|                                                                         |                                |            |                  |         |          |      |
| Bins Excluded from Average                                              |                                |            |                  |         |          |      |
| -----                                                                   |                                |            |                  |         |          |      |
| Bin Type                                                                | Direction                      | Bins       |                  |         |          |      |
| -----                                                                   |                                |            |                  |         |          |      |
| FD                                                                      | round-trip                     | 0,9        |                  |         |          |      |
| -----                                                                   |                                |            |                  |         |          |      |
|                                                                         |                                |            |                  |         |          |      |
| Delay Events Configured                                                 |                                |            |                  |         |          |      |
| -----                                                                   |                                |            |                  |         |          |      |
| Bin Type                                                                | Direction                      | Lowest Bin | Lower Bound (us) | Raise   | Clear    |      |
| -----                                                                   |                                |            |                  |         |          |      |
| FD                                                                      | round-trip                     | 8          | 5500             | 100     | none     |      |
| -----                                                                   |                                |            |                  |         |          |      |

|                                      |            |                     |                  |       |       |
|--------------------------------------|------------|---------------------|------------------|-------|-------|
| Bins Excluded from Delay Event Count |            |                     |                  |       |       |
| Bin Type                             | Direction  | Lowest Excluded Bin | Lower Bound (us) |       |       |
| FD                                   | round-trip | 9                   | 6500             |       |       |
|                                      |            |                     |                  |       |       |
| Delay Events Configured              |            |                     |                  |       |       |
| Bin Type                             | Direction  | Lowest Bin          | Lower Bound (us) | Raise | Clear |
| FD                                   | forward    | 3                   | 1000             | 200   | none  |
|                                      |            |                     |                  |       |       |
| Bins Excluded from Delay Event Count |            |                     |                  |       |       |
| Bin Type                             | Direction  | Lowest Excluded Bin | Lower Bound (us) |       |       |
| FD                                   | forward    | 4                   | 2000             |       |       |

## bin-group-using

### Syntax

**bin-group-using** [**bin-group** *bin-group-number*]

### Context

show>oam-pm

### Description

Show the list of sessions configured against one or all OAM Performance Monitoring bin groups.

### Parameters

#### ***bin-group-number***

Specifies an OAM Performance Monitoring bin group.

**Values** 1 to 255

### Output

The following output is an example of OAM-PM bin group session information.

#### Output Example

```
show oam-pm bin-group-using
=====
OAM Performance Monitoring Bin Group Configuration for Sessions
=====
Bin Group Admin Session Session State

2 Up vpls1000-PM-AL5-1/1/9:1000.1000 Act
```



```

3 Up vpls1000-PM-YL4-1/1/9:1000.1000 Act

Admin: State of the bin group
Session State: The state of session referencing the bin-group

show oam-pm bin-group-using bin-group 2
=====
OAM Performance Monitoring Bin Group Configuration for Sessions
=====
Bin Group Admin Session Session State

2 Up vpls1000-PM-AL5-1/1/9:1000.1000 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

Description

Show the configuration and status information for an OAM Performance Monitoring session.

Parameters

- session-name**  
Specifies the session name up to 32 characters.
- all**  
Displays all attributes.
- base**  
Specifies the base configuration option for the session.
- bin-group**  
Specifies the associated bin group and its attributes.
- event-mon**  
Configures event monitoring and last TCA.
- meas-interval**  
Configures event monitoring and last TCA.

Output

The following output is an example of OAM-PM configuration information.

## Output Example

```
*A:7705:Dut-A# show oam-pm session "sess1" all

Basic Session Configuration

Session Name : sess1
Description : (Not Specified)
Test Family : ip Session Type : proactive
Bin Group : 100

IP Configuration

Source IP Address : 10.10.1.1
Dest IP Address : 10.10.1.2
Config Src UDP Port: (Not Specified) In-Use Src UDP Port: 49154
Dest UDP Port : 64364 Time To Live : 255
Forwarding Class : be Profile : in
DSCP : resolve Allow Remark DSCP : no
Router : Base Bypass Routing : no
Egress Interface : (Not Specified)
Next Hop Address : (Not Specified)
Do Not Fragment : no Pattern : 0

TWAMP-Light Test Configuration and Status

Test ID : 1 Admin State : Up
Oper State : Up Pad Size : 0 octets
On-Demand Duration: Not Applicable On-Demand Remaining: Not Applicable
Interval : 100 ms Record Stats : delay
CHLI Threshold : 5 HLIs Frames Per Delta-T : 1 frames
Consec Delta-Ts : 10 FLR Threshold : 50%
HLI Force Count : no IPv6 UDP Checksum 0: Disallow
Detectable Tx Err : none

5-mins Measurement Interval Configuration

Duration : 5-mins Intervals Stored : 32
Boundary Type : test-relative Clock Offset : 0 seconds
Accounting Policy : none Event Monitoring : disabled
Delay Event Mon : disabled Loss Event Mon : disabled

15-mins Measurement Interval Configuration

Duration : 15-mins Intervals Stored : 32
Boundary Type : test-relative Clock Offset : 0 seconds
Accounting Policy : none Event Monitoring : disabled
Delay Event Mon : disabled Loss Event Mon : disabled

1-hour Measurement Interval Configuration

Duration : 1-hour Intervals Stored : 8
Boundary Type : test-relative Clock Offset : 0 seconds
Accounting Policy : none Event Monitoring : disabled
Delay Event Mon : disabled Loss Event Mon : disabled

```

-----  
 1-day Measurement Interval Configuration  
 -----

|                   |                 |                  |             |
|-------------------|-----------------|------------------|-------------|
| Duration          | : 1-day         | Intervals Stored | : 1         |
| Boundary Type     | : test-relative | Clock Offset     | : 0 seconds |
| Accounting Policy | : none          | Event Monitoring | : disabled  |
| Delay Event Mon   | : disabled      | Loss Event Mon   | : disabled  |

-----

-----  
 Configured Lower Bounds for Delay Tests, in microseconds  
 -----

| Group Description | Admin | Bin | FD(us) | FDR(us) | IFDV(us) |
|-------------------|-------|-----|--------|---------|----------|
| 100               | Up    | 0   | 0      | 0       | 0        |
|                   |       | 1   | 5000   | 5000    | 5000     |
|                   |       | 2   | 10000  | 10000   | 10000    |
|                   |       | 3   | 15000  | 15000   | 15000    |
|                   |       | 4   | 20000  | 20000   | 20000    |
|                   |       | 5   | 25000  | 25000   | 25000    |
|                   |       | 6   | 30000  | 30000   | 30000    |
|                   |       | 7   | 35000  | 35000   | 35000    |
|                   |       | 8   | 40000  | 40000   | 40000    |
|                   |       | 9   | 45000  | 45000   | 45000    |

-----

-----  
 Bins Excluded from Average  
 -----

| Bin Type | Direction | Bins |
|----------|-----------|------|
|----------|-----------|------|

-----

-----  
 Bins Excluded from Delay Event Count  
 -----

| Bin Type | Direction | Lowest Excluded Bin | Lower Bound (us) |
|----------|-----------|---------------------|------------------|
|----------|-----------|---------------------|------------------|

-----

-----  
 Delay Events for the TWAMP-Light Test  
 -----

| Bin Type | Direction | LowerBound(us) | Raise | Clear | Last TCA (UTC) |
|----------|-----------|----------------|-------|-------|----------------|
|----------|-----------|----------------|-------|-------|----------------|

-----

-----  
 Loss Events for the TWAMP-Light Test  
 -----

| Event Type | Direction | Raise | Clear | Last TCA (UTC) |
|------------|-----------|-------|-------|----------------|
|------------|-----------|-------|-------|----------------|

-----

\*A:7705:Dut-A# show oam-pm session "sess1" bin-group

-----

Configured Lower Bounds for Delay Tests, in microseconds

| Group Description | Admin | Bin | FD(us) | FDR(us) | IFDV(us) |
|-------------------|-------|-----|--------|---------|----------|
| 100               | Up    | 0   | 0      | 0       | 0        |
|                   |       | 1   | 5000   | 5000    | 5000     |
|                   |       | 2   | 10000  | 10000   | 10000    |
|                   |       | 3   | 15000  | 15000   | 15000    |
|                   |       | 4   | 20000  | 20000   | 20000    |
|                   |       | 5   | 25000  | 25000   | 25000    |
|                   |       | 6   | 30000  | 30000   | 30000    |
|                   |       | 7   | 35000  | 35000   | 35000    |
|                   |       | 8   | 40000  | 40000   | 40000    |
|                   |       | 9   | 45000  | 45000   | 45000    |

#### Bins Excluded from Average

| Bin Type | Direction | Bins |
|----------|-----------|------|
|----------|-----------|------|

#### Bins Excluded from Delay Event Count

| Bin Type | Direction | Lowest Excluded Bin | Lower Bound (us) |
|----------|-----------|---------------------|------------------|
|----------|-----------|---------------------|------------------|

### Output example

```
*A:7705:Dut-A# show oam-pm session "sess1" meas-interval
```

#### 5-mins Measurement Interval Configuration

|                   |                 |                  |             |
|-------------------|-----------------|------------------|-------------|
| Duration          | : 5-mins        | Intervals Stored | : 32        |
| Boundary Type     | : test-relative | Clock Offset     | : 0 seconds |
| Accounting Policy | : none          | Event Monitoring | : disabled  |
| Delay Event Mon   | : disabled      | Loss Event Mon   | : disabled  |

#### 15-mins Measurement Interval Configuration

|                   |                 |                  |             |
|-------------------|-----------------|------------------|-------------|
| Duration          | : 15-mins       | Intervals Stored | : 32        |
| Boundary Type     | : test-relative | Clock Offset     | : 0 seconds |
| Accounting Policy | : none          | Event Monitoring | : disabled  |
| Delay Event Mon   | : disabled      | Loss Event Mon   | : disabled  |

#### 1-hour Measurement Interval Configuration

|                   |                 |                  |             |
|-------------------|-----------------|------------------|-------------|
| Duration          | : 1-hour        | Intervals Stored | : 8         |
| Boundary Type     | : test-relative | Clock Offset     | : 0 seconds |
| Accounting Policy | : none          | Event Monitoring | : disabled  |
| Delay Event Mon   | : disabled      | Loss Event Mon   | : disabled  |

#### 1-day Measurement Interval Configuration

```

Duration : 1-day Intervals Stored : 1
Boundary Type : test-relative Clock Offset : 0 seconds
Accounting Policy : none Event Monitoring : disabled
Delay Event Mon : disabled Loss Event Mon : disabled

```

### Output example —TWAMP-Light Test

```

TWAMP-Light Test Configuration and Status

Test ID : 1 Admin State : Down
Oper State : Down Pad Size : 0 octets
On-Demand Duration: Not Applicable On-Demand Remaining: Not Applicable
Interval : 1000 ms Record Stats : delay
CHLI Threshold : 5 HLIs Frames Per Delta-T : 1 frames
Consec Delta-Ts : 10 FLR Threshold : 50%
HLI Force Count : no IPv6 UDP Checksum 0: Allow
Detectable Tx Err : none
Session Sender ID : none
Str Delay Tmpl:(Not Specified)

```

Table 33: Output fields: TWAMP-Light Test

| Label               | Description                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test ID             | The numerical value, between 0 to 2147483647, that is assigned to the protocol-specific test                                                                                                                                                                                                                                                                        |
| Admin State         | The administrative state of the test<br>Up – The test has been enabled by configuration<br>Down – The test has not been enabled by configuration                                                                                                                                                                                                                    |
| Oper State          | The operational state of the test<br>Up – The test is administratively up and currently transmitting, attempting to transmit packets, or ready to transmit packets<br>Down – The test is administratively down or an OAM-PM session configured with <b>session-type on-demand</b> has not been enabled using the global CLI <b>oam oam-pm session start</b> command |
| CHLI Threshold      | Displays the Consecutive High Loss Interval (CHLI) threshold                                                                                                                                                                                                                                                                                                        |
| FLR Threshold       | Displays the Frame Loss Ratio (FLR) threshold for the test                                                                                                                                                                                                                                                                                                          |
| Interval            | Displays the test interval, in milliseconds, between the received messages to maintain the session                                                                                                                                                                                                                                                                  |
| Record Stats        | Displays the type of statistics recorded for the TWAMP-Light test                                                                                                                                                                                                                                                                                                   |
| IPv6 UDP Checksum 0 | Displays whether the processing of received IPv6 UDPchecksum 0 packets is allowed or disallowed                                                                                                                                                                                                                                                                     |
| Detectable Tx Error | Displays the detected error condition that may prevent the test packet from being sent                                                                                                                                                                                                                                                                              |
| Session Sender ID   | Displays the session sender identifier (value, between 1 to 65535)                                                                                                                                                                                                                                                                                                  |

# sessions

## Syntax

```
sessions [test-family {ethernet | ip}]
sessions [test-family {ethernet | ip}] detectable-tx-errors
sessions [test-family {ethernet | ip}] event-mon
```

## Context

```
show>oam-pm
```

## Description

This command shows a summary of the OAM Performance Monitoring sessions.

## Parameters

- test-family**  
Shows all sessions that match the specified test family type when an optional filter is included.
- ethernet**  
Specifies Ethernet session types.
- ip**  
Specifies IP session types.
- event-mon**  
Specifies a summary of all event monitoring and current state for each session.
- detectable-tx-errors**  
Specifies to provide a summary of tests with detectable transmission errors that prevent the test from sending packets. Not all errors are detectable.

## Platforms

All

## Output

The following output is an example of OAM-PM session summary information.

### Output Example

```
*A:7705:Dut-A# show oam-pm sessions

=====
OAM Performance Monitoring Session Summary for the Ethernet Test Family
=====
Session State Bin Group Sess Type Test Types

=====
```

## OAM Performance Monitoring Session Summary for the IP Test Family

| Session  | State | Bin Group | Sess Type | Test Types |
|----------|-------|-----------|-----------|------------|
| sess1    | Act   | 100       | proactive | TWL        |
| demand_1 | Act   | 101       | on-demand | TWL        |

## statistics

### Syntax

**statistics session** *session-name* **twamp-light** **meas-interval** { **5-mins** | **15-mins** | **1-hour** | **1-day** | **raw** }  
**interval-number** *interval-number* **delay** [ **all** | **bins** | **summary** ]

### Context

show>oam-pm

### Description

This command shows the delay statistics for the specified test using the parameters specified.

### Parameters

#### *session-name*

Identifies the session to be queried.

#### **twamp-light**

Specifies that the delay test is from the IP test family and is using twamp-light style measurements for the delay.

#### **meas-interval**

Identifies the measurement interval to query for the statistics. When **raw** is specified, the interval number is not to be included because there is only one raw cumulative bin.

**Values** 5-mins, 15-mins, 1-hour, 1-day, raw

#### *interval-number*

Specifies the numerical reference that indicates the position from the latest sample window. The number 1 is the most recent with all higher numbers being that position in the past from current.

**Values** 1 to 97

#### [**all** | **bins** | **summary**]

Specifies a keyword to filter the output.

#### **delay**

Indicates that the statistics being queried are for delay. TWAMP-Light PDUs carry both delay and loss informational elements and it is not clear from only the test type name which statistic the operator requires.

**loss**

Indicates the statistics being queried are for loss. TWAMP-Light PDUs carry both delay and loss informational elements and it is not clear from only the test type name which statistic the operator requires. This keyword is specific to twamp-light.

**session****Syntax**

**session** *session-name*

**Context**

show>oam-pm>statistics

**Description**

This command selects the session for the statistical display.

**Parameters**

***session-name***

Specifies the session name, up to 32 characters.

**twamp-light****Syntax**

**twamp-light**

**Context**

show>oam-pm>stats>session

**Description**

This command selects the session's TWAMP-light test for the statistical display.

**meas-interval****Syntax**

**meas-interval raw [loss]**

**meas-interval raw [all | bins | summary]**

**meas-interval {1-min | 5-mins | 15-mins | 1-hour | 1-day} interval-number *interval-number* [loss]**

**meas-interval {1-min | 5-mins | 15-mins | 1-hour | 1-day} interval-number *interval-number* delay [all | bins | summary]**



## Context

show>oam-pm>stats>session>twamp-light

## Description

This command selects a measurement interval for the statistical display.

## Parameters

### raw

Specifies that the interval number is not to be included because there is only one raw cumulative bin.

### {1-min | 5-mins | 15-mins | 1-hour | 1-day}

Identifies the measurement interval to query for the statistics.

### interval-number

Specifies the numerical reference that indicates the position from the latest sample window. The number 1 is the most recent interval with all higher numbers being that position in the past from current.

**Values** 1 to 97

### delay

Indicates that the statistics being queried are for delay. TWAMP-light PDUs carry both delay and loss informational elements and it is not clear from only the test type name which statistic the operator requires.

### loss

Indicates the statistics being queried are for loss. TWAMP-light PDUs carry both delay and loss informational elements and it is not clear from only the test type name which statistic the operator requires.

### [all | bins | summary]

Specifies a keyword to filter the output.

## tests

## Syntax

**tests** [session *session-name*] [test-id *test-id*] [test-type {dm | dmm | lmm | slm | twamp-light}]

## Context

show>oam-pm

## Description

This command displays a list of OAM-PM test types and associated test IDs. The output provides an ordered list by type and ID to help locate available test IDs that may be configured within a specific type. Filters are available to refine the output to the operational need. Multiple filters can be included to further refine the output. The combination of the filters is an AND function. All filters must be true to provide tests output.

Parameters

- session-name**

Filters output by session name, up to 32 characters.
- test-id**

Filters output by test ID.

**Values** 0 to 2147483647
- test-type**

Filters output by test type.

**Values** twamp-light

Output

The following output is an example of OAM-PM test type and test ID information and the following table describes test fields.

Output Example

```
*A:7705:Dut-A# show oam-pm tests

=====
OAM Performance Monitoring Test Summary
=====
Test
Type Test ID Admin Oper TxE Sess Type Session

TWL 1 Up Up no proactive sess1
TWL 2 Up Up no on-demand demand_1

No. of OAM-PM Tests: 2
=====
TxE=yes: detected an error on the test's most recent packet transmit attempt.

*A:7705:Dut-A#
```

Table 34: Output fields: OAM-PM tests

| Label     | Description                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Type | The OAM-PM protocol specific test                                                                                                                                             |
| Test ID   | The numerical value, between 0 to 2147583647, that is assigned to the protocol specific test.<br><br>The <b>(auto)</b> tag appears if the test ID was automatically assigned. |
| Admin     | The administrative state of the test<br><br>Up – The test has been enabled by configuration<br>Down – The test was not enabled by configuration                               |
| Oper      | The operational state of the test                                                                                                                                             |

| Label     | Description                                                                                                                                                                                                                                                                                                                                          |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <p>Up – The test is administrative Up and currently transmitting, attempting to transmit packets, or ready to transmit packets</p> <p>Down – The test is administratively down or an oam-pm session has been configured with <b>session-type on-demand</b> and has not been enabled using the global CLI <b>oam oam-pm session start</b> command</p> |
| TxE       | <p>no – There has been no error detected</p> <p>yes – The has been an error detected</p>                                                                                                                                                                                                                                                             |
| Sess Type | The session type, <b>proactive</b> and <b>on-demand</b>                                                                                                                                                                                                                                                                                              |
| Session   | The name of the session, up to 32 characters                                                                                                                                                                                                                                                                                                         |

## saa

### Syntax

**saa** [*test-name* [**owner** *test-owner*]]

### Context

show>saa

### 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 test is specified, then 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 SAA test to display. The test name must already be configured in the **config>saa>test** context.

*test-owner*

specifies the owner of an SAA operation, up to 32 characters in length

**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 test result information, and [Table 35: SAA field descriptions](#) describes the fields.

**Output example**

```

*A:ALU-3>config>saa>test$ show saa

=====
SAA Test Information
=====
Test name : test5
Owner name : reuben
Administrative status : Enabled
Test type : sdp-ping 600 resp-sdp 700 fc "nc" count 50
Test runs since last clear : 1
Number of failed test runs : 0
Last test result : Success

Threshold
Type Direction Threshold Value Last Event Run #

Jitter-in Rising None None Never None
 Falling None None Never None
Jitter-out Rising None None Never None
 Falling None None Never None
Jitter-rt Rising None None Never None
 Falling None None Never None
Latency-in Rising None None Never None
 Falling None None Never None
Latency-out Rising None None Never None
 Falling None None Never None
Latency-rt Rising 50 None Never None
 Falling 50 10 04/23/2008 22:29:40 1
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 8 None Never None
 Falling 8 0 04/23/2008 22:30:30 1

=====
*A:ALU-3>config>saa>test$

```

*Table 35: SAA field descriptions*

| Label                      | Description                                                                              |
|----------------------------|------------------------------------------------------------------------------------------|
| Test name                  | Displays the name of the test                                                            |
| Owner name                 | Displays the test owner's name                                                           |
| Administrative status      | Indicates the administrative state of the test – enabled or disabled                     |
| Test type                  | Identifies the type of test configured                                                   |
| Test runs since last clear | Indicates 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                                          |

| Label            | Description                                                                                                                                                                                                                                                                   |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Last test result | Indicates the result of the last test 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: <ul style="list-style-type: none"> <li>in – inbound</li> <li>out – outbound</li> <li>rt – roundtrip</li> </ul> |
| 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                                                                                                                                                                                                                         |

## ldp-treetrace

### Syntax

**ldp-treetrace** [**prefix** *ip-prefix/mask*] [**detail**]

### Context

show>test-oam

### Description

This command displays OAM LDP tree-trace information.

### Parameters

*ip-prefix/mask*

the address prefix and subnet mask of the destination node

**detail**

displays detailed information

### Output

The following output is an example of LDP tree-trace information.

### Output example

```
A:ALU-3# 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 : 12/19/2012 05:10:14
Last Discovery End : 12/19/2012 05:12:02
Last Discovery Duration : 00h01m48s
Policy1 : policy-1
Policy2 : policy-2

*A:ALU-3# 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 : 12/19/2012 05:10:14
Last Discovery End : 12/19/2012 05:12:02
Last Discovery Duration : 00h01m48s
Policy1 : policy-1
Policy2 : policy-2
=====
Prefix (FEC) Info
=====
Prefix Path Last Probe Discov Discov
 Num Discovered State State Status

10.11.11.1/32 54 12/19/2012 05:10:15 OK Done OK
10.11.11.2/32 54 12/19/2012 05:10:15 OK Done OK
10.11.11.3/32 54 12/19/2012 05:10:15 OK Done OK
.....
10.14.14.95/32 72 12/19/2012 05:11:13 OK Done OK
10.14.14.96/32 72 12/19/2012 05:11:13 OK Done OK
10.14.14.97/32 72 12/19/2012 05:11:15 OK Done OK
10.14.14.98/32 72 12/19/2012 05:11:15 OK Done OK
10.14.14.99/32 72 12/19/2012 05:11:18 OK Done OK
10.14.14.100/32 72 12/19/2012 05:11:20 OK Done OK
=====
Legend: uP - unexplored paths, t0 - trace request timed out
 mH - max hop exceeded, mP - max path exceeded
 nR - no internal resource

*A:ALU3 show test-oam ldp-treetrace prefix 10.12.12.10/32
Discovery State : Done Last Discovered : 12/19/2012 05:11:02
Discovery Status : ' OK '
Discovered Paths : 54 Failed Hops : 0
Probe State : OK Failed Probes : 0

*A:ALU-3# show test-oam ldp-treetrace prefix 10.12.12.10/32 detail
Discovery State : Done Last Discovered : 12/19/2012 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

10.1.0.5 10.10.1.2 10.12.12.10 12/19/2012 05:11:01
 7 0 EgressRtr

```

|            |   |           |             |                     |
|------------|---|-----------|-------------|---------------------|
| 10.1.0.9   |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| 10.1.0.15  |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| 10.1.0.19  |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| 10.1.0.24  |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| 10.1.0.28  |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| .....      |   |           |             |                     |
| 10.1.0.252 |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| 10.1.0.255 |   | 10.10.1.2 | 10.12.12.10 | 12/19/2012 05:11:01 |
|            | 7 | OK        | 0           | EgressRtr           |
| =====      |   |           |             |                     |
| *A:ALU-3#  |   |           |             |                     |

server

Syntax

server [all] [prefix ip-prefix/mask]

Context

show>test-oam>twamp

Description

This command displays TWAMP server information.

Parameters

all

displays all TWAMP server information

prefix ip-prefix/mask

specifies the address prefix and subnet mask of the TWAMP server that contains one or more TWAMP clients

Output

The following output is an example of TWAMP server information, and [Table 36: TWAMP server field descriptions](#) describes the fields.

Output example

```
A:7705:Dut-A# show test-oam twamp server
=====
TwAMP Server
=====
Admin State : Up Operational State : Up
Up Time : 0d 00:02:15
Current Connections : 2 Max Connections : 64
Connections Rejected : 0 Inactivity Time Out : 900 seconds
Current Sessions : 4 Max Sessions : 128
Sessions Rejected : 0 Sessions Aborted : 0
```

```

Sessions Completed : 0 Ref Inact Time Out : 900 seconds
Test Packets Rx : 6395 Test Packets Tx : 6395
=====
TWAMP Server Prefix Summary
=====
Prefix Current Current Description
 Connections Sessions

10.10.0.0/16 2 4
10.32.5.2/32 0 0

No. of TWAMP Server Prefixes: 2
=====

```

Table 36: TWAMP server field descriptions

| Label                | Description                                                                                                                                                                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TWAMP Server</b>  |                                                                                                                                                                                                                                                                               |
| Admin State          | Displays one of the following:<br>Up – the server (or prefix) is administratively enabled ( <b>no shutdown</b> ) in configuration<br>Down – the server (or prefix) is administratively disabled ( <b>shutdown</b> ) in configuration                                          |
| Operational State    | Displays one of the following:<br>Up – the server (or prefix) is operationally enabled<br>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 total number of client connections that have been rejected for one of the following reasons: <ul style="list-style-type: none"> <li>the sender IP address is not part of a configured prefix</li> <li>the maximum number of concurrent connections was reached</li> </ul> |
| Inactivity Time Out  | The configured inactivity timeout for the server                                                                                                                                                                                                                              |
| Current Sessions     | The total number of currently in-progress test sessions (for which Start-Sessions have been received)                                                                                                                                                                         |
| Max Sessions         | The maximum number of concurrent test sessions from clients                                                                                                                                                                                                                   |
| Sessions Rejected    | The total number of test sessions that have been rejected                                                                                                                                                                                                                     |



| Label                              | Description                                                                                                           |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Sessions Aborted                   | The total number of test sessions that have been aborted                                                              |
| Sessions Completed                 | The total number of test sessions that have been completed                                                            |
| Ref Inact Time Out                 | The maximum inactivity time for the test session. The test session is cleared and released upon expiry of this timer. |
| Test Packets Rx                    | The total number of test packets received from session senders                                                        |
| Test Packets Tx                    | The total number of test packets sent to session senders                                                              |
| <b>TWAMP Server Prefix Summary</b> |                                                                                                                       |
| Prefix                             | The IP address prefix of a TWAMP client                                                                               |
| Current Connections                | The number of current connections for the specified TWAMP client                                                      |
| Current Sessions                   | The number of current sessions for the specified TWAMP client                                                         |
| Description                        | Optional description of the specified TWAMP client                                                                    |
| No. of TWAMP Server Prefixes       | The total number of TWAMP server prefixes                                                                             |

The following output example shows the information for the TWAMP server prefix and the TWAMP clients associated with the prefix that can connect to the TWAMP server. [Table 37: TWAMP server prefix field descriptions](#) describes the TWAMP server prefix fields.

```
*A:7705:Dut-A# show test-oam twamp server prefix 10.10.0.0/16

=====
TWAMP Server Prefix 10.10.0.0/16
=====
Description : (Not Specified)
Current Connections : 2 Max Connections : 64
Connections Rejected : 0
Current Sessions : 0 Max Sessions : 128
Sessions Rejected : 0 Sessions Aborted : 0
Sessions Completed : 4 Ref Inact Time Out : 900 seconds
Test Packets Rx : 400 Test Packets Tx : 400
=====

=====
Connection information for TWAMP server prefix 10.10.0.0/16
=====
Client State Curr Sessions Sessions Rejected Sessions Completed
 Idle Time (s) Test Packets Rx Test Packets Tx

10.10.101.101 ready 0 0 2
 37 100 100
10.10.101.102 ready 0 0 2
 49 100 100
```

|                                                            |       |         |          |          |
|------------------------------------------------------------|-------|---------|----------|----------|
| 10.10.101.103                                              | ready | 0<br>39 | 0<br>100 | 2<br>100 |
| 10.10.101.104                                              | ready | 0<br>42 | 0<br>100 | 2<br>100 |
| -----                                                      |       |         |          |          |
| No. of TWAMP Server Connections for Prefix 10.10.0.0/16: 2 |       |         |          |          |
| =====                                                      |       |         |          |          |

Table 37: TWAMP server prefix field descriptions

| Label                                          | Description                                                                 |
|------------------------------------------------|-----------------------------------------------------------------------------|
| TWAMP Server Prefix                            |                                                                             |
| Description                                    | Optional text that describes the server prefix                              |
| Current Connections                            | See <a href="#">Table 36: TWAMP server field descriptions</a> .             |
| Max Connections                                |                                                                             |
| Connections Rejected                           |                                                                             |
| Current Sessions                               |                                                                             |
| Max Sessions                                   |                                                                             |
| Sessions Rejected                              |                                                                             |
| Sessions Aborted                               |                                                                             |
| Sessions Completed                             |                                                                             |
| Ref Inact Time Out                             |                                                                             |
| Test Packets Rx                                |                                                                             |
| Test Packets Tx                                |                                                                             |
| Connection information for TWAMP server prefix |                                                                             |
| Client                                         | The IP address of the client                                                |
| State                                          | The operational state of the client                                         |
| Curr Sessions                                  | The number of current sessions for the specified TWAMP server prefix client |
| Sessions Rejected                              | The total number of test sessions that have been rejected by the client     |
| Sessions Completed                             | The total number of test sessions that have been completed for the client   |
| Idle Time (s)                                  | The idle time in seconds for each client                                    |

| Label                                      | Description                                                                      |
|--------------------------------------------|----------------------------------------------------------------------------------|
| Test Packets Rx                            | The total number of test packets received by the client from the session senders |
| Test Packets Tx                            | The total number of test packets sent to session senders from the client         |
| No. of TWAMP Server Connections for Prefix | The total number of current TWAMP server connections for the prefix              |

## reflectors

### Syntax

**reflectors**

### Context

show>test-oam>twamp>twamp-light

### Description

This command shows TWAMP Light reflector information.

### Output

The following output is an example of TWAMP Light information, and [Table 38: TWAMP Light field descriptions](#) describes the fields.

#### Output example

```
show test-oam twamp twamp-light reflectors
=====
TWAMP-Light Reflectors
=====
Router/VP RN Admin UDP Port Prefixes Frames Rx Frames Tx

Base Up 862 1 0 0
500 Up 64365 2 6340 6340

No. of TWAMP-Light Reflectors: 2
=====
```

*Table 38: TWAMP Light field descriptions*

| Label                        | Description                    |
|------------------------------|--------------------------------|
| <b>TWAMP Light Reflector</b> |                                |
| Router/VP RN                 | The TWAMP Light clients        |
| Admin                        | Displays one of the following: |

| Label     | Description                                                                                                                                                                                    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | Up – the server or prefix is administratively enabled ( <b>no shutdown</b> ) in configuration<br>Down – the server or prefix is administratively disabled ( <b>shutdown</b> ) in configuration |
| UDP Port  | The UDP port number used                                                                                                                                                                       |
| Prefixes  | The prefixes that the reflector accepts as valid sources for a TWAMP Light request                                                                                                             |
| Frames Rx | The total number of frames received from session senders                                                                                                                                       |
| Frames Tx | The total number of frames sent to session senders                                                                                                                                             |

## source-udp-port-pools

### Syntax

**source-udp-port-pools**

### Context

show>test-oam>twamp>twamp-light

### Description

This command shows the configured distribution of UDP ports between TWAMP light under OAM-PM and STAMP under link measurement.

### Output

The following output is an example of source UDP port information, and [Table 39: Source UDP port field descriptions](#) describes the fields.

### Output example

```
*A:sr12-1# show test-oam twamp twamp-light source-udp-port-pools
=====
Configuration of Source UDP Pool twamp-light Range [64374..64383]
=====
UDP Source Application In-Use
Port

64374 oam-pm Yes
64375 link-measurement No
64376 link-measurement Yes
64377 oam-pm No
64378 oam-pm No
64379 oam-pm No
64380 oam-pm Yes
64381 oam-pm Yes
64382 oam-pm Yes
64383 oam-pm Yes
```

-----  
=====

Table 39: Source UDP port field descriptions

| Label           | Description                                                       |
|-----------------|-------------------------------------------------------------------|
| UDP Source Port | The UDP port number                                               |
| Application     | The associated application OAM-PM or link measurement             |
| In-Use          | Displays whether the application is in use by the UDP source port |

testhead-profile

Syntax

testhead-profile profile-id

Context

show>test-oam

Description

This command displays ITU-T Y.1564 test head profile information.

Parameters

profile-id  
the ITU-Y Y.1564 test head profile ID number

Output

The following output example shows the information for the ITU-T Y.1564 test head profile. [Table 40: ITU-T Y.1564 test head profile field descriptions](#) describes the fields.

Output example

```
*A:7705:Dut-A#>show>test-oam# testhead-profile 1
=====
Y.1564 Testhead Profile
=====
Description : BasicTestHead
Profile Id : 1
CIR Configured : 1000
PIR Configured : Not Configured
Duration Hrs : 0
Duration Mins : 2
Duration Secs : 0

Acceptance Criteria Id 1

Loss TH : 1000 Jitter TH : 9000
InProf Loss TH : 400 InProf Jitter TH : 10000
```

```

OutProf Loss TH : 400 OutProf Jitter TH : 10000
Latency TH : 5000 Ref. Count : 0
InProf Latency TH : 6000 CIR TH : 755
OutProf Latency TH : 6000 PIR TH : 300

Frame Payload Id 1

Payload Type : tcp-ipv4
Description : (Not Specified)
Frame Size : 1514
Rate : 1000
Dst Mac : 00:00:00:00:00:00
Src Mac : 00:00:00:00:00:00
Vlan Tag 1 : Not configured
Vlan Tag 2 : Not configured
Ethertype : 0x0800 DSCP : be
TOS : 0 TTL : 255
Src. IP : 0.0.0.0 Dst. IP : 0.0.0.0
L4 Dst Port : 0 L4 Src Port : 0
Protocol : 6 Ref. Count : 0
Data Pattern : alb2c3d4e5f6
=====
* indicates that the corresponding row element may have been truncated.
*A:7705:Dut-A>show>test-oam#

```

Table 40: ITU-T Y.1564 test head profile field descriptions

| Label                  | Description                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Description            | The test head profile or Frame payload description                                                                                                  |
| Profile Id             | The test head profile ID number                                                                                                                     |
| CIR Configured         | The CIR threshold, if configured                                                                                                                    |
| PIR Configured         | The PIR threshold, if configured                                                                                                                    |
| Duration Hrs           | The specified test duration in hours                                                                                                                |
| Duration Mins          | The specified test duration in minutes                                                                                                              |
| Duration Secs          | The specified test duration in seconds                                                                                                              |
| Acceptance Criteria Id | The ID number of the acceptance criteria used for the test, taken from the list of configured acceptance-criteria for the testhead-profile template |
| Loss TH                | The loss threshold value                                                                                                                            |
| InProf Loss TH         | The in-profile loss threshold value                                                                                                                 |
| OutProf Loss TH        | The out-of-profile loss threshold value                                                                                                             |
| Latency TH             | The latency threshold value                                                                                                                         |
| InProf Latency TH      | The in-profile latency threshold value                                                                                                              |

| Label              | Description                                                            |
|--------------------|------------------------------------------------------------------------|
| OutProf Latency TH | The out-of-profile latency threshold value                             |
| Jitter TH          | The jitter threshold value                                             |
| InProf Jitter TH   | The in-profile jitter threshold value                                  |
| OutProf Jitter TH  | The out-of-profile jitter threshold value                              |
| Ref. Count         | The number of test results in memory that are referencing this profile |
| CIR TH             | The CIR threshold value, if configured                                 |
| PIR TH             | The PIR threshold value, if configured                                 |
| Frame Payload Id   | The ID number of the frame payload associated with the test head       |
| Payload Type       | Displays the frame payload type as l2, tcp-ipv4, udp-ipv4, or ipv4     |
| Frame Size         | The configured frame packet size                                       |
| Rate               | The configured frame rate                                              |
| Dst Mac            | The destination MAC address for the test head packets                  |
| Src Mac            | The source MAC address of the test head packets                        |
| Vlan Tag 1         | The first VLAN tag associated with the test head                       |
| Vlan Tag 2         | The second VLAN tag associated with the test head                      |
| Ethertype          | The Ethertype associated with the test head packets                    |
| TOS                | The IP service type                                                    |
| Src. IP            | The source IP address of the test head packets                         |
| L4 Dst Port        | The Layer 4 destination port for the test head packets                 |
| Protocol           | The IP protocol associated with the test head                          |
| Data Pattern       | The configured data pattern                                            |

| Label       | Description                                          |
|-------------|------------------------------------------------------|
| DSCP        | The DSCP associated with the test head               |
| TTL         | The time-to-live value for the test head packets     |
| Dst. IP     | The destination IP address for the test head packets |
| L4 Src Port | The Layer 4 source port of the test head packets     |

## testhead

### Syntax

**testhead** [*test-name* *owner* *owner-name*] [**detail**]

### Context

show

### Description

This command displays information for an ITU-T Y.1564 test head with a specific test name and owner.

### Parameters

*test-name*

the ITU-T Y.1564 test head name, maximum of 32 characters

*owner-name*

the ITU-T Y.1564 test head owner name, maximum of 32 characters

**Default** TIMOS CLI

**detail**

displays detailed information for the specified test head

### Output

The following output is an example of ITU-T Y.1564 test information, and [Table 41: ITU-T Y.1564 test field descriptions](#) describes the fields.

### Output example

```
*A:7705:Dut-A#show testhead Maint-test owner john detail
=====
Y.1564 Testhead Sessions
=====
Owner : john
Test : Maint-test
Marker Pkt Src Mac : 00:00:11:22:33:44
Profile Id : 1 SAP : 1/2/3:10.0
```



```

Accept. Crit. Id : 4
Completed : Yes
Stopped : No
Frame Payload Id : 1
Color Aware Test : Yes
Start Time : 06/13/2015 20:03:57
End Time : 06/13/2015 20:06:57
Total time taken : 0d 00:03:00
Test Status : Fail

```

#### ----- Latency Results

```

(total pkts in us): Min Max Average Jitter
Roundtrip : 207 222 208 1
(OutPrf pkts in us): Min Max Average Jitter
Roundtrip : 207 222 208 1
(InPrf pkts in us): Min Max Average Jitter
Roundtrip : 0 0 0 0

```

#### ----- Packet Count

```

Total Injected : 968569
Total Received : 968569
OutPrf Injected : 477471
OutPrf Received : 968569
InPrf Injected : 491098
InPrf Received : 0

```

#### ----- Test Compliance Report

```

Throughput Configd : 98000
Throughput Agg : 96838
Throughput Oper : 98019
Throughput Measurd : 98019
Tput Acceptance : Pass

PIR Tput Configd : 98000
PIR Tput Meas : 98019
PIR Tput Acep : Pass

CIR Tput Configd : 98000
CIR Tput Meas : 0
CIR Tput Acep : Fail

FLR Configured : 0.000000
FLR Measurd : 0.000000
FLR Acceptance : Pass

OutPrf FLR Conf : 1.000000
OutPrf FLR Meas : 0.000000
OutPrf FLR Acep : Pass

InPrf FLR Conf : 0.000000
InPrf FLR Meas : 1.000000
InPrf FLR Acep : Fail

Latency Configd(us): 226
Latency Measurd(us): 208
Latency Acceptance : Pass

OutPrf Lat Conf(us): 226
OutPrf Lat Meas(us): 208
OutPrf Lat Acep : Pass

InPrf Lat Conf(us) : 226

```

```

InPrf Lat Meas(us) : None
InPrf Lat Acep : Pass

Jitter Configd(us) : 65
Jitter Measurd(us) : 1
Jitter Acceptance : Pass

OutPrf Jit Conf(us): 65
OutPrf Jit Meas(us): 1
OutPrf Jit Acep : Pass

InPrf Jit Conf(us) : 65
InPrf Jit Meas(us) : None
InPrf Jit Acep : Pass

Total Pkts. Tx. : 180
OutPrf Lat Pkts. R* : 180
Total Tx. Fail : 0
Latency Pkts. Tx. : 180
InPrf Lat Pkts. R* : 0
=====
*A:7705:Dut-A#

```

Table 41: ITU-T Y.1564 test field descriptions

| Label              | Description                                                                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Owner              | The test owner                                                                                                                                         |
| Test               | The test name                                                                                                                                          |
| Marker Pkt Src Mac | The MAC address of the test source packets                                                                                                             |
| Performance Mon    | Marker-packet use for delay and jitter measurements, either enabled or disabled                                                                        |
| Profile Id         | The profile ID number assigned to the test                                                                                                             |
| SAP                | The SAP ID for the test                                                                                                                                |
| Accept. Crit. Id   | The ID number of the acceptance criteria profile associated with the test                                                                              |
| Completed          | Indicates if the test has been completed                                                                                                               |
| Stopped            | Indicates if the test has been stopped                                                                                                                 |
| Frame Payload Id   | The ID number of the frame payload associated with the test<br>Additional Frame Payload ID values are shown when the test uses parallel flows          |
| Frame Payload Type | Displays the frame payload type as I2, tcp-ipv4, udp-ipv4, or ipv4<br>Additional Frame Payload type values are shown when the test uses parallel flows |

| Label               | Description                                                                                                                            |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Color Aware Test    | Indicates if the color-aware test is active on the Y.1564 test                                                                         |
| Start Time          | The date and time that the test began                                                                                                  |
| End Time            | The date and time that the test ended                                                                                                  |
| Total time taken    | The time for the test to complete in days, hours, minutes, and seconds                                                                 |
| Test Status         | The result of the test, either pass or fail                                                                                            |
| Total injected      | The total number of packets injected during the test                                                                                   |
| Total Received      | The total number of packets received during the test                                                                                   |
| OutPrf Injected     | The total number of out-of-profile packets injected during the test                                                                    |
| OutPrf Received     | The total number of out-of-profile packets received during the test                                                                    |
| InPrf Injected      | The total number of in-profile packets injected during the test                                                                        |
| In Prf Received     | The total number of in-profile packets received during the test                                                                        |
| Throughput Configd  | The configured throughput threshold value                                                                                              |
| Throughput Agg      | The sum of all frame payload rates used for the test                                                                                   |
| Throughput Oper     | The measured SAP ingress throughput of the test head                                                                                   |
| Throughput Measured | The measured throughput value, which must be within 1% of configured CIR or PIR threshold value in order for the test to pass          |
| Marker Pkt Bandwid* | The extra bandwidth used by the test head, in addition to the provisioned frame payload, in order to run a performance monitoring test |
| Tput Acceptance     | The throughput acceptance test result, either pass or fail                                                                             |
| PIR Tput Configured | The configured PIR throughput value                                                                                                    |
| PIR Tput Meas       | The measured PIR throughput                                                                                                            |
| PIR Tput Acep       | The PIR throughput acceptance test result, either pass or fail                                                                         |

| Label               | Description                                                           |
|---------------------|-----------------------------------------------------------------------|
| CIR Tput Configured | The configured CIR throughput value                                   |
| CIR Tput Meas       | The measured CIR throughput                                           |
| CIR Tput Acep       | The CIR throughput acceptance test result, either pass or fail        |
| FLR Configured      | The frame loss rising acceptance criteria value                       |
| FLR Measured        | The measured frame loss rising value                                  |
| FLR Acceptance      | The frame loss rising test result, either pass or fail                |
| OutPrf FLR Conf     | The out-of-profile frame loss rising acceptance criteria value        |
| OutPrf FLR Meas     | The out-of-profile measured frame loss rising value                   |
| OutPrf FLR Acep     | The out-of-profile frame loss rising test result, either pass or fail |
| InPrf FLR Conf      | The in-profile frame loss rising acceptance criteria value            |
| InPrf FLR Meas      | The in-profile measured frame loss rising value                       |
| InPrf FLR Acep      | The in-profile frame loss rising test result, either pass or fail     |
| Latency Configd     | The latency acceptance criteria value                                 |
| Latency Measurd     | The measured latency value                                            |
| Latency Acceptance  | The latency test result, either pass or fail                          |
| OutPrf Lat Conf     | The out-of-profile latency acceptance criteria value                  |
| OutPrf Lat Meas     | The out-of-profile measured latency value                             |
| OutPrf Lat Acep     | The out-of-profile latency test result, either pass or fail           |
| InPrf Lat Conf      | The in-profile latency acceptance criteria value                      |
| InPrf Lat Meas      | The in-profile measured latency value                                 |
| InPrf Lat Acep      | The in-profile latency test result, either pass or fail               |
| Jitter Configd      | The jitter rising acceptance criteria value                           |
| Jitter Measurd      | The measured jitter rising value                                      |
| Jitter Acceptance   | The jitter rising test result, either pass or fail                    |

| Label              | Description                                                       |
|--------------------|-------------------------------------------------------------------|
| OutPrf Jit Conf    | The out-of-profile jitter rising acceptance criteria value        |
| OutPrf Jit Meas    | The out-of-profile measured jitter rising value                   |
| OutPrf Jit Acep    | The out-of-profile jitter rising test result, either pass or fail |
| InPrf Jit Conf     | The in-profile jitter rising acceptance criteria value            |
| InPrf Jit Meas     | The in-profile measured jitter rising value                       |
| InPrf Jit Acep     | The in-profile jitter rising test result, either pass or fail     |
| Total Pkts. Tx.    | The total number of packets transmitted during the test           |
| OutPrf Lat Pkts R* | The out-of-profile latency packets received                       |
| InPrf Lat Pkts. R* | The in-profile latency packets received                           |

## oam-perf

### Syntax

**oam-perf** [detail]

### Context

show>test-oam

### Description

This command displays OAM performance information, including packet per second rates and the cumulative packets receive and transmitted. Statistics are cleared using the **clear>test-oam>oam-perf** command to properly interpret current data rate. The counts are displayed since the last clear and may be skewed because of irrelevant historical data.

### Parameters

**detail**

displays detailed information

### Output

The following output is an example of OAM performance information.

#### Output example

```
*A:Sar18 Dut-B>show#test-oam oam-perf detail
Current Time : 01/25/2021 15:12:59
```

```

Last Clear : 01/25/2021 15:12:57
Period Duration : 0d 00:00:01 (1.49 seconds)

=====
OAM packets Tx by locally initiated tests and Rx from remotely initiated tests
=====
OAM Type --- Local Tests --- -- Remote Tests --
 TxPackets Rate(pps) RxPackets Rate(pps)

BIER 0 0.00 0 0.00
Eth-CFM 1 0.67 0 0.00
ICMP 2 1.34 0 0.00
LSP 0 0.00 0 0.00
LSP-Self-Ping 0 0.00 0 0.00
MAC CPE MFIB 0 0.00 0 0.00
MPLS DM 0 0.00 0 0.00
Multicast 0 0.00 0 0.00
SDP SVC 0 0.00 0 0.00
Twamp-Light 47 31.54 0 0.00
VCCV 0 0.00 0 0.00
VPRN 0 0.00 0 0.00
VXLAN 0 0.00 0 0.00
other 0 0.00 0 0.00
Total 50 33.56 0 0.00
=====

```

## interface

### Syntax

**interface** *interface-name* [**detail** | **aggregate** | **sample** | **debug-counters**]

### Context

show>test-oam>link-meas

### Description

This command displays the link measurement operational information, reporting, and recorded results for a specific interface.

The **aggregate** option displays basic operational information and a summary of aggregate sample window delay information. The **sample** option displays basic operational information and a summary of sample window delay measurement information. The **detail** option displays information for both sample window types.

### Parameters

*interface-name*

the interface name, up to 32 characters, for which link measurement information is displayed

**detail**

displays complete link measurement operational information, reporting, and results

**aggregate**

displays operational information, reporting and aggregate sample window results

**sample**

displays operational information, reporting, and sample window results

**debug-counters**

displays debug counter information

**Output**

The following output is an example of link measurement operational information for an interface and [Table 42: Interface link measurement field descriptions](#) describes the fields.

**Output example**

```
*A:SAR18>show>test-oam>link-meas# interface "to1" detail
```

```
=====
Interface Link Measurement Information - to1
=====
Template Name: LinkMeasurementTpl
Oper State : Up
Protocol : IPv4
Oper Source Address : 1.2.2.2
Source Auto-Assigned : Yes
Oper Destination Address : 1.2.2.1
Destination Auto-Assigned: No
In-Use Src UDP Port : 49154
In-Use Dst UDP Port : 862
STAMP Session Identifier : 1003
Failure Condition(s) : None
Detectable Tx Error : None

Reporting

Reporting Operational : Yes
Delay Measure Last Reported: 25us
Timestamp : 2026/10/21 15:08:02
Triggered By : SampleThresholdAbsolute

Aggregate Sample Window Delay Measurement Detail Currently Reporting: Min

End Timestamp (UTC) State Count Min(us) Max(us) Avg(us) I Result

N/A InProgress 6 0 0 0 - 0
2026/10/21 15:14:02 Completed 12 24 25 24 Y 24
2026/10/21 15:12:02 Completed 12 24 25 24 Y 24
2026/10/21 15:10:02 Completed 12 24 25 24 Y 24
2026/10/21 15:08:02 SwReported 1 0 0 0 N 0
2026/10/21 15:07:52 Completed 12 24 24 24 Y 24
2026/10/21 15:05:51 Terminated 0 0 0 0 N 0
2026/10/21 15:05:46 SwReported 7 0 0 0 N 0
2026/10/21 15:04:36 SwReported 1 0 0 0 N 0
2026/10/21 15:04:26 SwReported 2 0 0 0 N 0

Sample Window Delay Measurement Detail Currently Reporting: Min

End Timestamp (UTC) State Rcv/Snt Min(us) Max(us) Avg(us) E F I Result

N/A InProgress 8/8 0 0 0 N N - 0
2026/10/21 15:15:02 Completed 10/10 25 25 25 N Y Y 25
```

```

2026/10/21 15:14:52 Completed 10/10 24 26 24 N Y Y 24
2026/10/21 15:14:42 Completed 10/10 24 25 24 N Y Y 24
2026/10/21 15:14:32 Completed 10/10 24 25 24 N Y Y 24
2026/10/21 15:14:22 Completed 10/10 24 26 24 N Y Y 24
2026/10/21 15:14:12 Completed 10/10 24 25 24 N Y Y 24
2026/10/21 15:14:02 Completed 10/10 24 25 24 N Y Y 24
2026/10/21 15:13:52 Completed 10/10 24 26 25 N Y Y 24
2026/10/21 15:13:42 Completed 10/10 24 26 25 N Y Y 24

```

-----  
Sample and Aggregate Legend:

\*: Value greater than column width allows

N/A: Nonexistent or incalculable value

I: Integrity threshold satisfied

E: Indicates reception of duplicate packets or zero or negative values

F: Indicates unexpected STAMP flag state

Table 42: Interface link measurement field descriptions

| Label                                         | Description                                                                                                                                                                                                                                                                  |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Interface Link Measurement Information</b> |                                                                                                                                                                                                                                                                              |
| Template Name                                 | The name of the link measurement template                                                                                                                                                                                                                                    |
| Oper State                                    | The operational state of the test configured under the interface<br><br>Up — assigned link-measurement template. A test protocol is enabled; UDP port is available, and internal resources are available.<br><br>Down — one or more requirements for the Up state is not met |
| Protocol                                      | The active protocol encapsulating the test packet, either IPv4 or IPv6                                                                                                                                                                                                       |
| Oper Source Address                           | The source address of the test packet                                                                                                                                                                                                                                        |
| Source Auto-Assigned                          | The source address is automatically determined<br><br>No — the source is configured or cannot be automatically determined<br><br>Yes — the source is automatically determined                                                                                                |
| Oper Destination Address                      | The destination address of the test packet (IPv4 or IPv6)                                                                                                                                                                                                                    |
| Destination Auto-Assigned                     | The destination address is automatically determined<br><br>No — the destination is configured or cannot be automatically determined<br><br>Yes — the destination is automatically determined                                                                                 |
| In-Use Src UDP Port                           | The in-use source UDP port                                                                                                                                                                                                                                                   |
| In-Use Dst UDP Port                           | The in-use destination UDP port                                                                                                                                                                                                                                              |



| Label                                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STAMP Session Identifier                                | The STAMP session ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Failure Condition(s)                                    | The requirements not met causing an Oper Down state                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Detectable Tx Errors                                    | The error condition detected that may prevent the test packet from being sent                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Reporting</b>                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Reporting Operational                                   | Indicates whether the current value should be compared to a threshold and possibly reported<br><br>Yes — at least one threshold in either window is configured<br>No — none of the thresholds in either window is configured                                                                                                                                                                                                                                                                                               |
| Delay Measurement Last Reported                         | The value of the last measurement reported to the routing engine                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Timestamp                                               | The end timestamp (UTC) of the last reported delay measurement                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Trigger By                                              | The window and threshold type that was exceeded triggering the reporting. Only one will be reported if multiple are triggered in the same window.                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Aggregate Sample Window Delay Measurement Detail</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Count                                                   | The number of sample windows included in the aggregate sample window                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Sample Window Delay Measurement Detail</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Rcv/Snt                                                 | The number of response test packets received (Rcv) and sent (Snt)                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Err                                                     | The number of errors included in the sample window.<br>This is the total of duplicates, zero, and negative valued measurements. The negative error count is incremented if either direction is negative, regardless of the unidirectional-measurement configuration method.<br><br>A negative measurement in either direction calls into question the validity of both directions. Errors are included in the receive count, but do not count toward integrity.<br><br>* — value exceeds column width; value more than 999 |
| <b>Sample Window Delay Measurement Detail</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Currently Reporting                                     | The configured value of the delay measurement to consider (Min, Max, Avg, MoX, XoM)                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Label               | Description                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| End Timestamp (UTC) | The time at which the window closed                                                                                                                                                                                                                                                                                                                                                             |
| State               | <p>The state of the window</p> <p>InProgress — currently executing</p> <p>Completed — closed via normal execution</p> <p>Terminated — preempted by some action; closed and not considered for report</p> <p>SwReported — new delay reported from this sample window</p> <p>AswReported — new delay reported from this aggregate sample window (only applicable to Aggregate Sample Windows)</p> |
| Min (us)            | <p>The minimum delay value recorded in this window, in microseconds</p> <p>N/A — not applicable or in calculable, when no responses are received, or all are in error</p>                                                                                                                                                                                                                       |
| Max (us)            | <p>The maximum delay value recorded in this window, in microseconds</p> <p>N/A — not applicable or in calculable, when no responses are received, or all are in error</p>                                                                                                                                                                                                                       |
| Avg (us)            | <p>The average delay value recorded in this window, in microseconds</p> <p>N/A — not applicable or in calculable, when no responses are received, or all are in error</p>                                                                                                                                                                                                                       |
| I                   | The window has integrity percentage and should be considered, either yes (Y) or no (N)                                                                                                                                                                                                                                                                                                          |
| Results             | <p>The metric considered for reporting in this window</p> <p>N/A — not applicable or in calculable, when no responses are received, or all are in</p>                                                                                                                                                                                                                                           |

## measurement-template

### Syntax

**measurement-template** [*template-name*]

### Context

show>test-oam>link-meas

Description

This command displays basic link measurement template information, such as the administrative state and number of interfaces referencing the template.

The base command can filter and produce output for a single measurement template. When the measurement template name is specified, delayed information about the template is displayed.

Parameters

*template-name*  
the link measurement template name, up to 64 characters, for which to display a filtered list

Output

The following outputs are examples of link measurement template information and [Table 43: Link measurement template field descriptions](#) describes the fields.

Output example

```
*A:Sar18 Dut-B>show>test-oam>link-meas# measurement-template
=====
Measurement Templates
=====
Name Admin Interface
 Act/Tot

measurement-template-1 up 2/4
measurement-template-2 down 10/22

No. of measurement templates: 1
=====

*A:SAR18>show>test-oam>link-meas# measurement-template "LinkMeasurementTpl"
=====
Template Name: LinkMeasurementTpl
=====
Description : (Not Specified)
Admin State : Up
Unidirectional Measurement: derived
Delay Measurement : min
Interval : 1s
Last Reported Delay Hold : 86400s
Reporting : enabled

Protocol: TWAMP Light

Cfg Src UDP Port : (Not Specified)
Destination UDP Port: 862
DSCP : ncl
Profile : in
TTL : 1
Timestamp Format : ntp
FC : h1
Allow Egress Remark: No
IPv6 UDP Checksum 0: Disallow

STAMP TLVs

Pad TLV Size : 500
Return Path TLV: N/A
```

```

IPv6 Destination Discovery

Admin State : Down
Discovery Interval: 10 Discovery Timer: 60
Update Interval : 600

Sample Window

Interval Multiplier : 10 Duration : 10s
Relative Threshold : 500% Absolute Threshold : 1us
Window Integrity : 0%

Aggregate Sample Window

Sample Multiplier : 12 Duration : 120s
Relative Threshold : N/A Absolute Threshold : N/A
Window Integrity : N/A

Active Interfaces: 1
Total Interfaces : 1
=====

```

Table 43: Link measurement template field descriptions

| Label                        | Description                                                                                                                                                                             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name                         | Displays the name of the link measurement template                                                                                                                                      |
| Admin                        | Displays the administrative state of the measurement                                                                                                                                    |
| Ref Act                      | Displays the number of interfaces actively (Oper Up) referencing this link measurement template                                                                                         |
| Refs Total                   | Displays the number of interfaces referencing this link measurement template, regardless of the operational state                                                                       |
| No. of measurement templates | Displays the total number of configured measurement templates                                                                                                                           |
| Template Name                | Displays the name of the link measurement template                                                                                                                                      |
| Description                  | Displays the configured description of the link measurement template                                                                                                                    |
| Admin State                  | Displays the administrative state of the measurement template                                                                                                                           |
| Unidirectional Measurement   | Displays which computational method is used to calculate the delay metric: <ul style="list-style-type: none"> <li>actual — forward delay</li> <li>derived — half the roundup</li> </ul> |
| Delay Measurement            | Displays the delay metric compared to the threshold: <ul style="list-style-type: none"> <li>min — minimum recorded value</li> </ul>                                                     |

| Label                    | Description                                                                                                                                                                                                                                                              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | <ul style="list-style-type: none"> <li>max — maximum recorded value</li> <li>avg — average recorded value</li> </ul>                                                                                                                                                     |
| Interval                 | Displays the probe frequency of the test packet                                                                                                                                                                                                                          |
| Last Reported Delay Hold | Displays the configured value that determines the time a reported delay measurement should be cleared if the operational state of the test transitions to down and remains there at least the length of this timer                                                       |
| Reporting                | Displays whether reporting is enabled or disabled                                                                                                                                                                                                                        |
| Protocol                 | Displays the type of test packet used to report delay                                                                                                                                                                                                                    |
| Config Src UDP Port      | The configured source UDP port for test packets                                                                                                                                                                                                                          |
| Destination UDP Port     | The configured destination UDP port for test packets                                                                                                                                                                                                                     |
| Timestamp Format         | Displays the format of the timestamp encoded in the test: <ul style="list-style-type: none"> <li>packetntp — Network Time Protocol format 32 seconds, 32 fractional</li> <li>secondsptp — Truncated Precision Time Protocol format 32 seconds, 32 nanoseconds</li> </ul> |
| DSCP                     | Displays the configured DSCP in the IP header of the test packet                                                                                                                                                                                                         |
| FC                       | Displays the configured forwarding class in the local node                                                                                                                                                                                                               |
| Profile                  | Displays the profile of the test packet in the local node                                                                                                                                                                                                                |
| Allow Egress Remark      | Displays whether the egress QoS policy can remark the DSCP of the test<br><br>packetNo — the egress QoS policy is bypassed unless force-remark is enabled<br><br>Yes — the egress QoS policy is applied                                                                  |
| TTL                      | Displays the IP header time to live (IPv4) or hop limit (IPv6)                                                                                                                                                                                                           |
| IPv6 UDP Checksum 0      | Displays whether processing of IPv6 packets that arrive with UDP checksum 0 is allowed or disallowed<br><br>Disallow — packets are discarded<br><br>Allow — the arriving packets are processed                                                                           |
| <b>STAMP TLVs</b>        |                                                                                                                                                                                                                                                                          |
| Pad TLV Size             | Displays the TLV padding size                                                                                                                                                                                                                                            |
| Return Path TLV          | Displays whether the router will include a return path sub-TLV link                                                                                                                                                                                                      |

| Label                   | Description                                                                                                    |
|-------------------------|----------------------------------------------------------------------------------------------------------------|
| Admin State             | Displays whether IPv6 address discovery is enabled or disabled                                                 |
| Discovery Interval      | The discovery interval in seconds                                                                              |
| Discovery Timer         | The length of time to remain in discovery mode, in seconds                                                     |
| Update Interval         | The update interval, in seconds                                                                                |
| <b>Sample Window</b>    |                                                                                                                |
| Sample Window           | Displays the header for sample window objects                                                                  |
| Interval Multiplier     | Displays the number of probes in the sample window, multiplying this value and the interval                    |
| Aggregate Sample Window | Displays the calculated length of the window in seconds                                                        |
| Sample Multiplier       | Displays the number of sample windows in the aggregate sample window                                           |
| Duration                | Displays the calculated length of the window, in seconds                                                       |
| Relative Threshold      | Displays the configured percentage difference comparing the current and previously reported measurements       |
| Absolute Threshold      | Displays the configured microsecond difference comparing the current and previously reported measurements      |
| Window Integrity        | Displays the minimum number of measurements, expressed as a percentage, before the window is consider integral |
| Active Interfaces       | Displays the number of interfaces actively (Oper Up) referencing the link measurement template                 |
| Total Interfaces        | Displays the number of interfaces referencing the link measurement template, regardless of operational state   |

## measurement-template-using

### Syntax

**measurement-template-using** [*measurement-template*]

### Context

show>test-oam>link-meas

Description

This command displays the link measurement templates and the IP interfaces associated with those templates.

The base command provides a single list of all measurement templates, but the command can filter and produce output for a single measurement template.

Parameters

*measurement-template*  
the link measurement template name, up to 64 characters, for which to display a filtered list

Output

The following output is an example of link measurement template and IP interfaces information and [Table 44: Link measurement templates and IP interfaces field descriptions](#) describes the fields.

Output example

```
*A:Sar18 Dut-B>show>test-oam>link-meas#measurement-template-using [<template-name>]
=====
Measurement Templates
=====
Template Name
Interface Name Protocol

measurement-template-1
router-interface-1-2 ipv4
measurement-template-1
router-interface-1-55 ipv6
=====
```

Table 44: Link measurement templates and IP interfaces field descriptions

| Label          | Description                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Template Name  | The name of the link measurement template                                                                                                   |
| Interface Name | The name of the interface using the link measurement template                                                                               |
| Protocol       | The IP protocol enabled under the dynamic delay section of the interface: IPv4, IPv6, or None.<br><br>None indicates no protocol is enabled |

3.8.2.3 Clear commands

```
saa
```

Syntax

**saa-test** [*test-name* [*owner test-owner*]]

## Context

clear

## Description

This command clears the SAA results for the specified test and the history for the test. If the test name is omitted, all the results for all tests are cleared.

## Parameters

*test-name*

specifies the SAA test to clear. The test name must already be configured in the **config>saa>test** context.

*test-owner*

specifies the owner of an SAA operation, up to 32 characters in length

**Default** If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI"

## dual-ended-loss-test

## Syntax

**dual-ended-loss-test mep mep-id domain md-index association ma-index**

## Context

clear>eth-cfm

## Description

This command clears the accumulated frame counters during a dual-ended loss measurement (LM) test.

The LM counters are reset when a MEP on the datapath is created or deleted automatically by the system for network or configuration reasons. Some of the reasons for creating or deleting a MEP are as follows, excluding the general functions of manually creating or deleting a MEP:

- for SAPs
  - changing the ccm-ltm-priority using the CLI or SNMP
  - changing the ccm-interval using the CLI or SNMP
  - changing the SAP egress QoS policy
  - changes to the SAP state (due to, for example, moving (bouncing) ports, link loss forwarding (LLF), or network changes that require recreation of flows)
- for spoke SDPs
  - changing the VC type on the spoke SDP
  - changing the VC vc-tag on the spoke SDP
  - changing the VC etype on the spoke SDP
  - change to the spoke SDP state due to network conditions





**Note:** The **clear>dual-ended loss-test** command only resets the “Accumulated Frames During the Test” results for both the far end and near end. The frame counters for aggregated results are not reset. See [Output example - before receiving fewer than two CCMs](#).

Parameters

- mep-id

specifies the target MEP ID

Values1 to 8191
- md-index

displays the index of the MD to which the MEP is associated, or 0, if none

Values1 to 4294967295
- ma-index

displays the index of the MA to which the MEP is associated, or 0, if none

Values1 to 4294967295

Output

The following outputs are examples of displays after a **show>eth-cfm>.....>dual-ended-loss-test** command is issued:

- before receiving fewer than two CCMs after the **clear** command is issued
- after receiving two or more CCMs after the **clear** command is issued

Output example - before receiving fewer than two CCMs

|                                |                     |                |         |
|--------------------------------|---------------------|----------------|---------|
| =====                          |                     |                |         |
| Eth CFM Dual-Ended Test Result |                     |                |         |
| =====                          |                     |                |         |
| Far-End Mac Addr               | : 00:1a:f0:69:d4:a6 | Duration (sec) | : 0     |
| Latest Frame Counters          | In Previous CCM     | In Current CCM | Delta   |
| TxLocal                        | : 0                 | 0              | 0       |
| RxFarEnd                       | : 0                 | 0              | 0       |
| TxFarEnd                       | : 0                 | 0              | 0       |
| RxLocal                        | : 0                 | 0              | 0       |
| Accumulated Frames During Test |                     | Near-End       | Far-End |
| Total Tx                       | :                   | 0              | 0       |
| Total Rx                       | :                   | 0              | 0       |
| Total Loss                     | :                   | 0              | 0       |
| Loss Ratio(%)                  | :                   | 0.00           | 0.00    |
| =====                          |                     |                |         |

Output example - after receiving two or more CCMs

|                                |                     |                |       |
|--------------------------------|---------------------|----------------|-------|
| =====                          |                     |                |       |
| Eth CFM Dual-Ended Test Result |                     |                |       |
| =====                          |                     |                |       |
| Far-End Mac Addr               | : 00:1a:f0:69:d4:a6 | Duration (sec) | : 2   |
| Latest Frame Counters          | In Previous CCM     | In Current CCM | Delta |
| TxLocal                        | : 123556            | 123566         | 10    |

|                                |   |        |          |         |
|--------------------------------|---|--------|----------|---------|
| RxFarEnd                       | : | 123550 | 123560   | 10      |
| TxFarEnd                       | : | 123550 | 123560   | 10      |
| RxLocal                        | : | 123556 | 123566   | 10      |
| Accumulated Frames During Test |   |        | Near-End | Far-End |
| Total Tx                       | : |        | 10       | 10      |
| Total Rx                       | : |        | 10       | 10      |
| Total Loss                     | : |        | 0        | 0       |
| Loss Ratio(%)                  | : |        | 0.00     | 0.00    |
| =====                          |   |        |          |         |

## oam-pm

### Syntax

**oam-pm session** *session-name* **twamp-light**

### Context

clear

### Description

This command clears OAM performance statistics reported by **show>test-oam >oam-perf [ detail]**.

### Parameters

#### **session-name**

Identifies the session name, up to 32 characters, that the test is associated with.

#### **twamp-light**

Specifies the TWAMP-light test that is affected by the command.

## server

### Syntax

**server**

### Context

clear>test-oam>twamp>

### Description

This command clears the statistics for the TWAMP server.

## testhead

### Syntax

**testhead [result] [test-name [owner test-owner]]**

**Context**

clear

**Description**

This command clears the ITU-T Y.1564 test head statistics.

**Parameters**

*test-name*

specifies a Y.1564 test to clear

*test-owner*

clears all Y.1564 tests assigned to a specific owner

### 3.8.2.4 Monitor commands

oam-pm

**Syntax**

oam-pm

**Context**

monitor

**Description**

Commands in this context monitor Operations, Administration, and Maintenance Performance Management information.

session

**Syntax**

**session** *session-name*

**Context**

monitor>oam-pm

**Description**

This command monitors the raw measurement interval for the specified session and test.

**Output**

The following output is an example of raw session measurement information.

## Output Example

```
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

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          |
| 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)

```

```

 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

```

```

monitor oam-pm session "ip-vprn-500" twamp-light

```

```

At time t = 0 sec (Base Statistics)

```

|                                               |             |         |          |            |
|-----------------------------------------------|-------------|---------|----------|------------|
| -----                                         |             |         |          |            |
| Frame Delay (FD) Bin Counts                   |             |         |          |            |
| -----                                         |             |         |          |            |
| Bin                                           | Lower Bound | Forward | Backward | Round Trip |
| -----                                         |             |         |          |            |
| 0                                             | 0 us        | 89719   | 113813   | 82529      |
| 1                                             | 1000 us     | 51728   | 43288    | 62811      |
| 2                                             | 2000 us     | 19304   | 7882     | 16979      |
| 3                                             | 3000 us     | 5207    | 1300     | 3067       |
| 4                                             | 4000 us     | 1166    | 335      | 1280       |
| 5                                             | 5000 us     | 469     | 255      | 781        |
| 6                                             | 6000 us     | 227     | 129      | 361        |
| 7                                             | 7000 us     | 121     | 166      | 152        |
| 8                                             | 8000 us     | 83      | 253      | 114        |
| 9                                             | 10000 us    | 125     | 728      | 75         |
| -----                                         |             |         |          |            |
| Frame Delay Range (FDR) Bin Counts            |             |         |          |            |
| -----                                         |             |         |          |            |
| Bin                                           | Lower Bound | Forward | Backward | Round Trip |
| -----                                         |             |         |          |            |
| 0                                             | 0 us        | 167124  | 166618   | 167138     |
| 1                                             | 5000 us     | 1025    | 1531     | 1011       |
| -----                                         |             |         |          |            |
| Inter-Frame Delay Variation (IFDV) Bin Counts |             |         |          |            |
| -----                                         |             |         |          |            |
| Bin                                           | Lower Bound | Forward | Backward | Round Trip |
| -----                                         |             |         |          |            |
| 0                                             | 0 us        | 29284   | 45291    | 36062      |
| 1                                             | 100 us      | 9615    | 10793    | 28238      |
| 2                                             | 200 us      | 9289    | 9827     | 20379      |
| 3                                             | 300 us      | 8933    | 8733     | 14325      |
| 4                                             | 400 us      | 8597    | 8362     | 10257      |
| 5                                             | 500 us      | 8216    | 7789     | 7635       |
| 6                                             | 600 us      | 8178    | 7606     | 5893       |
| 7                                             | 700 us      | 7782    | 7345     | 4963       |
| 8                                             | 800 us      | 14799   | 14500    | 8416       |
| 9                                             | 1000 us     | 63455   | 47902    | 31980      |
| -----                                         |             |         |          |            |

twamp-light

Syntax

twamp-light [interval seconds] [ repeat repeat] [absolute | rate] [delay | loss]

Context

monitor>oam-pm>session

Description

This command monitors the IP Two Way Active Measurement Protocol Light (TWAMP Light) statistics for the specified test's raw measurement interval.

**Parameters**

***seconds***

specifies the time interval, in seconds

**Values**    3 to 60

**Default**    10

***repeat***

specifies the number of times the command is repeated

**Values**    1 to 999

**Default**    10

***absolute***

specifies that the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

***rate***

specifies that the rate-per-second is displayed

**Default**    delta

***delay***

specifies the delay metrics are displayed

**Default**    delay

***loss***

specifies the loss metrics are displayed

**3.8.2.5 Debug commands**

oam

**Syntax**

[no] oam

**Context**

debug

**Description**

This command enables or disables debugging for OAM.



## lsp-ping-trace

### Syntax

**lsp-ping-trace** [tx | rx | both] [raw | detail]

**no lsp-ping-trace**

### Context

debug>oam

### Description

This command enables debugging for LSP ping.

### Parameters

**tx | rx | both**

specifies the direction for the LSP ping debugging: transmit, receive, or both transmit and receive

**raw | detail**

displays output for the debug mode

## 4 Mirroring

This chapter provides information about mirroring support on the 7705 SAR.

Topics in this chapter include:

- [Mirroring overview](#)
- [Mirroring implementation](#)
- [Packet capture](#)
- [Configuration notes](#)
- [Configuring mirroring with the CLI](#)
- [Mirror service configuration command reference](#)

### 4.1 Mirroring overview

To assist in troubleshooting complex operational problems, certain packets may need to be examined as they traverse the network. One way to accomplish this is with an overlay of network analyzers established at multiple PoPs, together with skilled technicians to operate them to decode the data provided. This method of traffic mirroring often requires setting up complex filters in multiple switches or routers. These, at best, are only able to mirror from one port to another on the same device.

Nokia support for mirroring on the 7705 SAR extends and integrates these capabilities into the network and provides significant operational benefits. Each router can mirror packets to any Ethernet interface destination point in the network. Mirroring can be sourced from ports, SAPs, or MAC filters, enabling flexible traffic selection across access, hybrid, and network service configurations.

This capability also extends beyond troubleshooting services. Telephone companies have the ability to obtain itemized calling records and wiretaps where legally required by investigating authorities. The process can be complex and costly to carry out on data networks. Service mirroring simplifies these tasks by enabling mirroring directly from the service SAP, and reduces costs through centralization of analysis tools and skilled technicians.

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

The mirrored frame size that is to be transmitted to the mirror destination can be explicitly configured by using slicing features. This enables mirroring of only the parts needed for analysis while minimizing network resource usage. For example, only the headers can be copied for analysis, protecting the integrity and security of customer data, or conversely, copying the full packet, including customer data.

#### 4.1.1 Hardware support

Mirroring is supported on the following hardware:

- 2-port 10GigE (Ethernet) Adapter card (only on the 2.5 Gb/s v-port)

- 6-port Ethernet 10Gbps Adapter card
- 8-port Gigabit Ethernet Adapter card
- 10-port 1GigE/1-port 10GigE X-Adapter card
- Packet Microwave Adapter card
- 2-port 10GigE (Ethernet) module (only on the 2.5 Gb/s v-port)
- 4-port SAR-H Fast Ethernet module
- 6-port SAR-M Ethernet module
- 7705 SAR-A
- 7705 SAR-Ax
- 7705 SAR-H
- 7705 SAR-Hc
- 7705 SAR-M
- 7705 SAR-Wx
- 7705 SAR-X

## 4.2 Mirroring implementation

The 7705 SAR supports port mirroring, as well as SAP-based and MAC filter-based mirroring. The network processor of the datapath preserves the original packet throughout the forwarding and mirroring process, making any necessary packet changes, such as adding encapsulation, on a separate copy.

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

- Ingress and egress packets are mirrored as they appear on the wire. This is important for troubleshooting encapsulation and protocol issues.
  - When mirroring at ingress, the network processor sends an exact copy of the original ingress packet to the mirror destination while normal forwarding proceeds on the original packet.
  - When mirroring is at egress, the system performs normal packet handling on the egress packet, encapsulating it for the destination interface. A copy of the forwarded packet is forwarded to the mirror destination. Because the mirror copy of the packet is created before egress queuing, the mirrored packet stream may include copies of packets that are discarded in egress queues, such as during congestion or rate limiting.
- Mirroring supports tunnel destinations.
  - 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.

### 4.2.1 Mirror sources and destinations

Mirror sources and destinations have the following characteristics:

- Mirroring is supported on the following service types: Epipe (including MEF 8), VPLS, IES, and Ipipe.
- Sources and destinations can be on the same router (local) or on two different routers (remote).

- Mirror destinations can terminate on egress virtual ports, which allows 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.

When multiple mirror destinations terminate on the same egress port, the individual dot1q tags can provide a DTE/DCE separation between the mirror sources.

- Packets ingressing a port can have a mirror destination separate from packets egressing the same port or a different port (the ports can be on separate nodes).
- Multiple mirror destinations are supported (local or remote) on a single node.
- 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** objects are down. The state of a mirror destination does not depend on inputs such as SDPs configured under **mirror-dest>remote-source** or **debug>mirror-source** entries.

#### 4.2.1.1 Mirror source priority

Mirror sources on the 7705 SAR include ports, SAPs, and MAC filters. SAP-based mirroring follows the same destination behavior as port-based mirroring and supports both local and remote mirror destinations. When multiple mirror sources apply to the same packet, the system mirrors the packet only once, based on a fixed priority order. On the 7705 SAR, mirror source priority from highest to lowest is:

1. MAC filter mirroring
2. SAP mirroring
3. port mirroring

MAC filter mirroring is evaluated first. If a packet matches a MAC filter rule, it is mirrored according to the filter's mirror-source definition. If no MAC filter applies, SAP mirroring is evaluated next. Port mirroring is applied only when neither MAC filter nor SAP mirroring applies.

#### 4.2.1.2 Local remote mirroring

Mirrored frames can be copied and sent to a specific local destination 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 network analyzer (sniffer) resources, and also the technical staff who operate them.

The router allows multiple concurrent mirroring sessions so that traffic from more than one ingress mirror source can be mirrored to the same or different egress mirror destinations.

Remote mirroring uses an SDP, which acts as a logical way of directing traffic from one router to another through a unidirectional 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 wants to provide mirroring services. SDPs must be created first, before services can be configured.

## 4.2.2 Mirroring refinements

Service mirroring can be refined using:

- [Slicing](#)
- [MAC filters](#)

### 4.2.2.1 Slicing

Slicing is a function that only mirrors a specified packet length from each frame. This is useful to monitor network usage without having to copy the actual data. Slicing enables the mirroring of larger frames than the destination packet decoding equipment can handle. It also allows conservation of mirroring resources by limiting the size of the stream of packets through the router and the core network.

When a mirror **slice-size** is defined, a threshold that truncates a mirrored frame to a specific size is created. For example, if the value of 256 bytes is defined, up to the first 256 bytes of the frame are transmitted to the mirror destination. The original frame is not affected by the truncation. Mirrored frames grow larger as encapsulations are added when packets are transmitted through the network core or out the mirror destination SAP to the packet/protocol decoding equipment.

The transmission of a sliced or non-sliced frame is also dependent on the mirror destination SDP path MTU or the mirror destination SAP physical MTU. Packets that require a larger MTU than the mirroring destination supports are discarded if the defined slice size does not truncate the packet to an acceptable size.

### 4.2.2.2 MAC filters

Mirroring can be refined with a MAC filter policy so that only specific MAC addresses, (source or destination), are mirrored. MAC filter policies are defined in the **config>filter>mac-filter** context. See the 7705 SAR Router Configuration Guide, "Filter Command Reference" for configuration information.

A MAC filter can be applied to the ingress or egress traffic on a VPLS SAP based on the source or destination MAC address. The filter can then be used as the source of mirrored traffic using the **debug>mirror-source>mac-filter** command. Service packets from matching MAC addresses can be mirrored to a local SAP or a remote router.

Mirrored traffic only includes packets as they would appear on the wire. For example, discarded packets in egress queues during congestion are not mirrored.

When multiple mirroring sources apply to the same packet, MAC filter mirroring takes priority over both SAP-based and port-based mirroring. Only if the MAC filter criteria are not met will SAP mirroring be applied, followed by port mirroring as the least specific match.

## 4.2.3 Mirroring performance

Replication of mirrored packets can affect performance and should be used carefully. The 7705 SAR, making use of network processor based forwarding, allows efficient mirror service scaling and, at the same time, allows a large amount of data to be mirrored with minimal performance impact. When a mirror destination is configured, the packet slice option can truncate mirrored packets to the destination, which minimizes replication and tunneling overhead.

When a packet at port ingress is mirrored, one extra buffer per packet is used. For more information, see the "Buffer Allocation for Multicast Traffic" section in the 7705 SAR Quality of Service Guide.

#### 4.2.4 Mirroring configuration

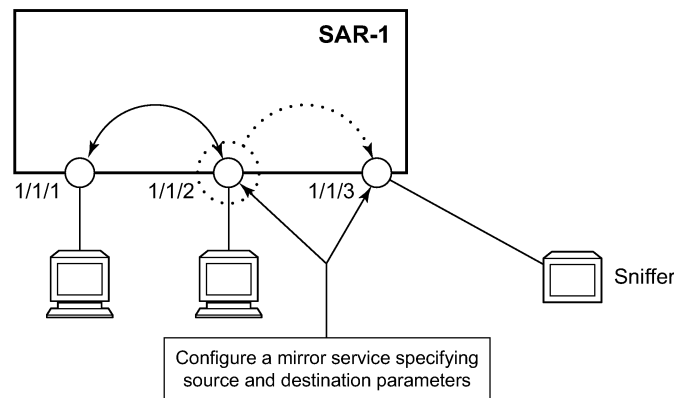
Configuring mirroring is similar to creating a unidirectional service. Mirroring requires the configuration of:

- mirror source – the port, ports, SAP, or MAC filter from which traffic is to be mirrored
- mirror destination – the location to send the mirrored traffic, where the sniffer will be located

The following figure shows a local mirror service configured on a 7705 SAR (SAR-1).

- Port 1/1/2 is specified as the source. Mirrored traffic ingress 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 ingress and egressing port 1/1/2 is sent here. SAP, encapsulation requirements, packet slicing, and mirror classification parameters are configured for the destination port. SDPs are not used in local mirroring.

Figure 30: Local mirroring example

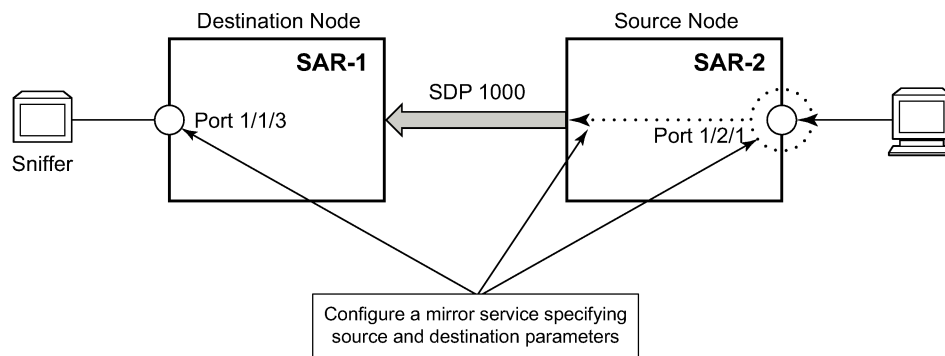


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The following figure shows a remote mirror service configured with SAR-2 as the mirror source and SAR-1 as the mirror destination. Mirrored traffic ingress and egressing port 1/2/1 (the source) on SAR-2 is handled in the following ways:

- Port 1/2/1 is specified as the mirror source port. Parameters are defined to select specific traffic ingress and egressing this port.
- Destination parameters are defined to specify where the mirrored traffic will be sent. In this case, mirrored traffic will be sent to a SAP configured as part of the mirror service on port 1/1/3 on SAR-1 (the mirror destination).
- SAR-1 decodes the service ID and sends the traffic out of port 1/1/3.
- The sniffer is physically connected to port 1/1/3. SAP, encapsulation requirements, packet slicing, and mirror classification parameters are configured for the destination port.

Figure 31: Remote mirroring example



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## 4.3 Packet capture

Packet capture (PCAP) provides the ability to copy control and data plane packets into a PCAP file for offline viewing and debugging. Debugging often requires packet mirroring. On the 7705 SAR, only remote file URLs are supported for PCAP. PCAP can be used with any mirroring source, including ports, SAPs, and MAC filters.

PCAP is useful in situations where the routing infrastructure limits remote packet capture due to subnet segregation for security purposes or due to firewall and filter rules.

Capturing mirrored packets in a PCAP file offers the following benefits:

- byte-level details for each captured packet
- full protocol analysis for every protocol related to the mirror source

Third-party applications such as Wireshark, for example, have a complete set of decoders.

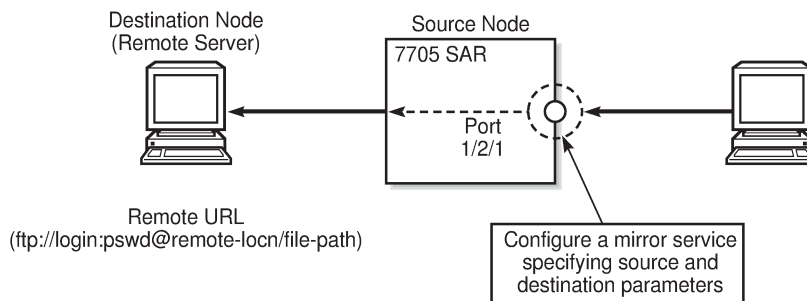
- a single capture for all relevant protocol packets instead of enabling captures on a per-control protocol basis. The capture contains details in chronological order.

The PCAP feature uses the **debug>mirror-source** command. Applying mirroring to a port does not affect the port itself and does not require changes to the port.

### 4.3.1 Feature details

The following figure illustrates a PCAP mirroring service. Configuration is done on the source node, including specifying a mirror source, mirror destination, and packet capture start and stop.

Figure 32: PCAP mirroring service



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The PCAP feature supports only mirror destinations that have remote file URLs. As shown in the figure, the remote URL includes the absolute path and filename for the remote FTP server.

A PCAP instance is required for packet capture and is created by issuing the **pcap session-name create** command. Creating a PCAP instance allocates a buffer and other background processes necessary to capture packets. The buffer does not accept packets until a file location for the mirror destination is specified and a mirror source is specified. The PCAP session name (*session-name*) has a one-to-one relationship with the PCAP file (*file-url*), meaning each session name is associated with one PCAP file.

The PCAP file is created when the filename is specified in the mirror destination configuration.

The **debug pcap capture start** command starts the capture, which stops automatically after a configured number of packets or the maximum number of packets (250) have been captured. Alternatively, before automatic capture is complete, the **capture stop** command can manually stop the capture.

In addition to starting the capture, the **start** command starts an FTP session. Packets start being written to the FTP server 500 ms after the **start** command is issued.

When the **stop** command is issued, all packets remaining in the buffer are written to the FTP server before the connection closes.

After buffering has stopped, restarting the PCAP session overwrites the existing PCAP file unless this is restricted by the FTP server's operating system.

When the buffer starts receiving packets, a periodic process to write packets to the file destination begins. The period is approximately 500 ms. Therefore, the operator must expect a similar delay before packets are written to the PCAP file. Packets continue to be written to the remote server until 250 packets have been captured, the operator manually stops the debug process, or the configured number of packets have been captured.

Packets are buffered in PCAP format and are ready to be written to the file without changes.

Deleting a mirror destination is allowed at any time, which immediately purges the buffer.

Deleting a mirror source is also allowed at any time; this causes the packets remaining in the buffer to be written to the mirror destination.



### 4.3.1.1 PCAP file format

The PCAP file format is shown in the example below. [Table 45: PCAP file format default values](#) lists the default values.

```
typedef struct pcap_hdr_s {
 guint32 magic_number; /* magic number */
 guint16 version_major; /* major version number */
 guint16 version_minor; /* minor version number */
 gint32 thiszone; /* GMT to local correction */
 guint32 sigfigs; /* accuracy of timestamps */
 guint32 snaplen; /* max length of captured packets, in octets */
 guint32 network; /* data link type */
} pcap_hdr_t;
```

```
typedef struct pcaprec_hdr_s {
 guint32 ts_sec; /* timestamp seconds */
 guint32 ts_usec; /* timestamp microseconds */
 guint32 incl_len; /* number of octets of packet saved in file */
 guint32 orig_len; /* actual length of packet */
} pcaprec_hdr_t;
```

Table 45: PCAP file format default values

| Field         | Description                                                       | Default value            |
|---------------|-------------------------------------------------------------------|--------------------------|
| magic_number  | The magic number used to detect the file format and byte ordering | 0xd4c3b2a1               |
| version_major | The major version number of the file format                       | 0x0200                   |
| version_minor | The minor version number of the file format                       | 0x0400                   |
| thiszone      | The GMT corrected to the local time setting                       | 0x00                     |
| sigfigs       | The number of significant figures in the timestamp                | 0x00                     |
| snaplen       | The maximum length of captured packets (octets)                   | 0xFFFF0000               |
| network       | The type of data link (Ethernet or RAW IP only)                   | 0x01000000 or 0x65000000 |
| ts_sec        | The timestamp in seconds                                          | —                        |
| ts_usec       | The timestamp in microseconds                                     | —                        |
| incl_len      | The number of octets of the packet saved in the file              | —                        |
| orig_len      | The total length of the packet                                    | —                        |

### 4.3.1.2 Limitations

The following limitations apply to PCAP:

- slicing size is not configurable for PCAP mirrored packets and is set to a fixed maximum value of 200 bytes
- up to 250 mirrored packets can be captured per PCAP session
- VLANs cannot be removed
- mirrored packets to PCAP may be dropped if cflowd and one or more PCAP sessions are used simultaneously, or if multiple PCAP sessions are used simultaneously

#### 4.3.1.3 Hardware support

The PCAP feature is supported on the hardware listed in [Hardware support](#).

#### 4.3.1.4 QoS requirements

The PCAP feature uses the same queues as cflowd. For more information about cflowd, see the "Cflowd" section in the 7705 SAR Router Configuration Guide. FTP packets use the SGT-QoS FTP application parameters.

### 4.4 Configuration notes

The mirroring configuration guidelines and restrictions are as follows:

- Multiple mirroring service IDs (mirror destinations) may be created within a single system.
- A mirrored source can only have one destination.
- The destination mirroring service IDs and service parameters are persistent between router reboots and are included in the configuration saves.

Mirror source criteria configuration (defined in **debug>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 and jabbers are not mirrored. Typically, only complete packets are mirrored.
- When starting or shutting down mirroring on mirror destinations, the following must be considered.
  - 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 or remote source. The associated mirror source is put into an operationally down mode. Mirrored packets are not transmitted out the SAP or SDP. Each mirrored packet is silently discarded. If the mirror destination is a SAP, the SAP's discard counters are incremented.
  - Issuing the **shutdown** command causes the mirror destination service or its mirror source to be put into an administratively down state. Mirror destination service IDs must be shut down first in order to delete a service ID, SAP, or SDP association from the system.

When starting or shutting down mirroring on mirror sources, the following must be considered.

- The default state for a mirror source for a given mirror destination service ID is **no shutdown**. You must 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.

## 4.5 Configuring mirroring with the CLI

This section provides information about configuring service mirroring using the CLI.

Topics in this section include:

- [Basic mirroring configuration](#)
- [Common configuration tasks](#)
- [Service management tasks](#)

### 4.5.1 Mirror configuration overview

Mirroring can be organized into the following logical entities:

- The mirror source is the location where ingress or egress traffic specific to a port, SAP or MAC filter is to be mirrored (copied). The original frames are not altered or affected in any way.
- An SDP is used to define the mirror destination on the source router to point to a remote destination (another router).
- A SAP is defined in local and remote mirror services as the mirror destination to which the mirrored packets are sent.

## 4.6 Basic mirroring configuration

Mirror destination parameters must include:

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

Mirror source parameters must include:

- a mirror service ID (same as the mirror destination service ID)
- the source type (port, SAP, or MAC filter)

The following example shows a configuration of a local mirrored service where the source and destinations are on the same device.

```
*A:SAR-1>config>mirror# info

mirror-dest 103 create
 sap 1/1/25:0 create
 egress
 qos 1
 exit
```

```

 exit
 no shutdown
 exit

*A:SAR-1>config>mirror#

```

The following example shows a mirror source configuration:

```

*A:SAR-1>show debug mirror
debug
 mirror-source 103
 port 1/1/24 egress ingress
 no shutdown
 exit
exit
*A:SAR-1>debug>mirror-source# exit

```

The following example shows a mirror source configuration using a SAP:

```

*A:srl2# show debug
debug
 mirror-source 10010
 sap 1/1/3 egress ingress
 no shutdown
 exit

```

The following example shows a configuration of a remote mirrored service where the source is a port on SAR-1 and the destination is a SAP on SAR-2:

```

*A:SAR-1>config>mirror# info

 mirror-dest 1000 create
 spoke-sdp 2:1 egr-vc-label 7000
 no shutdown
 exit

*A:SAR-1>config>mirror# exit all
*A:SAR-1# show debug
debug
 mirror-source 1000
 port 1/1/2 egress ingress
 no shutdown
 exit
exit
*A:SAR-1#

*A:SAR-2>config>mirror# info

 mirror-dest 1000 create
 remote-source
 far-end 10.10.10.104 ing-svc-label 7000
 exit
 sap 1/1/2:0 create
 egress
 qos 1
 exit
 exit
 no shutdown
 exit

*A:SAR-2>config>mirror#

```

## 4.6.1 Mirror classification rules

The 7705 SAR implementation of mirroring can be performed by configuring parameters to select network traffic based on ports or SAPs. Each mirror source can specify ingress, egress, or both directions.

### 4.6.1.1 Port

The **port** command associates a port with a mirror source. The port is identified by the port ID.

The defined port can be an Ethernet port or a link aggregation group (LAG) ID. When a LAG ID is given as the port ID, mirroring is enabled on all ports making up the LAG. Ports that are circuit emulation (CEM) and PPP bundle groups cannot be used as a mirror source.

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

Table 46: Mirror source port requirements

| Port type | Port mode | Port encapsulation type |
|-----------|-----------|-------------------------|
| Ethernet  | access    | dot1q, null, qinq       |
| Ethernet  | network   | dot1q, null             |
| Ethernet  | hybrid    | dot1q                   |

### 4.6.1.2 SAP

More than one SAP can be associated with a single mirror source. Each SAP supports independent **ingress** and **egress** parameters to define which packets are mirrored to the configured mirror destination (SAP). A SAP that is configured as a mirror destination cannot be used as a mirror source.

Ethernet SAPs can be mirrored in access or hybrid mode and support all encapsulation types (null, dot1q, and qinq).

All packets captured on a SAP can be mirrored to any supported mirror destination on the 7705 SAR, including both local and remote mirror services. The supported combinations are shown in the following table.

Table 47: Mirror source SAP requirements

| SAP mode | Encapsulation type |
|----------|--------------------|
| access   | dot1q, null, qinq  |
| hybrid   | dot1q              |

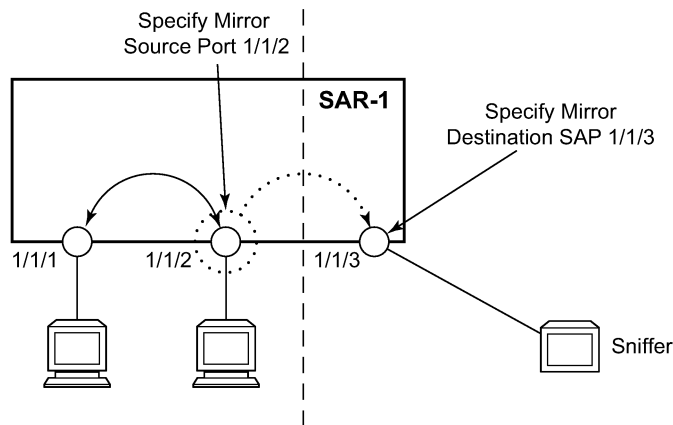
## 4.7 Common configuration tasks

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

Each local mirrored service (within the same router) requires the following configurations as shown in the figure:

1. Specify the mirror destination (SAP).
2. Specify the mirror source.

*Figure 33: Local mirrored service tasks*

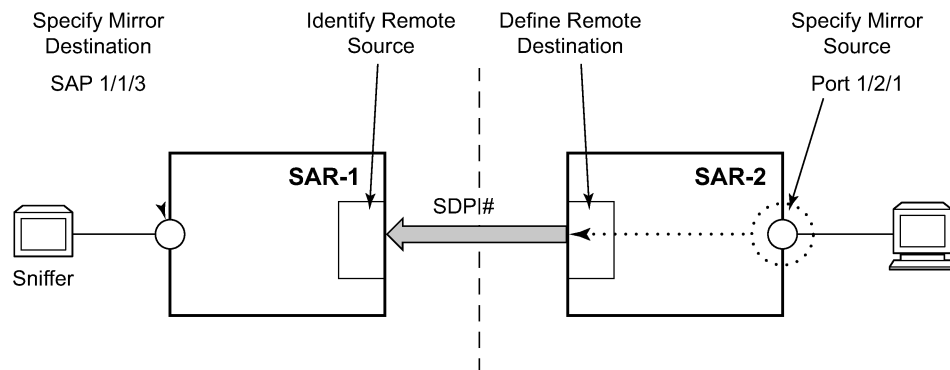


No3499

Each remote mirrored service (across the network core) requires the following configurations as shown in the figure:

1. Define the remote destination (SDP).
2. Identify the remote source (the device allowed to mirror traffic to this device).
3. Specify the mirror destination (SAP).
4. Specify the mirror source.

Figure 34: Remote mirrored service tasks



No3500

### 4.7.1 Configuring a local mirror service

To configure a local mirror service, the source and destinations must be located on the same router. 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.

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.

The following output shows an example of a local mirrored service. On SAR-1, mirror service 103 is mirroring egress and ingress traffic on port 1/1/24 and sending the mirrored packets to SAP 1/1/25:

```
*A:SAR-1>config>mirror# info

 mirror-dest 103 create
 sap 1/1/25:0 create
 egress
 qos 1
 exit
 exit
 no shutdown
exit

*A:SAR-1>config>mirror#
```

The following output shows debug mirroring information:

```
*A:SAR-1>show debug mirror

 debug
 mirror-source 103
 no shutdown
 port 1/1/24 egress ingress
 exit
 exit

*A:SAR-1>debug>mirror-source# exit
```

## 4.7.2 Configuring SDPs for mirroring

This section provides a brief overview of the tasks that must be performed to configure SDPs and provides the CLI commands. For more information about service configuration, see the 7705 SAR Services Guide.

The following SDP characteristics apply:

- The SDP must be configured for GRE or MPLS encapsulation.
- Each distributed service must have an SDP defined for every remote 7705 SAR to provide Epipe, VPLS, or mirrored services.
- A distributed service must be bound to an SDP. By default, no SDP is associated with a service. Once an SDP is created, services can be associated with that SDP.
- An SDP is not specific to any one service or any type of service. An SDP can have more than one service bound to it.
- For SDPs use **remote-source>far-end** entries. Remote source far-end details are configured in the destination node.
- To configure an MPLS SDP, LSPs must be configured first and then the LSP-to-SDP association must be explicitly created.

To configure a basic SDP, perform the following steps:

1. Select an originating node.
2. Create an SDP ID.
3. Select an encapsulation type.
4. Select the far-end node.

To configure the return path SDP, perform the same steps on the far-end router.

Use the following CLI syntax to create an SDP and select an encapsulation type. If you do not specify GRE or MPLS, the default encapsulation type is GRE.



**Note:** When you specify the far-end IP address, you are creating the tunnel. In essence, you are creating the path from Point A to Point B. Use the **show service sdp** command to display the qualifying SDPs.

### CLI syntax:

```
config>service# sdp sdp-id [gre | mpls] create
description description-string
far-end ip-addr
lsp lsp-name
path-mtu octets
no shutdown
keep-alive
 hello-time seconds
 hold-down-time seconds
 max-drop-count count
 message-length octets
 no shutdown
```

On the mirror-source router, configure an SDP pointing toward the mirror-destination router (or use an existing SDP).



On the mirror-destination router, configure an SDP pointing toward the mirror-source router (or use an existing SDP).

The following example shows SDP configurations on both the mirror-source and mirror-destination routers.

```
*A:SAR-1>config>service# info

sdp 1 create
 description "to-10.10.10.104"
 far-end 10.10.10.104
 no shutdown
exit

*A:SAR-1>config>service#

*A:SAR-2>config>service# info

sdp 4 create
 description "to-10.10.10.103"
 far-end 10.10.10.103
 no shutdown
exit

*A:SAR-2>config>service#
```

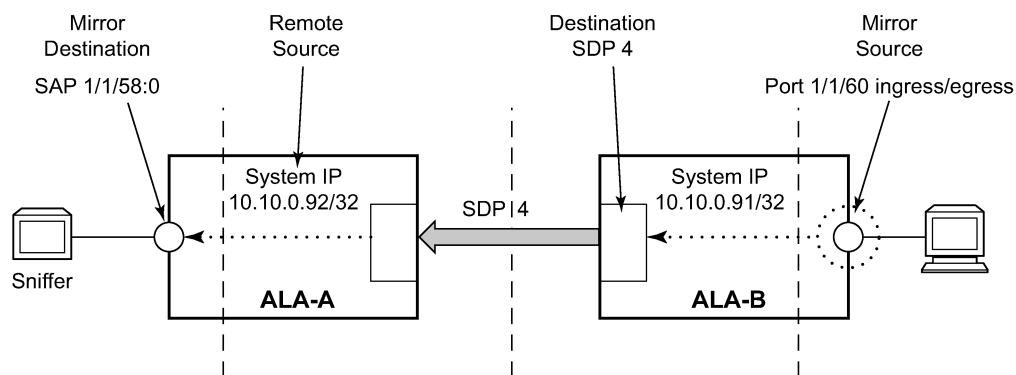
### 4.7.3 Configuring a remote mirror service

For remote mirroring, the source and destination are configured on different routers. Mirror source and mirror destination parameters must be configured under the same service ID context.

For SDPs, use **remote-source>far-end** entries. Remote source far-end details are configured in the destination node.

The following figure shows the mirror destination (SAR-1), 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 1/1/58 and states that the service only accepts traffic from far-end 10.10.0.92 (SAR-2) 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. The slice size limits the size of the stream of packet through the router and the core network.

Figure 35: Remote mirrored service tasks



No3501

The following example shows the CLI output for configuration of remote mirrored service 1216. The traffic ingressing and egressing port 1/1/60 on 10.10.0.92 (SAR-2) will be mirrored to the destination SAP 1/1/58:0 on SAR-1.

```
*A:SAR-1>config>mirror# info

 mirror-dest 1216 create
 description "Receiving mirror traffic from .91"
 remote-source
 far-end 10.10.0.91 ing-svc-label 5678
 exit
 sap 1/1/58:0 create
 egress
 qos 1
 exit
 exit
 no shutdown
 exit
*A:SAR-1>config>mirror#
```

The following example shows the remote mirror destination configured on SAR-2:

```
*A:SAR-2>config>mirror># info

mirror-dest 1216 create
description "Sending mirrored traffic to .92"
fc h1
spoke-sdp 4:60 create
egress
vc-label 5678
exit
no shutdown
exit
slice-size 128
no shutdown
exit
*A:SAR-2>config>mirror#
```

The following example shows the mirror source configuration for SAR-2:

```
*A:SAR-2# show debug mirror

 debug
 mirror-source 1216
 port 1/1/60 egress ingress
 no shutdown
 exit
 exit
*A:SAR-2#
```

The following example shows the SDP configuration from SAR-1 to SAR-2 (SDP 2) and the SDP configuration from SAR-2 to SAR-1 (SDP 4):

```
*A:SAR-1>config>service>sdp# info

 description "GRE-10.10.0.91"
 far-end 10.10.0.91
```

```

no shutdown

*A:SAR-1>config>service>sdp#

*A:SAR-2>config>service>sdp# info

description "GRE-10.10.20.92"
far-end 10.10.0.92
no shutdown

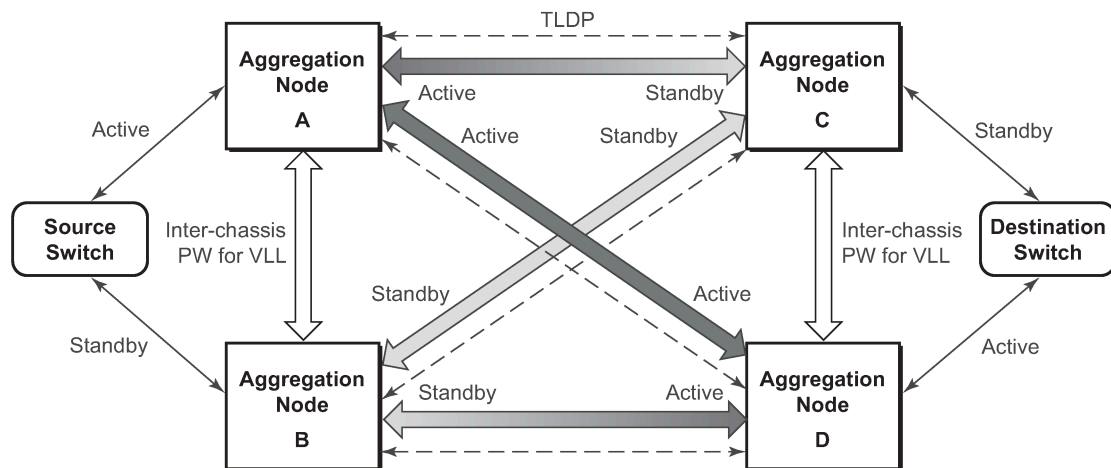
*A:SAR-2>config>service>sdp#

```

#### 4.7.4 Pseudowire redundancy for mirror services configuration example

A configuration based on the following figure is described in this section.

Figure 36: State engine for redundant service to a redundant mirror service



No3502

The mirror traffic must be forwarded from the configured debug mirror source together with the mirror dest/ remote source (ICB or non-ICB) to either a SAP endpoint or SDP endpoint.

A SAP endpoint is an endpoint with a SAP and with or without an additional ICB spoke. An SDP endpoint is an endpoint with regular and ICB spokes.

Only one **tx-active** will be chosen for either the SAP endpoint or SDP endpoint. Traffic ingressing into a remote-source ICB will have only ingressing traffic while an ICB spoke will have only egressing traffic.

The ingressing traffic to a remote-source ICB cannot be forwarded out of another ICB spoke.

The following example shows a high-level summary of a configuration; it is not intended to be syntactically correct:

```

Node A:
config mirror mirror-dest 100
endpoint X
sdp to-C endpoint X
sdp to-D endpoint X
sdp to-B endpoint X icb // connects to B's remote-source IP-A, traffic A->B only

```

```

remote-source IP-B icb // connects to B's sdp to-A, traffic B->A only

Node B:
config mirror mirror-dest 100
endpoint X
sdp to-C endpoint X
sdp to-D endpoint X
sdp to-A endpoint X icb // connects to A's remote-source IP-B, traffic B->A only
remote-source IP-A icb // connects to Node A's sdp to-B, traffic A->B only

Node C:
config mirror mirror-dest 100
endpoint X
sap to-destination-switch endpoint X
sdp to-D endpoint X icb // connects to D's remote-source IP-C, traffic C->D only
remote-source IP-A
remote-source IP-B
remote-source IP-D icb // connects to D's sdp to-C, traffic D->C only

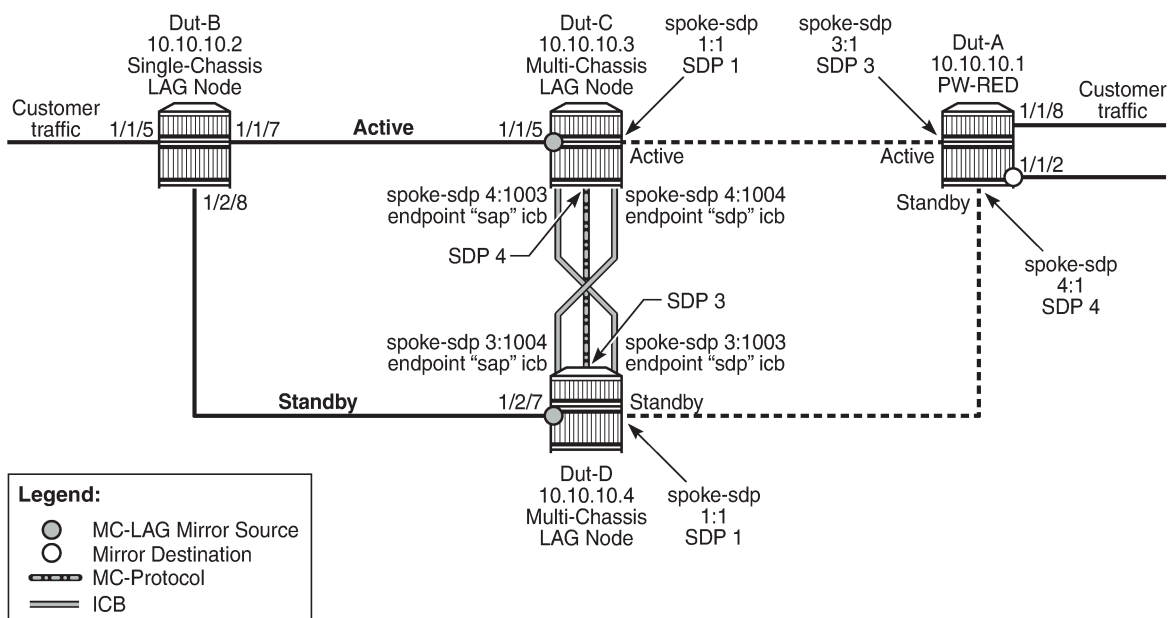
Node D:
config mirror mirror-dest 100
endpoint X
sap to-destination-switch endpoint X
sdp to-C endpoint X icb // connects to C's remote-source IP-D, traffic D->C only
remote-source IP-A
remote-source IP-B
remote-source IP-C icb // connects to C's sdp to-D, traffic C->D only

```

#### 4.7.5 MC-LAG setup with ICB for mirror services configuration example

A configuration based on the following figure is described in this section.

Figure 37: Remote mirroring of MC-LAG ports



25953

ICB spoke SDPs have been supported for Epipe services in an MC-LAG configuration. ICB spoke SDP improves switch times, provides additional protection in case of network failures, and reduces packet loss when an active endpoint is switched from a failed MC-LAG node to a protection node.

ICB spoke SDPs are now being supported for mirror services in an MC-LAG setup. ICB helps reduce the packet loss of mirrored packets during access MC-LAG switchovers. ICB also provides protection for mirrored packets in case of a network failure.

ICBs must be configured in both directions. Mirroring traffic does not work if only one ICB is configured for mirroring traffic from one MC-LAG node.

The mirroring traffic from both the MC-LAG ports that are mirror sources is mirrored to a common remote mirror destination. The mirror destination receives the mirror traffic from the active MC-LAG port. When an MC-LAG switchover happens due to an active node failure or link failure, the mirror destination will start receiving traffic from the newly activated MC-LAG port.

If there is a network failure on the active network path, the MC-LAG does not switch over. In this case, ICB will provide protection for the data traffic and mirror traffic.

The following example shows the service configuration and the corresponding remote mirroring configuration; it is not intended to be syntactically correct.

### Service configuration with ICB on Dut-C

```
*A:7705:Dut-C>config>service# info

sdp 1 create
 description "ldp SDP to Dut-A"
 far-end 10.10.10.1
 ldp
 keep-alive
 shutdown
 exit
 no shutdown
exit
sdp 4 create
 description "ldp SDP to Dut-D for ICB"
 far-end 10.10.10.4
 ldp
 keep-alive
 shutdown
 exit
 no shutdown
exit
customer 1 create
 description "Default customer"
exit
epipe 1 customer 1 vpn 1 create
 description "Default epipe description for service id 1"
 service-name "XYZ Epipe 1"
 endpoint "sap" create
 description "Default description for Endpoint sap in service 1"
 exit
 endpoint "sdp" create
 description "Default description for Endpoint sdp in service 1"
 exit
 sap lag-1:1 endpoint "sap" create
 description "Default sap description for service id 1"
 exit
 spoke-sdp 1:1 endpoint "sdp" create
 no shutdown
 exit
 spoke-sdp 4:1003 endpoint "sap" icb create
```

```

 no shutdown
 exit
 spoke-sdp 4:1004 endpoint "sdp" icb create
 no shutdown
 exit
 no shutdown
exit

```

### Service configuration with ICB on Dut-D

```

*A:7705:Dut-D>config>service# info

sdp 1 create
 description "ldp SDP to Dut-A"
 far-end 10.10.10.1
 ldp
 keep-alive
 shutdown
 exit
 no shutdown
exit
sdp 3 create
 description "ldp SDP to Dut-C for ICB"
 far-end 10.10.10.3
 ldp
 keep-alive
 shutdown
 exit
 no shutdown
exit
customer 1 create
 description "Default customer"
exit
epipe 1 customer 1 vpn 1 create
 description "Default epipe description for service id 1"
 service-name "XYZ Epipe 1"
 endpoint "sap" create
 description "Default description for Endpoint sap in service 1"
 exit
 endpoint "sdp" create
 description "Default description for Endpoint sdp in service 1"
 exit
 sap lag-1:1 endpoint "sap" create
 description "Default sap description for service id 1"
 exit
 spoke-sdp 1:1 endpoint "sdp" create
 no shutdown
 exit
 spoke-sdp 3:1003 endpoint "sdp" icb create
 no shutdown
 exit
 spoke-sdp 3:1004 endpoint "sap" icb create
 no shutdown
 exit
 no shutdown
exit

```

### Service configuration on Dut-A

```

*A:7705:Dut-A>config>service# info

sdp 3 create
 description "ldp SDP to Dut-C"

```

```

 far-end 10.10.10.3
 ldp
 keep-alive
 shutdown
 exit
 no shutdown
 exit
 sdp 4 create
 description "ldp SDP to Dut-D"
 far-end 10.10.10.4
 ldp
 keep-alive
 shutdown
 exit
 no shutdown
 exit
 customer 1 create
 description "Default customer"
 exit
 epipe 1 customer 1 vpn 1 create
 description "Default epipe description for service id 1"
 service-name "XYZ Epipe 1"
 endpoint "sdp" create
 description "Default description for Endpoint sdp in service 1"
 exit
 sap 1/1/8:1 create
 description "Default sap description for service id 1"
 exit
 spoke-sdp 3:1 endpoint "sdp" create
 no shutdown
 exit
 spoke-sdp 4:1 endpoint "sdp" create
 no shutdown
 exit
 no shutdown
 exit
exit

```

### Mirror configuration for Dut-C (MC-LAG port as mirror source)

```

*A:7705:Dut-C>config>mirror# info

 mirror-dest 9000 create
 endpoint "sdp" create
 exit
 remote-source
 far-end 10.10.10.4 ing-svc-label 9004 icb
 exit
 spoke-sdp 1:9001 endpoint "sdp" create
 egress
 vc-label 9001
 exit
 no shutdown
 exit
 spoke-sdp 4:9003 endpoint "sdp" icb create
 egress
 vc-label 9003
 exit
 no shutdown
 exit
 no shutdown
exit

```

```
*A:7705:Dut-C>show debug
debug
 mirror-source 9000
 port lag-1 egress ingress
 no shutdown
 exit
exit
```

### Mirror configuration for Dut-D (MC-LAG port as mirror source)

```
*A:7705:Dut-D>config>mirror# info

mirror-dest 9000 create
 endpoint "sdp" create
 exit
 remote-source
 far-end 10.10.10.3 ing-svc-label 9003 icb
 exit
 spoke-sdp 1:9002 endpoint "sdp" create
 egress
 vc-label 9002
 exit
 no shutdown
exit
 spoke-sdp 3:9004 endpoint "sdp" icb create
 egress
 vc-label 9004
 exit
 no shutdown
exit
 no shutdown
exit
exit

*A:7705:Dut-D>show debug
debug
 mirror-source 9000
 port lag-1 egress ingress
 no shutdown
 exit
exit
```

### Mirror configuration for Dut-A (remote mirror destination)

```
*A:7705:Dut-A>config>mirror# info

mirror-dest 9000 create
 remote-source
 far-end 10.10.10.3 ing-svc-label 9001
 far-end 10.10.10.4 ing-svc-label 9002
 exit
 sap 1/1/2 create
 exit
 no shutdown
exit
```

## 4.7.6 Configuring a PCAP mirroring service

The following steps describe how to configure, start, stop, and restart a PCAP mirroring service:



1. Configure the mirror destination using the **config>mirror>mirror-dest** command. Include the PCAP file URL and session name. Only remote URL locations are supported.
2. (Optionally) Configure the number of packets to be captured using the **capture-count** command.
3. Configure the mirror source using the **debug>mirror-source** command.  
The 7705 SAR waits for the **debug>mirror-source** command to begin mirroring.
4. Start the packet capture by issuing the **debug>pcap>capture start** command. The FTP process begins as soon as the **start** command is issued.
5. Stop the packet capture using one of the following methods:
  - automatic stop  
The system automatically stops after the configured number of **capture-count** packets or the maximum number of packets have been captured.
  - manual stop  
Use the **debug>pcap>capture stop** command to stop capturing packets and clear the buffer. The FTP session stops.
6. (Optionally) Restart the packet capture by reissuing the **capture start** command.  
The new packet capture file overwrites the existing file. To separate the capture files, either configure a new mirror destination URL or rename the existing file on the FTP server.

Use the following CLI syntax to create and start a PCAP mirroring service.

**CLI syntax:**

```
config>mirror# mirror-dest service-id create
pcap session-name [create]
file-url file-url
capture-count packet-num
```

**CLI syntax:**

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

**CLI syntax:**

```
debug
pcap session-name
capture {start | stop}
```

The following example shows a PCAP mirror destination configuration to the remote node:

```
*A:SAR-1>config>mirror# info

mirror-dest 103 create
pcap PCAP_test create
file-url ftp:login:pswd@remote-locn/file-path
capture-count 100
exit
exit
exit

*A:SAR-1>config>mirror#
```

The following example shows a mirror source configuration:

```
*A:SAR-1>show debug mirror
debug
 mirror-source 103
 port 1/1/2 egress ingress
 no shutdown
 exit
exit
*A:SAR-1>debug>mirror-source# exit
```

The following example shows the start of packet capture:

```
*A:SAR-1>debug>pcap PCAP_test#
 capture start
 exit
*A:SAR-1>debug>pcap
```

## 4.8 Service management tasks

This section describes service management tasks.

### 4.8.1 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 example shows the commands to modify parameters for a basic local mirroring service:

**Example:**

```
config>mirror# mirror-dest 103
config>mirror>mirror-dest# shutdown
config>mirror>mirror-dest# no sap
config>mirror>mirror-dest# sap 1/1/5:0 create
config>mirror>mirror-dest>sap$ exit
config>mirror>mirror-dest# fc be
config>mirror>mirror-dest# slice-size 128
config>mirror>mirror-dest# no shutdown
```

**Example:**

```
debug# mirror-dest 103
debug>mirror-source# no port 1/1/24 ingress egress
debug>mirror-source# port 1/1/7 ingress egress
```

The following output shows the local mirrored service modifications:

```
*A:SAR-1>config>mirror# info

mirror-dest 103 create
 no shutdown
 fc be
 remote-source
 exit
 sap 1/1/5:0 create
```

```

 egress
 qos 1
 exit
 exit
 slice-size 128
exit

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

```

## 4.8.2 Deleting a local mirrored service

Existing mirroring parameters can be deleted in the CLI. A shutdown must be issued on a service level in order 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 example shows the commands to delete a local mirrored service:

### Example:

```

SAR-1>config>mirror# mirror-dest 103
config>mirror>mirror-dest# shutdown
config>mirror>mirror-dest# exit
config>mirror# no mirror-dest 103
config>mirror# exit

```

## 4.8.3 Modifying a remote mirrored service

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

In the following example, the mirror destination is changed from 10.10.10.2 (SAR-2) to 10.10.10.3 (SAR3). The mirror destination service ID on SAR-2 must be shut down first before it can be deleted.

The following example shows the commands to modify parameters for a remote mirrored service:

### Example:

```

*A:SAR-1>config>mirror# mirror-dest 104
config>mirror>mirror-dest# remote-source
config>mirror>mirror-dest>remote-source# no far-end 10.10.10.2
remote-source# far-end 10.10.10.3 ing-svc-label 3500

*A:SAR-2>config>mirror# mirror-dest 104
config>mirror>mirror-dest# shutdown
config>mirror>mirror-dest# exit
config>mirror# no mirror-dest 104

SAR3>config>mirror# mirror-dest 104 create
config>mirror>mirror-dest# spoke-sdp 4:60 egress vc-label 3500
config>mirror>mirror-dest# no shutdown
config>mirror>mirror-dest# exit all

SAR3># debug
debug# mirror-source 104
debug>mirror-source# port 1/1/2 ingress egress

```

```
debug>mirror-source# no shutdown
```

```
*A:SAR-1>config>mirror# info

mirror-dest 104 create
 remote-source
 far-end 10.10.10.3 ing-svc-label 3500
 exit
 sap 1/1/15:0 create
 egress
 qos 1
 exit
 exit
 no shutdown
exit

A:SAR3>config>mirror# info

 mirror-dest 104 create
 spoke-sdp 4:60 egress vc-label 3500
 no shutdown
 exit

A:SAR3>config>mirror#

A:SAR3# show debug mirror
debug
 mirror-source 104
 no shutdown
 port 1/1/2 egress ingress
 exit
 exit
A:SAR3#
```

#### 4.8.4 Deleting a remote mirrored service

Existing mirroring parameters can be deleted in the CLI. A **shutdown** must be issued on a service level in order to delete the service. It is not necessary to shut down or remove SAP or far-end references to delete a remote mirrored service. To delete a mirrored service with SDP configured, it is necessary to first remove or shut down the SDP.

Mirror destinations must be shut down first before they can be deleted.

##### Example:

```
*A:SAR-1>config>mirror# mirror-dest 105
config>mirror>mirror-dest# shutdown
config>mirror>mirror-dest# exit
config>mirror# no mirror-dest 105
config>mirror# exit

*A:SAR-2>config>mirror# mirror-dest 105
config>mirror>mirror-dest# shutdown
config>mirror>mirror-dest# exit
config>mirror# no mirror-dest 105
config>mirror# exit
```

In the example, the mirror-destination service ID 105 was removed from the configuration on SAR-1 and SAR-2; therefore, it does not appear in the **info** command output.

```
*A:SAR-1>config>mirror# info
```

```

```

```
*A:SAR-1>config>mirror# exit
```

```
*A:SAR-2>config>mirror# info
```

```

```

```
*A:SAR-2>config>mirror# exit
```

Because the mirror destination was removed from the configuration on SAR-2, the port information was automatically removed from the debug mirror source configuration.

```
*A:SAR-2# show debug mirror
```

```
debug
```

```
exit
```

```
*A:SAR-2#
```

## 4.9 Mirror service configuration command reference

### 4.9.1 Command hierarchies

- [Mirror configuration commands](#)
- [Show commands](#)
- [Debug commands](#)

#### 4.9.1.1 Mirror configuration commands

```

config
- mirror
- mirror-dest service-id [type mirror-type] [create]
- no mirror-dest service-id
 - description description-string
 - no description
 - endpoint endpoint-name [create]
 - no endpoint endpoint-name
 - description description-string
 - no description
 - revert-time {revert-time | infinite}
 - no revert-time
- fc fc-name
- no fc
- pcap session-name [create]
- no pcap session-name
 - capture-count packet-num
 - no capture-count
 - file-url file-url
 - no file-url
- [no] remote-source
 - far-end ip-address [vc-id vc-id] [ing-svc-label ing-vc-label | tldp] [icb]
 - no far-end ip-address
- sap sap-id [create] [no-endpoint]
- sap sap-id [create] endpoint name
- no sap
 - [no] egress
 - qos policy-id
 - no qos
- service-name service-name
- no service-name
- [no] shutdown
- slice-size slice-size
- no slice-size
- spoke-sdp sdp-id:vc-id [create] [no-endpoint]
- spoke-sdp sdp-id:vc-id [create] endpoint name [icb]
- no spoke-sdp sdp-id:vc-id
 - egress
 - vc-label egress-vc-label
 - no vc-label [egress-vc-label]
 - precedence precedence-value | primary
 - no precedence
 - [no] shutdown

```

### 4.9.1.2 Show commands

```
show
- debug [application]
- mda [slot/mda] statistics [source-mda | dest-mda | mirror | security [encryption |
firewall]]
- mirror mirror-dest [service-id]
- pcap [session-name] [detail]
- service
 - service-using [epipe] [ies] [vpls] [vprn] [mirror] [apipe] [fpipe] [ipipe] [cpipe]
[hpipe] [sdp sdp-id] [customer customer-id]
```

### 4.9.1.3 Debug commands

```
debug
- [no] mirror-source service-id
 - mac-filter mac-filter-id entry entry-id [entry-id ...]
 - no mac-filter mac-filter-id [entry entry-id ...]
 - port {port-id | lag lag-id} {[egress] [ingress]}
 - no port {port-id | lag lag-id} [egress] [ingress]
 - sap sap-id {[ingress] [egress]}
 - no sap sap-id [ingress] [egress]
 - [no] shutdown
- pcap session-name
 - capture pcap-action
```

## 4.9.2 Command descriptions

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

### 4.9.2.1 Configuration commands

- [Generic commands](#)
- [Mirror destination configuration commands](#)

#### 4.9.2.1.1 Generic commands

description

##### Syntax

**description** *description-string*

**no description**

##### Context

config>mirror>mirror-dest

config>mirror>mirror-dest>endpoint

##### Description

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

The **no** form of the command removes the description string from the configuration.

##### Default

no description

##### Parameters

*description-string*

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



## shutdown

### Syntax

[no] shutdown

### Context

config>mirror>mirror-dest

config>mirror>mirror-dest>spoke-sdp

debug>mirror-source

### Description

The **shutdown** command administratively disables an entity. The operational state of the entity is disabled as well as the operational state of any entities contained within. When disabled, an entity does not change, reset, or remove any configuration settings or statistics. Many objects must be shut down before they may be deleted. Many entities must be explicitly enabled using the **no shutdown** command.

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

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

### Default

shutdown (for mirror destination service ID)

no shutdown (for source destination service ID)

### 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 or remote source router. The associated mirror source is put into an operationally down mode. Mirrored packets are not transmitted out of the SAP or SDP. Each mirrored packet is silently discarded. If the mirror destination is a SAP, the SAP's discard counters are incremented.

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 in order to delete the service ID, SAP or SDP 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 in order to remove them from the system.

When a mirror source is **shutdown**, mirroring is terminated for all sources defined locally for the [mirror-dest](#) service ID. If the [remote-source](#) command has been executed on the [mirror-dest](#) associated with the shutdown [mirror-source](#), mirroring continues for remote sources.

The default state for a mirror source for a given [mirror-dest](#) service ID is **no shutdown**. A **shutdown** command is required to disable mirroring from that mirror source.

#### 4.9.2.1.2 Mirror destination configuration commands

##### mirror-dest

##### Syntax

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

**no mirror-dest** *service-id*

##### Context

config>mirror

##### Description

This command creates a context to set up a service that is intended for packet mirroring. It is configured as a service to allow mirrored packets to be directed locally (within the same router) or remotely over the core of the network with a far-end decoding mirror encapsulation.

The mirror-dest service is composed of destination parameters that define where the mirrored packets are to be sent. It also specifies whether the defined *service-id* will receive mirrored packets from a far-end router over the network core.

The mirror-dest service IDs are persistent between boots of the router and are included in the configuration saves. The local sources of mirrored packets for the service ID are defined within the **debug mirror-source** command that references the same *service-id*. Up to 255 mirror-dest service IDs can be created within a single system.

When a mirror destination is configured on the 7705 SAR, the **debug mirror-source** *service-id* is automatically created and the following lines are automatically added to the config file:

##### Example:

```
debug
 mirror-source service-id
 no shutdown
 exit
exit
```

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

The **no** form of the 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 will also be removed from the system.

**Default**

no mirror-dest

**Parameters**

*service-id*

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

If a particular service ID already exists for a service, the same value cannot be used to create a mirror destination service ID. For example, if an Epipe service-ID 11 exists, a mirror destination service-ID 11 cannot be created.

|               |                    |                                                            |
|---------------|--------------------|------------------------------------------------------------|
| <b>Values</b> | <i>service-id:</i> | 1 to 2147483690 or <i>svc-name</i> (64 characters maximum) |
|---------------|--------------------|------------------------------------------------------------|

**type** *mirror-type*

the encapsulation type supported by the mirror service

|               |       |
|---------------|-------|
| <b>Values</b> | ether |
|---------------|-------|

**create**

keyword is mandatory when creating a mirror destination

endpoint

**Syntax**

**endpoint** *endpoint-name* [**create**]

**no endpoint** *endpoint-name*

**Context**

config>mirror>mirror-dest

**Description**

This command creates mirror service endpoints. A mirror service supports two implicit endpoints managed internally by the system. The following applies to endpoint configurations.

Up to two named endpoints can be created per mirror service. The endpoint name is locally significant to the mirror service.

- Objects (SAPs or SDPs) may be created on the mirror service with the following limitations:
  - two implicit endpoint objects (without explicit endpoints defined)
  - one implicit object and multiple explicit objects with the same endpoint name
  - multiple explicit objects each with one of two explicit endpoint names
- All objects become associated implicitly or indirectly with the implicit endpoints "x" and "y".
- Objects may be created without an explicit endpoint defined.

- Objects may be created with an explicit endpoint defined.
- Objects without an explicit endpoint may have an explicit endpoint defined without deleting the object.
- Objects with an explicit endpoint defined may be dynamically moved to another explicit endpoint or may have the explicit endpoint removed.

When creating an object without an explicit endpoint, the following points apply.

- If an object on a mirror service has no explicit endpoint name associated, the system attempts to associate the object with implicit endpoint "x" or "y".
- The implicit endpoint cannot have an existing object association.
- If both "x" and "y" are available, "x" will be selected.
- If an "x" or "y" association cannot be created, the object cannot be created.

When creating an object with an explicit endpoint name, the following points apply.

- The endpoint name must exist on the mirror service.
- If this is the first object associated with the endpoint name:
  - the object is associated with either implicit endpoint "x" or "y"
  - the implicit endpoint cannot have an existing object associated
  - if both "x" and "y" are available, "x" will be selected
  - if "x" or "y" is not available, the object cannot be created
  - the implicit endpoint is now associated with the named endpoint
  - if this is not the first object associated with the endpoint name, the object is associated with the named endpoint's implicit association

When changing an object's implicit endpoint to an explicit endpoint name, the following points apply.

- If the explicit endpoint name is associated with an implicit endpoint, the object is moved to that implicit endpoint.
- If the object is the first to be associated with the explicit endpoint name:
  - the object is associated with either implicit endpoint "x" or "y"
  - the implicit endpoint cannot have an existing object associated (except this one)
  - if both "x" and "y" are available, "x" will be selected
  - if "x" or "y" is not available, the object cannot be moved to the explicit endpoint
  - if moved, the implicit endpoint is now associated with the named endpoint

When changing an object's explicit endpoint to another explicit endpoint name, the following points apply.

- If the new explicit endpoint name is associated with an implicit endpoint, the object is moved to that implicit endpoint.
- If the object is the first to be associated with the new explicit endpoint name:
  - the object is associated with either implicit endpoint "x" or "y"
  - the implicit endpoint cannot have an existing object associated (except this one)
  - if both "x" and "y" are available, "x" will be selected
  - if "x" or "y" is not available, the object cannot be moved to the new endpoint
  - if moved, the implicit endpoint is now associated with the named endpoint

An explicitly named endpoint can have a maximum of one SAP and one ICB. Once a SAP is added to the endpoint, only one more object of type ICB SDP is allowed. The ICB SDP cannot be added to the endpoint if the SAP is not part of an MC-LAG instance. Conversely, a SAP that is not part of an MC-LAG instance cannot be added to an endpoint that already has an ICB SDP.

An explicitly named endpoint that does not have a SAP object can have a maximum of four SDPs, which can include any of the following: a single primary SDP, one or many secondary SDPs with precedence, and a single ICB SDP.

The user can only add a SAP configured on an MC-LAG instance to this endpoint. Conversely, the user will not be able to change the mirror service type away from mirror service without first deleting the MC-LAG SAP.

The **no** form of the command removes the association of a SAP or a SDP with an explicit endpoint name. When removing an object's explicit endpoint association the following points apply.

- The system attempts to associate the object with implicit endpoint "x" or "y".
- The implicit endpoint cannot have an existing object association (except this one).
- If both "x" and "y" are available, "x" will be selected.
- If an "x" or "y" association cannot be created, the explicit endpoint cannot be removed.

## Parameters

*endpoint-name*

specifies the endpoint name, up to 32 characters maximum

**create**

mandatory keyword to create this entry

## revert-time

## Syntax

**revert-time** {*revert-time* | **infinite**}

**no revert-time**

## Context

config>mirror>mirror-dest>endpoint

## Description

This command sets the length of time to wait before reverting to the primary SDP. This command has an effect only when used in conjunction with an endpoint that contains an SDP of type primary. It is ignored and has no effect in all other cases. The revert timer is the length of time the system waits before it switches the path of the mirror service from an active secondary SDP in the endpoint into the endpoint primary SDP after the latter comes back up.

The **no** form of the command resets the timer to the default value of 0. This means that the mirror service path will be switched back to the endpoint primary SDP immediately after it comes back up.

## Default

0 – the mirror service path will be switched back to the endpoint primary SDP immediately after it comes back up

## Parameters

### *revert-time*

the delay, in seconds, before the system switches the path of the mirror service from an active secondary SDP in the endpoint into the endpoint primary SDP after the latter comes back up

**Values** 0 to 600

### *infinite*

forces the mirror service path to never revert to the primary SDP as long as the currently active secondary SDP is up

**fc**

## Syntax

**fc** *fc-name*

**no fc**

## Context

config>mirror>mirror-dest

## Description

This command specifies a forwarding class for all mirrored packets transmitted to the destination SAP or SDP 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*.

When the destination is on an SDP, the *fc-name* defines the DiffServ-based egress queue that will be used to reach the destination. The *fc-name* also defines the encoded forwarding class of the encapsulation.

The **fc** configuration also affects how mirrored packets are treated at the ingress queuing point on the line cards. One ingress queue is used per mirror destination (service) and that will be an expedited queue if the configured FC is expedited (one of nc, h1, ef, or h2). The ingress mirror queues have no CIR but have a line-rate PIR.

The **no** form of the command resets the [mirror-dest](#) service ID forwarding class to the default forwarding class.

## Default

be

## Parameters

*fc-name*

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 will be returned and the **fc** command will have no effect. If the *fc-name* does exist, the forwarding class associated with the *fc-name* will override the default forwarding class.

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

## pcap

### Syntax

**pcap** *session-name* [create]

**no pcap** *session-name*

### Context

config>mirror>mirror-dest

### Description

This command specifies a PCAP instance used for packet capture.

The **no** form of this command removes the PCAP instance and stops the packet capture and file transfer session.

### Default

none

## Parameters

*session-name*

the session name, up to 32 characters

## capture-count

### Syntax

**capture-count** *packet-num*

**no capture-count**

### Context

config>mirror>mirror-dest>pcap

Description

This command specifies the number of packets to be captured in the PCAP file during the PCAP session. When this number of packets has been captured, the PCAP session will automatically close.

The **no** form of this command sets the capture-count value back to the default.

Default

250

Parameters

*packet-num*  
the number of packets to be captured in file PCAP file during the PCAP session

**Values**    1 to 250

file-url

Syntax

**file-url** *file-url*  
**no file-url**

Context

config>mirror>mirror-dest>pcap

Description

This command specifies a file URL for the FTP server, including the filename for packet capture transfer. This command overwrites any file on the FTP server with the same filename.

The **no** form of this command removes the *file-url* and stops the packet capture and file transfer session.

Parameters

*file-url*  
specifies the remote URL for the file

**Values**    *remote-url*, where:

|                     |                                                                                                                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <i>remote-url</i>   | [{ftp://} <i>login:pswd@remote-locn/</i> ][ <i>file-path</i> ]<br>180 characters maximum<br>directory length 99 characters maximum each |
| <i>remote-locn</i>  | [ <i>hostname</i>   <i>ipv4-address</i>   <i>ipv6-address</i> ]                                                                         |
| <i>ipv4-address</i> | a.b.c.d                                                                                                                                 |
| <i>ipv6-address</i> | x:x:x:x:x:x:x[- <i>interface</i> ]<br>x:x:x:x:x:x.d.d.d.d[- <i>interface</i> ]                                                          |



x – [0 to FFFF]H

d – [0 to 255]D

*interface* – 32 characters maximum, for link local addresses

## remote-source

### Syntax

[no] remote-source

### Context

config>mirror>mirror-dest

### Description

This command is used to enable remote source configuration on a destination router in a remote mirroring solution. The mirroring (packet copy) is performed on the source router and sent via an SDP to the destination router. Remote mirroring requires remote-source configuration on the destination router.

Remote mirroring allows a destination router to terminate SDPs from multiple remote source routers. This allows consolidation of packet sniffers/analyzers at a single or small set of points in a network.

A remote-source entry must be configured on the destination router for each source router from which mirrored traffic is being sent via SDPs.

A mirror destination service that is configured for a destination router must not be configured for a source router.

Remote-source configuration is only used when a source router is sending mirrored traffic to a destination router via SDPs.

Only a far-end type of remote-source entry can be configured.

Certain remote-source types are applicable with certain SDP types. For descriptions of the command usage in the **mirror-dest** context, see [spoke-sdp](#).

The **no** form of the command removes all remote-source entries.

### Default

no remote-source

## far-end

### Syntax

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

**no far-end** *ip-address*

## Context

config>mirror>mirror-dest>remote-source

## Description

This command is used to configure the mirror far end on a destination router in a remote mirroring solution. See the description of the **remote-source** command for more information.

The destination router should be configured with **remote-source>far-end** entries.

Up to 50 far-end entries can be specified.

## Default

no far-end

## Parameters

*ip-address*

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** 1.0.0.1 to 223.255.255.254

*vc-id*

the virtual circuit identifier of the remote source. For mirror services, the *vc-id* defaults to the *service-id*. However, if the *vc-id* is being used by another service, a unique VC ID is required to create an SDP binding. For this purpose, the mirror service SDP binding accepts *vc-ids*. This VC ID must match the VC ID used on the spoke SDP that is configured on the source router.

**Values** 1 to 4294967295

*ing-svc-label*

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

The defined *ing-svc-label* is entered into the ingress service label table, which causes ingress packets with that service label to be handled by this [mirror-dest](#) service.

The specified *ing-svc-label* must not have been used for any other service ID and must match the egress service label being used on the spoke SDP that is configured on the source router. It must be within the range specified for manually configured service labels defined on this router. It may be reused for other far-end addresses on this **mirror-dest service-id**.

**Values** 2048 to 18431

**tldp**

specifies that the label is obtained through signaling via LDP

**icb**

specifies that the remote source is an inter-chassis backup SDP binding

## sap

### Syntax

**sap** *sap-id* [**create**] [**no-endpoint**]  
**sap** *sap-id* [**create**] **endpoint** *name*  
**no sap**

### Context

config>mirror>mirror-dest

### Description

This command creates a 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 SAP may be defined on an Ethernet access port with a dot1q, null, or qinq encapsulation type.

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 will change to the newly created SAP. In addition, the port cannot be a member of a multi-link bundle, APS group, IMA bundle, or microwave link.

If the defined SAP exists in the context of another service ID, an error is generated.

Mirror destination SAPs can be created on Ethernet interfaces that have been defined as access interfaces. 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.

### Default

n/a

### Parameters

*sap-id*

specifies the physical port identifier portion of the SAP definition

*name*

specifies the name of the endpoint associated with the SAP

**no endpoint**

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

## egress

### Syntax

**[no] egress**

### Context

config>mirror>mirror-dest>sap

### Description

This command enables access to the context to associate an egress SAP Quality of Service (QoS) policy with a mirror destination SAP.

If no QoS policy is defined, the system default SAP egress QoS policy is used for egress processing.

## qos

### Syntax

**qos** *policy-id*

**no qos**

### Context

config>mirror>mirror-dest>sap>egress

### Description

This command associates a QoS policy with an egress SAP for a mirrored service.

By default, no specific QoS policy is associated with the SAP for egress, so the default QoS policy is used.

The **no** form of the command removes the QoS policy association from the SAP, and the QoS policy reverts to the default.

### Default

QoS policy-id 1

### Parameters

*policy-id*

QoS policy ID to associate with a SAP for the mirrored service. The policy ID must already exist.

**Values** 1 to 65535 or *policy-name*

## service-name

### Syntax

**service-name** *service-name*

**no service-name**

### Context

config>mirror>mirror-dest

### Description

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

### Parameters

*service-name*

the name of the existing service

## slice-size

### Syntax

**slice-size** *slice-size*

**no slice-size**

### Context

config>mirror>mirror-dest

### Description

This command enables mirrored frame truncation and specifies the maximum size, in bytes, of a mirrored frame that can be transmitted to the mirror destination.

This command enables mirroring larger frames than the destination packet decoding equipment can handle. It also allows conservation of mirroring resources by limiting the size of the packet stream through the router and the core network.

When defined, the mirror **slice-size** creates a threshold that truncates a mirrored frame to a specific size. For example, if the value of 256 bytes is defined, a frame larger than 256 bytes will only have the first 256 bytes transmitted to the mirror destination. The original frame is not affected by the truncation. The mirrored frame size may increase if encapsulation information is added during transmission through the network core or out the mirror destination SAP to the packet/protocol decoding equipment.

The actual capability of the router to transmit a sliced or non-sliced frame is also dictated by the mirror destination SDP **path-mtu** and/or the mirror destination SAP physical MTU. Packets that require a larger MTU than the mirroring destination supports are discarded if the defined **slice-size** does not truncate the packet to an acceptable size.

When the mirror destination is used for PCAP, the *slice-size* setting is not used. In this case, the mirrored frame is always truncated to a maximum of 200 bytes.

The **no** form of the command disables mirrored packet truncation.

### Default

no slice-size

### Parameters

*bytes*

the number of bytes to which mirrored frames will be truncated, expressed as a decimal integer

**Values** 128 to 9216

## spoke-sdp

### Syntax

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

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

**no sdp** *sdp-id:vc-id*

### Context

config>mirror>mirror-dest

### Description

This command binds an existing mirror SDP to the mirror destination service ID.

Spoke SDPs are used to send and receive mirrored traffic between mirror source and destination routers in a remote mirroring solution. A spoke SDP configured in the mirror service context is used on the source router.

The **no** form of the command removes the SDP binding from the mirror destination service.

### Default

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

### Parameters

*sdp-id:vc-id*

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

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

**Values** 1 to 17407

*name*

specifies the name of the endpoint associated with the SAP

**no endpoint**

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

**icb**

indicates that the SDP is of type Inter-Chassis Backup (ICB). This is a special pseudowire used for MC-LAG and pseudowire redundancy applications.

An explicitly named endpoint can have a maximum of one SAP and one ICB. Once a SAP is added to the endpoint, only one more object of type ICB SDP is allowed. The ICB SDP cannot be added to the endpoint if the SAP is not part of an MC-LAG instance. This means that all other SAP types cannot exist on the same endpoint as an ICB SDP since a non-Ethernet SAP cannot be part of an MC-LAG instance. Conversely, a SAP that is not part of an MC-LAG instance cannot be added to an endpoint that already has an ICB SDP.

An explicitly named endpoint, which does not have a SAP object, can have a maximum of four SDPs, which can include any of the following: a single primary SDP, one or many secondary SDPs with precedence, and a single ICB SDP.

**Default** null. The user should explicitly configure this option at creation time. The user can remove the ICB type by re-entering the SDP configuration without the **icb** keyword.

## egress

### Syntax

**egress**

### Context

config>mirror>mirror-dest>spoke-sdp

### Description

This command enters the context to configure spoke SDP egress parameters.

## vc-label

### Syntax

**vc-label** *egress-vc-label*

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

### Context

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

## Description

This command configures the spoke-SDP egress VC label.

## Parameters

*egress-vc-label*

a VC egress value that indicates a specific connection

**Values** 16 to 1048575

## precedence

## Syntax

**precedence** *precedence-value* | **primary**

**no precedence**

## Context

config>mirror>mirror-dest>spoke-sdp

## Description

This command indicates that the SDP is of type secondary with a specific precedence value or is of type primary.

The mirror service always uses the primary type as the active pseudowire and only switches to a secondary pseudowire when the primary is down. The mirror service switches the path back to the primary pseudowire when it is back up. The user can configure a timer to delay reverting to primary or to never revert to primary.

If the active pseudowire goes down, the mirror service switches the path to a secondary SDP with the lowest precedence value. That is, secondary SDPs that are operationally up are considered in the order of their precedence value, 1 being the lowest value and 4 being the highest value. If the precedence value is the same, the SDP with the lowest SDP ID is selected.

An explicitly named endpoint can have a maximum of one SAP and one ICB. Once a SAP is added to the endpoint, only one more object of type ICB SDP is allowed. An explicitly named endpoint, which does not have a SAP object, can have a maximum of four SDPs, which can include any of the following: a single primary SDP, one or many secondary SDPs with precedence, and a single ICB SDP.

An SDP is created with type secondary and with the lowest precedence value of 4.

## Parameters

*precedence-value*

the precedence of the SDP

**Values** 1 to 4

**primary**

a precedence value that assigns the SDP the lowest precedence and enables revertive behavior



### 4.9.2.2 Show commands



**Note:** The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

#### debug

##### Syntax

**debug** [*application*]

##### Context

show

##### Description

This command displays set debug points.

##### Parameters

*application*

display which debug points have been set for the specified application

**Values** atm, bgp, cisco-hdlc, cmpv2, diameter, ethernet, filter, frame-relay, igmp, ip, ipsec, isis, lag, ldp, local-dhcp-server, mcast-management, mirror, mld, mpls, mtrace, oam, ocsp, open-flow, ospf, ospf3, pim, ppp, radius, radius-proxy, rip, rsvp, service, snmp, subscriber-mgmt, system, vrrp, wlan-gw

#### mirror

##### Syntax

**mirror mirror-dest** *service-id*

##### Context

show

##### Description

This command displays information about mirror services.

##### Parameters

*service-id*

identifies the service in the service domain

Values

service-id:

1 to 2147483690 or svc-name

Output

The following output is an example of mirror services information, and [Table 48: Mirror field descriptions](#) describes the fields.

Output example

```
A:7705:Dut-B# show mirror mirror-dest 100
=====
Mirror Service
=====
Service Id : 100 Type : Ether
Description : 100
Admin State : Up Oper State : Up
Forwarding Class : be Remote Sources: Yes
Slice : 0
Destination SAP : 1/1/2:100.150 Egr QoS Policy: 3
=====
Mirror Services SDP
=====
SdpId IP Addr CfgLabel Signal EgrLabel

No Matching Entries
=====
Remote Sources

Far End : 1.1.1.1 Ingress Label : 131067
ICB : false Vc-Id : 4294967295
Far End : 3.3.3.3 Ingress Label : 131066
ICB : false Vc-Id : 4294967294

Local Sources

Admin State : Up
-Port : 1/1/2 Egr Ing
=====
A:7705:Dut-B#
```

Table 48: Mirror field descriptions

| Label       | Description                                        |
|-------------|----------------------------------------------------|
| Service Id  | The unique ID for the mirror service               |
| Type        | The encapsulation type                             |
| Description | The mirror service description                     |
| Admin State | Down – the service is administratively disabled    |
|             | Up – the service is administratively enabled       |
| Oper State  | The operational status of the service (up or down) |

| Label            | Description                                                                       |
|------------------|-----------------------------------------------------------------------------------|
| 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                                            |
| Slice            | The mirrored frame slice size                                                     |
| Destination SAP  | The destination to which mirrored packets are sent                                |
| Egr Qos Policy   | The egress QoS policy ID. A value of 0 indicates that no QoS policy is specified. |
| SdpId            | The SDP configured to the remote node of the mirror destination                   |
| IP Addr          | The mirror destination node IP address                                            |
| CfgLabel         | The statically configured egress vc label                                         |
| Signal           | The type of signaling used                                                        |
| EgrLabel         | The egress label used                                                             |
| Far End          | The IP address of the mirror source node                                          |
| ICB              | true – ICB is enabled                                                             |
|                  | false – ICB is disabled                                                           |
| Ingress Label    | The ingress vc label used                                                         |
| Vc-Id            | The virtual circuit ID of the remote source                                       |
| Local Sources    | The details of the source ports configured on the mirror source                   |

## pcap

### Syntax

**pcap** [session-name] [detail]

### Context

show

### Description

This command shows information about the packet capture session and confirms whether the packet is reliable.

Parameters

*session-name*  
the session name

Output

The following output is an example of packet capture session information, and [Table 49: PCAP session field descriptions](#) describes the fields.

Output example

```
*A:7705:Dut-A>show pcap "pcap_1" detail
=====
Pcap Session "pcap_1" Information
=====
Application Type : mirror-dest Session State : ready
Capture : stop Last Changed : 02/06/2018 19:52:07
Capture Count : 250 Received packets: 0
Packets contiguous : true
Capture File Url : ftp://*:~@192.x.x.x/pcap.pcap

Buffer Size : 0 Bytes File Size : 0 Bytes
Write Failures : 0 Read Failures : 0
Proc Time Bailouts : 0 Last File Write : 02/06/2018 19:52:07
Dropped Packets : 0 Packets
=====
```

Table 49: PCAP session field descriptions

| Label            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Application Type | The application type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Session State    | The state of the PCAP session:<br><br>failed – packet capture has failed on the PCAP session<br><br>init – the PCAP session is initializing<br><br>ready – the PCAP session is ready for capture<br><br>start – the PCAP session is in the start state waiting to commence capture<br><br>in-progress – packet capture is in progress on the PCAP session<br><br>stopped – packet capture has stopped on the PCAP session<br><br>file-error – there are issues performing file operations on the PCAP session<br><br>buffer-full – the PCAP session is running out of memory on its packet capture buffer<br><br>buffer-high-watermark – the PCAP session is reaching the operating buffer limit on the packet capture buffer. This may trigger a write to file operation. |
| Capture          | The capture state: start or stop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Label              | Description                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Last Changed       | The timestamp of the last change to the capture state                                                                                                                  |
| Capture Count      | The number of packets to be captured in the PCAP file during the PCAP session                                                                                          |
| Received packets   | The number of packets captured from the mirror source                                                                                                                  |
| Packets contiguous | Indicates whether packets were contiguous or dropped packets were detected:<br>True: packets were contiguous<br>False: dropped packets were detected                   |
| Capture File Url   | The file URL for the FTP server, including the filename for packet capture transfer                                                                                    |
| Buffer Size        | The total buffer size, in bytes, currently in use by the PCAP session                                                                                                  |
| File Size          | The current size of the capture file                                                                                                                                   |
| Write Failures     | The number of errors that occurred when packets were written into the buffer. A number greater than 0 indicates that some packets were not captured.                   |
| Read Failures      | The number of errors that occurred when packets were read from the buffer for exporting to FTP. A number greater than 0 indicates that some packets were not captured. |
| Proc Time Bailouts | Number of packets not captured due to a system process timeout                                                                                                         |
| Dropped Packets    | The number of packets dropped from the buffer due to errors                                                                                                            |
| Last File Write    | The timestamp of the last write to file                                                                                                                                |

### 4.9.2.3 Debug commands

#### mirror-source

##### Syntax

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

##### Context

debug

## Description

This command configures mirror source parameters for a mirrored service.

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

A mirrored packet cannot be mirrored to multiple destinations. If a packet matches multiple mirror source entries, the packet is mirrored to a single mirror destination service ID physical port. The precedence is structured so that the most specific match criteria has precedence over a less specific match.

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

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

The **no** form of the 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.

## Default

n/a

## Parameters

*service-id*

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

**Values**    *service-id*: 1 to 2147483647 or *svc-name*

## mac-filter

## Syntax

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

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

## Context

debug>mirror-source

## Description

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

The command directs packets that match the defined list of entry IDs to be mirrored to the mirror destination referenced by the *service-id* of the **mirror-source**. The match criteria can be source or destination MAC addresses

The MAC filter must already exist in order for the command to execute. Filters are configured in the **config>filter** context. If the MAC filter does not exist, an error will occur. If the filter exists but has not been associated with a VPLS SAP, an error is not generated but mirroring is not enabled because there are no packets to mirror. Once the filter is associated with a VPLS SAP 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 prior to any ingress packet modifications.

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

Each entry ID must exist in the MAC filter. If the *entry-id* is renumbered in 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.

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

The **no** version of this command without an *entry-id* configured disables mirroring on all entry IDs within the MAC filter.

The **no** version of this command with one or more entry IDs listed disables mirroring of packets matching those specific MAC filter entries. 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 normally.

## Default

n/a

## Parameters

*mac-filter-id*

the MAC filter ID whose entries are mirrored

**Values** 1 to 65535

*entry-id*

the MAC filter entries to use as match criteria for packet mirroring. Up to eight entry IDs can be specified with a single command. Each *entry-id* must be separated by a space.

If no entry IDs are specified, mirroring does not occur for that MAC filter ID and the command will have no effect.

**Values** 1 to 65535

## sap

## Syntax

**sap** *sap-id* {[**ingress**] [**egress**]}

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

## Context

debug>mirror-source

## Description

This command enables mirroring of traffic ingressing or egressing an Ethernet SAP.

The **sap** command associates a specific SAP with a mirror source. The SAP is identified by the *sap-id*. The defined SAP can be configured in access or hybrid mode and can use any supported encapsulation type, including null, dot1q, or QinQ.

The SAP is referenced only within the mirror source context for mirroring purposes. If the SAP is removed from the system, the mirroring association is also removed from the mirror source.

A SAP cannot be associated with more than one mirror-source definition when the **ingress** or **egress** parameter is defined.

If the SAP is not associated with a **mirror-source**, packets on that SAP will not be mirrored unless they match more specific mirroring criteria, such as MAC filter mirroring.

SAP mirroring is applied with higher priority than port mirroring for both ingress and egress directions.

The **no** version of this command disables mirroring for the specified SAP. Mirroring of packets on the SAP may continue due to more specific mirror criteria. If the **ingress** or **egress** parameters are specified, only the corresponding mirroring direction is disabled.

## Default

n/a

## Parameters

*sap-id*

the SAP ID

**ingress**

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

**egress**

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

port

## Syntax

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

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

## Context

debug>mirror-source



## Description

This command enables mirroring of traffic ingressing or egressing an Ethernet port or link aggregation group (LAG).

The **port** command associates a port or LAG with a mirror source. The port is identified by the *port-id*. The defined port can be an Ethernet access, network, or hybrid port. A network port may be a single port or a LAG ID. When a LAG ID is given as the *port-id*, mirroring is enabled on all ports making up the LAG.

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

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

If the port is not associated with a **mirror-source**, packets on that port will not be mirrored.

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

## Default

n/a

## Parameters

*port-id*

the port ID

*lag-id*

the LAG identifier, expressed as a decimal integer

**Values** 1 to 32

**egress**

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

**ingress**

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

**pcap**

## Syntax

**pcap** *session-name*

## Context

debug

## Description

This command specifies the session for the packet capture process.

Parameters

*session-name*  
the session name

capture

Syntax

**capture** *pcap-action*

Context

debug>pcap

Description

This command starts and stops the packet capture process for the specified *session-name*.

Parameters

*pcap-action*  
the PCAP session start or stop action

**Values**    start or stop

**start:** starts the packet capture process and also starts or restarts the FTP session. If the FTP server is unreachable, the command prompt blocks further input until the retries are timed out after 24 s (after four attempts of about 6 s each). If the same filename is unchanged in the **config>mirror>mirror-dest>pcap** context between captures, this command overwrites the file content.

**stop:** stops the packet capture process and also stops the FTP session. If the FTP server is unreachable, the command prompt blocks further input until the retries are timed out after 24 s (after four attempts of about 6 s each).

## 5 Tools

### 5.1 Tools command reference

#### 5.1.1 Command hierarchies

- [Tools dump commands](#)
- [Tools perform commands](#)
- [Tools ADP commands](#)

##### 5.1.1.1 Tools dump commands

```
tools
- dump
 - anysec interface interface-name [clear]
 - auto-discovery [detail] [log]
 - cflowd
 - cache aggregate {src-dst-proto | src-dst-proto-port} family {ipv4 | ipv6}
 - cache all family {ipv4 | ipv6}
 - packet-size protocols [clear]
 - top-flows protocols [clear]
 - top-protocols protocols [clear]
 - control-queues failures
 - eth-ring [clear]
 - gnss port-id
 - lag lag-id lag-id
 - ldp-treetrace {prefix ip-prefix/mask | manual-prefix ip-prefix/mask} [path-
destination ip-address] [trace-tree]
 - mpls-resources
 - persistence
 - dhcp-server [record record-key]
 - summary
 - port port-id discard [clear]
 - ppp port-id
 - router router-instance
 - router service-name service-name
 - bgp
 - routes [family] received [url file-url]
 - fib slot-number [ipv4 | ipv6] summary
 - ldp
 - fec vc-type vc-type agi agi
 - fec p2mp-id identifier root ip-address
 - fec root ip-address source ip-address group mcast-address inner-root ip-
address
 - fec prefix ip-prefix/mask
 - fec root ip-address source ip-address group mcast-address [rd rd]
 - fec vc-type vc-type vc-id vc-id
 - fec p2mp-id identifier root ip-address [rd rd] inner-root ip-address
 - instance
 - interface [ip-int-name | ip-address]
```

```

- memory-usage
- peer ip-address
- session [ip-address [:label-space] [connection | peer | adjacency]
- sockets
- timers
- mpls
 - ftn [endpoint endpoint | sender sender | nexthop nexthop | lsp-id lsp-id |
tunnel-id tunnel-id | label start-label end-label]
 - ilm [endpoint endpoint | sender sender | nexthop nexthop | lsp-id lsp-id |
tunnel-id tunnel-id | label start-label end-label]
 - lspinfo [lsp-name] [detail]
 - memory-usage
- ospf
 - abr [detail]
 - area-range
 - 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]
 - sham-bad-packet interface-name
 - sr-adjacencies [remote ip-address] [detail]
 - sr-database [sid sid] [detail]
- ospf3
 - abr [detail]
 - area-range
 - asbr [detail]
 - bad-packet interface-name
 - 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]
- pim
 - iom-failures [detail]
- rsvp
 - neighbor [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]
- segment-routing
 - tunnel
- static-route
 - ldp-sync-status
- te-database [adv-router adv-router] [neighbor neighbor] [detail]
 - isis [instance isis-instance] [level level]
 - ospf [instance ospf-instance] [area area-id]
- service
 - evpn usage
 - id service-id
 - evpn usage
 - evpn-mpls [clear]

```

```

- ip-transport ipt-id
 - remote-host host-id check-tcp
- loopback
 - sap sap-id
 - sdp sdp-id:vc-id
- mp-bgp family vpn stats [clear]
- network-latency-measurement [clear]
- sap sap-id stats [clear]
- sdp sdp-id[:vc-id] stats [clear]
 - ipsec-tunnel ipsec-tunnel-name stats
- loopback
- system
 - bgp-evpn
 - ethernet-segment name evi value df
 - security
 - secure-boot
 - uefi-vars cpm-slot
 - support-mode
 - nonce
 - session-tokens
 - vpls-fdb-stats [clear]
- system-limits
- system-resources slot-number
- testhead
- test-oam
 - testhead test-name test-name [test-owner test-owner]
 - twamp twamp server error-counters

```

### 5.1.1.2 Tools perform commands

```

tools
- perform
 - aps
 - clear aps-id {protect | working}
 - exercise aps-id {protect | working}
 - force aps-id {protect | working}
 - lockout aps-id
 - request aps-id {protect | working}
 - cflowd
 - manual-export
 - eth-ring
 - clear ring-index
 - force ring-index path {a | b}
 - manual ring-index path {a | b}
 - ima
 - reset bundle-id
 - lag
 - clear-force all-mc
 - clear-force lag-id lag-id [sub-group sub-group-id]
 - clear-force peer-mc ip-address
 - force all-mc {active | standby}
 - force lag-id lag-id [sub-group sub-group-id] {active | standby}
 - force peer-mc peer-ip-address {active | standby}
 - lcr
 - clear lcr-id {protect | working}
 - force lcr-id {protect | working}
 - lockout lcr-id
 - log
 - test-event
 - mda-table-refresh
 - mw

```

```

- clear mw-link-id {main | spare} {eps | tps | rps}
- force mw-link-id {eps | tps | rps}
- lockout mw-link-id {eps | tps | rps}
- manual mw-link-id {main | spare} {eps | tps | rps}
- software-download [force]
- ptp reset-clk-rec clock-id clock-id
- router router-instance
- router service-name service-name
 - isis [isis-instance]
 - ldp-sync-exit
 - run-manual-spf
 - mpls
 - cspf to ip-addr [from ip-addr] [bandwidth bandwidth] [include-bitmap bitmap]
 [exclude-bitmap bitmap] [hop-limit limit] [exclude-address excl-addr [excl-addr...(up to 8
max)]] [use-te-metric] [strict-srlg] [srlg-group grp-id...(up to
8 max)]] [exclude-node excl-node-id [excl-node-id...(up to 8 max)]] [skip-interface interface-
name] [cspf-reqtype req-type] [least-fill-min-thd thd]
 - resignal {lsp lsp-name path path-name | delay minutes}
 - resignal {sr-te-lsp srte-lsp-name path path-name | sr-te-delay minutes}
 - resignal-bypass delay minutes
 - resignal-bypass lsp bypass-lsp-name [force]
 - sr-te-cspf [path-computation-method path-computation-method] to ip-address
 [path path-name] [from ip-address] [include-bitmap bitmap] [exclude-bitmap bitmap] [hop-
limit limit] [metric-type-te] [strict-srlg] [srlg-group group-id] [local-sr-protection local-
sr-protection] [label-stack-reduction] [max-sr-labels label-stack-size]
 - trap-suppress number-of-traps time-interval
 - update-path {lsp lsp-name path current-path-name new-path new-path-name}
 - ospf
 - ldp-sync-exit
 - refresh-lsas [lsa-type] [area-id]
 - run-manual-spf [externals-only]
- security
 - authentication-server-check server-address ip-address [port port] user-name dhcp-
client-user-name password password secret key [source-address ip-address] [timeout seconds]
 [router router-instance | service-name service-name]
 - service
 - id service-id
 - endpoint endpoint-name
 - force-switchover sdp-id:vc-id
 - no force-switchover
 - ip-transport ipt-id
 - remote-host host-id check-tcp
 - sap sap-id cem asym-delay-adjust
- system
 - management-interface
 - snmp
 - change-key authentication authentication-protocol old-authentication-key
new-authentication-key
 - change-key authentication authentication-protocol privacy privacy-
protocol old-privacy-key new-privacy-key
 - generate-key authentication authentication-protocol authentication-
password [privacy privacy-protocol privacy-password] [engine-id identifier]
 - script-control
 - script-policy
 - stop [script-policy-name] [owner script-policy-owner] [all]
 - security
 - support-mode
 - generate-new-nonce

```

### 5.1.1.3 Tools ADP commands

```
tools
- auto-discovery [retry] [terminate]
- [no] auto-discovery echo [debugger]
```

## 5.1.2 Command descriptions

- [Tools generic commands](#)
- [Tools dump commands](#)
- [Tools perform commands](#)
- [Tools ADP commands](#)

### 5.1.2.1 Tools generic commands

tools

#### Syntax

tools

#### Context

<root>

#### Description

This command enables the context to use tools for debugging purposes.

#### Default

n/a

### 5.1.2.2 Tools dump commands

- [Dump commands](#)
- [Dump test OAM commands](#)
- [Dump router commands](#)

#### 5.1.2.2.1 Dump commands

dump

#### Syntax

dump

#### Context

tools



## Description

This command enables the context to display information for debugging purposes.

## Default

n/a

## anysec

## Syntax

**anysec interface** *interface-name* [**clear**]

## Context

tools>dump

## Description

This command dumps ANYsec information.

## Default

n/a

## Parameters

*interface-name*

specifies an existing interface. If the string contains special characters (such as #, \$, or spaces), the entire string must be enclosed within double quotes.

**clear**

clears the statistics after displaying them

## Output

The following output is an example of ANYsec information.

### Output example

```
*A:7705:Dut-C# tools dump anysec interface "if_to_Dut-E"
Tx Packets:
 Encrypted : 21535
 Bypassed : N/A
 Dropped - No Encr. support : 0
 Dropped - Other Errors : 1
Rx Packets:
 Decrypted : 0
 Dropped - No Tag : 0
 Dropped - Bad Tag : 0
 Dropped - No SA : 0
 Bypassed : N/A
 Dropped - No Encr. support : 0
 Dropped - Other Errors : 0
*A:7705:Dut-C#
```

## auto-discovery

### Syntax

**auto-discovery** [detail] [log]

### Context

tools>dump

### Description

This command allows you to view all progress and event logs stored by ADP.

### Default

n/a

### Parameters

#### detail

displays detailed information about the system, ports, and ADP instructions

#### log

displays all detailed progress and event logs with timestamps

## cflowd

### Syntax

**cflowd**

### Context

tools>dump

### Description

This command enables dump tools for cflowd.

### Default

n/a

## cache

### Syntax

**cache aggregate** {src-dst-proto | src-dst-proto-port} family {ipv4 | ipv6}

**cache all** family {ipv4 | ipv6}

Context

tools>dump>cflowd

Description

This command displays the contents of the cflowd active cache. This information can be displayed either in raw form where every flow entry is displayed or in an aggregated form.

Default

n/a

Parameters

- all

displays the raw active cache flow data with no aggregation.
- aggregate

displays the aggregated active cache flow data

src-dst-proto

– aggregates the active flow cache based on the source and destination IP address and the IP protocol value

src-dst-proto-port

– aggregates the active flow cache based on the source and destination IP address, IP protocol value, and the source and destination port numbers
- family

specifies which IP address family flow data should be displayed

ipv4

– displays the IPv4 flow data

ipv6

– displays the IPv6 flow data

Output

The following output is an example of cflowd cache information, and [Table 50: Tools dump cflowd cache field descriptions](#) describes the fields.

Output example

```
*A:NOK1>config>router# /tools dump cflowd cache aggregate src-dst-proto family ipv4
Cache dump aggregation in progress, please wait...
Current time: 03/21/2019 17:15:46

Proto Source Address Pkt-Cnt Start
 Destination Address Byte-Cnt

TCP 10.40.1.5 11741 03/21/2019 17:13:35
 3.1.38.1 2700430

```

Table 50: Tools dump cflowd cache field descriptions

| Label          | Description                                      |
|----------------|--------------------------------------------------|
| Proto          | The IPv4 or IPv6 protocol type                   |
| Source Address | The source IP address of the flow (IPv4 or IPv6) |

| Label               | Description                                                                                                                              |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Destination Address | The destination IP address of the flow (IPv4 or IPv6)                                                                                    |
| Intf/Ingr           | The ingress interface associated with the sampled flow (only displayed with the raw (all) output)                                        |
| Intf/Egr            | The egress interface associated with the sampled flow (only displayed with the raw (all) output)                                         |
| S-Port              | The source protocol port number                                                                                                          |
| D-Port              | The destination protocol port number                                                                                                     |
| Pkt-Cnt             | The total number of packets sampled for the associated flow                                                                              |
| Byte-Cnt            | The total number of bytes of traffic sampled for the associated flow                                                                     |
| Start               | The system time when the first packet was sampled for the associated flow                                                                |
| Flags               | The IP flag value from the sampled IP flow header (only displayed with the raw (all) output)                                             |
| ToS                 | The ToS byte values from the sampled IP flow header (only displayed with the raw (all) output)                                           |
| (Src) Mask          | The IP route mask for the route to the flow source IP address associated with the flow (only displayed with the raw (all) output)        |
| (Dst) Mask          | The IP route mask for the route to the flow destination IP address associated with the flow (only displayed with the raw (all) output)   |
| (Src) AS            | The ASN associated with the route to the flow source IP address associated with the flow (only displayed with the raw (all) output)      |
| (Dst) AS            | The ASN associated with the route to the flow destination IP address associated with the flow (only displayed with the raw (all) output) |
| vRtr-ID             | The Virtual Router ID associated with the reported IP flow (only displayed with the raw (all) output)                                    |

## packet-size

### Syntax

**packet-size** *protocol* [**clear**]

## Context

tools>dump>cflowd

## Description

This command displays packet size distribution for sampled IP traffic. Values are displayed in decimal format (1.0 = 100%, 500 = 50%). Separate statistics are maintained and shown for IPv4 and IPv6 traffic.

The **clear** option clears the cache after the packet size statistics are displayed.

## Default

n/a

## Parameters

*protocol*

specifies the type of cflowd packet information to display

**Values**    ipv4 | ipv6 | mpls | mcast-ipv4 | mcast-ipv6

**clear**

clears the cache after the packet size statistics are displayed

## Output

The following output is an example of cflowd packet size information.

### Output example

```

NOK-12# tools dump cflowd packet-size ipv4
IP packet size distribution (801600 total packets):
 1-32 64 96 128 160 192 224 256 288 320 352 384 416 448 480
.000 .250 .000 .000 .010 .100 .500 .090 .000 .000 .000 .000 .000 .000 .000

 512 544 576 1024 1536 2048 2560 3072 3584 4096 4608 9000
.000 .000 .000 .050 .000 .000 .000 .000 .000 .000 .000 .000 .000

```

## top-flows

## Syntax

**top-flows** *protocols* [**clear**]

## Context

tools>dump>cflowd

## Description

This command displays the top 20 (highest traffic volume) flows for IPv4, IPv6, or MPLS traffic types collected since the cflowd top-flow table was last cleared or initialized.

The **clear** option clears the top-flow table after the top flows are displayed.

Default

n/a

Parameters

*protocols*

specifies the type of cflowd packet information to display

**Values**    ipv4 | ipv6 | mpls | mcast-ipv4 | mcast-ipv6

**clear**

clears the top-flow table after the top flows are displayed

Output

The following output is an example of cflowd top flow information, and [Table 51: Tools dump cflowd top flows field descriptions](#) describes the fields.

Output example

```
*A:7705:Dut-A# tools dump cflowd top-flows ipv4
The top 20 IPv4 unicast flows seen by cflowd are:
 Current Time: 04/01/2019 17:44:17
Last Cleared Time: 04/01/2019 17:38:36
 ifIndexContext: global
Intf/Ingr SrcIP Intf/Egr DstIP Pro ToS
I-vRtrID S-Port Msk AS E-vRtrID D-Port Msk AS Flgs Pkts
 Pkt-Size Time

2 150.2.1.2 1 150.1.1.2 6 0x00
1 10 /24 300 1 20 /24 200 0x00 25
 1.20.1.2 46 0

*A:7705:Dut-A# tools dump cflowd top-flows ipv6
The top 20 IPv6 unicast flows seen by cflowd are:
 Current Time: 04/01/2019 17:44:24
Last Cleared Time: 04/01/2019 17:38:36
 ifIndexContext: global
SrcIP Intf/Ingr S-Port I-vRtrID ToS
DstIP Intf/Egr D-Port E-vRtrID Flags
NextHop Pkts Pkt-Size Proto Time

::9602:102 2 10 1 0x03
::9601:102 1 20 1 0x00
::114:102 25 60 6 0

*A:7705:Dut-
```

Table 51: Tools dump cflowd top flows field descriptions

| Label     | Description                                      |
|-----------|--------------------------------------------------|
| Intf/Ingr | The ingress interface ID                         |
| SrcIP     | The source IP address of the flow (IPv4 or IPv6) |
| Intf/Egr  | The egress interface ID                          |

| Label     | Description                                                                                                                                    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------|
| DstIP     | The destination IP address of the flow (IPv4 or IPv6)                                                                                          |
| Pro       | The protocol type for the flow                                                                                                                 |
| ToS       | The Type of Service/DSCP bits field markings                                                                                                   |
| Flgs      | The protocol flag markings                                                                                                                     |
| Pkts      | The total number of packets sampled for this flow since the statistics were last cleared                                                       |
| I-vRtr-ID | The vRouter context the flow was sampled in                                                                                                    |
| S-Port    | The source protocol port number                                                                                                                |
| Mask      | The route prefix length for route to source IP address                                                                                         |
| AS        | The autonomous systems number for the source route (the AS is either the originating AS or peer AS depending on the cflowd configuration)      |
| D-Port    | The destination protocol port number                                                                                                           |
| Mask      | The route prefix length for route to destination IP address (forwarding route)                                                                 |
| AS        | The autonomous systems number for the destination route (the AS is either the originating AS or peer AS depending on the cflowd configuration) |
| NextHop   | The next-hop address used to forward traffic associated with the flow                                                                          |
| Pkt-Size  | The average packet size of sampled traffic associated with this flow (total number of packets sampled/volume of traffic sampled)               |
| Time      | The number of seconds the flow has been active                                                                                                 |

## top-protocols

### Syntax

**top-protocols** *protocols* [clear]

### Context

tools>dump>cflowd

Description

This command displays the summary information for the top 20 protocol traffic flows in the cflowd cache. All statistics are calculated based on the data collected since the last clearing of the cflowd statistics. If the **clear** option clears the cache after the top protocol statistics are displayed.

Default

n/a

Parameters

- protocols*  
specifies the type of cflowd packet information to display  
**Values**    ipv4 | ipv6 | mpls | mcast-ipv4 | mcast-ipv6
- clear**  
clears the cache after the top protocol statistics are displayed

Output

The following output is an example of cflowd top protocol traffic information, and [Table 52: Tools dump cflowd top protocols field descriptions](#) describes the fields.

Output example

```
NOK1# tools dump cflowd top-protocols

The top 20 IPv4 protocols seen by cflowd are:
 Current Time: 08/29/2011 15:36:15
Last Cleared Time: 08/29/2011 15:35:08
Protocol ID Total Flows Packets Bytes Packets Duration % Total
----- Flows /Sec /Flow /Pkt /Sec /Flow Bandwidth

UDP 2 0 6 100 0 6 75%
pr1 1 0 6 64 0 6 24%

TOTALS 3 0 6 88 0 6 100%
```

Table 52: Tools dump cflowd top protocols field descriptions

| Label        | Description                                                                                                               |
|--------------|---------------------------------------------------------------------------------------------------------------------------|
| Protocol ID  | The IPv4 or IPv6 protocol type. The protocol ID is either the protocol name or the decimal protocol number.               |
| Total Flows  | The total number of flows recorded since the last clearing of cflowd statistics with this protocol type                   |
| Flows/Sec    | The average number of flows detected for the associated protocol type<br>(Total flows/number of seconds since last clear) |
| Packets/Flow | The average number of packets per flow                                                                                    |



| Label             | Description                                                                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | (Total number of packets/total flows)                                                                                                                                              |
| Bytes/Pkt         | The average number of bytes per packet for the associated protocol type<br>(Total number of bytes for the associated protocol/total number of packets for the associated protocol) |
| Packets/Sec       | The average number of packets for the associated protocol type<br>(Number of packets/number of seconds since last clear)                                                           |
| Duration/Flow     | The average lifetime of a flow for the associated protocol type<br>(Number of seconds since last clear/total flows)                                                                |
| % Total Bandwidth | The percentage of bandwidth consumed by the associated protocol type<br>(Total protocol bytes/total bytes of all flows)                                                            |

## control-queues

### Syntax

**control-queues failures**

### Context

tools>dump

### Description

This command displays information about failed control queues.

### Default

n/a

### Output

The following output is an example of control queue failures, and [Table 53: Control queue failures field descriptions](#) describes the fields.

#### Output example

```
*A:NOK1# /tools dump control-queues failures
```

| Ingress SF queue       | Size | Free | Buf Alloc Failures |
|------------------------|------|------|--------------------|
| MDA Startup            | 1250 | 1250 | 0                  |
| SF Large High priority | 1024 | 1024 | 0                  |
| SF Small High priority | 8192 | 8192 | 0                  |
| SF Large Med priority  | 1024 | 1024 | 0                  |
| SF Small Med priority  | 8192 | 8192 | 0                  |

|                       |      |      |   |
|-----------------------|------|------|---|
| SF Large Low priority | 1024 | 1024 | 0 |
| SF Small Low priority | 8192 | 8192 | 0 |
| SF Cflowd             | 8192 | 8192 | 0 |

Table 53: Control queue failures field descriptions

| Label              | Description                                   |
|--------------------|-----------------------------------------------|
| Ingress SF queue   | The ingress control queue                     |
| Size               | The size of the control queue, in packets     |
| Free               | The remaining space in the control queue      |
| Buf Alloc Failures | The number of recorded control queue failures |

eth-ring

Syntax

eth-ring ring-index [clear]

Context

tools>dump

Description

This command displays Ethernet ring information.

Default

n/a

Parameters

ring-index

specifies an Ethernet ring index

clear

clears stored information for the specified Ethernet ring

gnss

Syntax

gnss port-id

Context

tools>dump

**Description**

This command displays GNSS satellite signal strength information.

**Default**

n/a

**Parameters**

*port-id*  
specifies the port ID in the format *slot/mda/port*

**Output**

The following output is an example of GNSS information.

**Output example**

```
A:ALU-1># tools dump gnss 1/3/1
=====
Satellites
=====
SVID Signal-Strength
 C/No (dB-Hz)

31 50
23 48
29 47
26 45
16 45
3 45
9 44
14 42
74 40
27 40
22 40
75 33
65 31
83 26
84 24

Entries found: 15
=====
A:ALU-1>#
```

**lag**

**Syntax**

**lag lag-id lag-id**

**Context**

tools>dump

**Description**

This command displays link aggregation group (LAG) information.

**Default**

n/a

**Parameters**

*lag-id*  
the LAG identifier, expressed as a decimal integer  
**Values** 1 to 32

ldp-treetrace

**Syntax**

**ldp-treetrace** {**prefix** *ip-prefix/mask* | **manual-prefix** *ip-prefix/mask*} [**path-destination** *ip-address*] [**trace-tree**]

**Context**

tools>dump

**Description**

This command displays treetrace information. The **prefix** command displays automated treetrace results only if **ldp-treetrace** is enabled at the OAM test level. The **manual-prefix** command displays results discovered by a previously run **ldp-treetrace** manual test.

Path information displayed by the ldp-treetrace command supports SNMP. The 7705 SAR stores this information in the TIMETRA-OAM-TEST-MIB tmnxOamLTraceHopInfoTable object.

**Default**

n/a

**Parameters**

*ip-prefix/mask*  
specifies the IP prefix and subnet mask  
*ip-address*  
specifies the destination IP address

**Output**

The following outputs are examples of **ldp-treetrace** information.

**Note:** The **tools dump ldp-treetrace prefix** command displays entries only if **ldp-treetrace** is enabled using the **configure test-oam ldp-treetrace no shutdown** CLI command.

**Output example**

The following example shows automated **ldp-treetrace** results. This command collects all information but displays a summary of the ECMP paths indexed by the path destination (PathDst), which is the IP address used in the LSP Ping message to probe a specific ECMP path to the destination FEC.

```
*A:ALU-1># tools dump ldp-treetrace prefix 10.12.12.10/32
Discovered Paths:
=====
```

| Id    | PathDst<br>discoveryTtl | Egr-NextHop<br>ProbeState | Reply-Rtr-Addr<br>ProbeTmOutCnt | DisCovery-Time<br>RtnCode |
|-------|-------------------------|---------------------------|---------------------------------|---------------------------|
| 001   | 10.1.0.5<br>007         | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 002   | 10.1.0.9<br>007         | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 003   | 10.1.0.15<br>007        | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 004   | 10.1.0.19<br>007        | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 005   | 10.1.0.24<br>007        | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| ..... |                         |                           |                                 |                           |
| 051   | 10.1.0.243<br>007       | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 052   | 10.1.0.247<br>007       | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 053   | 10.1.0.252<br>007       | 10.10.1.2<br>OK           | 10.12.12.10 12/19/2006<br>00    | 05:11:01<br>EgressRtr     |
| 054   | 10.1.0.255              | 10.10.1.2                 | 10.12.12.10 12/19/2006          | 05:11:01                  |

```
ldp-treetrace discovery state: Done
ldp-treetrace discovery status: ' OK '
Total number of discovered paths: 54
Total number of probe-failed paths: 0
Total number of failed traces: 0
```

### Output example

The following example shows an automated **ldp-treetrace** with a path destination. This command displays the details of the label stack at each hop by filtering on a specific ECMP path.

```
tools dump ldp-treetrace prefix 10.12.12.10/32 path-destination 10.1.0.5
FEC: 10.12.12.10/32 PathDst: 10.1.0.5
=====
Protocol Legend: L - LDP, R - RSVP, U - Not Applicable
```

| HopId | HopAddr     | TTL | Label1  | Label2  | Label3  | Label4  | Label5  |
|-------|-------------|-----|---------|---------|---------|---------|---------|
| 277   | 10.12.12.10 | 007 | 000000L | 000000U | 000000U | 000000U | 000000U |
| 223   | 10.1.1.17   | 006 | 001609L | 000000U | 000000U | 000000U | 000000U |
| 196   | 10.2.1.2    | 005 | 001609L | 000000U | 000000U | 000000U | 000000U |
| 187   | 10.2.1.1    | 004 | 001609L | 000000U | 000000U | 000000U | 000000U |
| 184   | 10.1.1.11   | 003 | 001609L | 000000U | 000000U | 000000U | 000000U |
| 183   | 10.1.1.1    | 002 | 001609L | 000000U | 000000U | 000000U | 000000U |
| 182   | 10.10.1.2   | 001 | 001609L | 000000U | 000000U | 000000U | 000000U |

```
Total number of Hops: 7
```

## mpls-resources

### Syntax

**mpls-resources**

### Context

tools>dump

### Description

This command displays FEC-to-NHLFE (next hop label forwarding entry) and ILM (incoming label message) information for MPLS.

### Default

n/a

## persistence

### Syntax

**persistence**

### Context

tools>dump

### Description

This command enables the context to display persistence information.

### Default

n/a

## dhcp-server

### Syntax

**dhcp-server** [**record** *record-key*]

### Context

tools>dump>persistence

### Description

This command displays persistence information for the DHCP server.

Default

n/a

Parameters

*record-key*  
specifies the record identification number

Output

The following output is an example of DHCP server persistence information, and [Table 54: DHCP server persistence field descriptions](#) describes the fields.

Output example

```
A:7705# tools dump persistence dhcp-server

Persistency File Info

Filename : cf3:\dhcp_serv.001
ClientDescr : dhcp-server
UserDataSize : 372
DataPadding : 128
NumberOfEntries : 4112
FileSize : 8225
Version : 0001
Entries in use : 9
State : ACTIVE
```

Record key output example

```
A:7705# tools dump persistence dhcp-server record 0x1

Persistency File Record

Filename : cf3:\dhcp_serv.001
Key : 00000001
Last Update : 2013/07/12 11:45:37 (UTC)
Action : ADD
Data
 service Id : 0
 server : defaultDhcpServer
 IP : 10.1.1.20
 MAC : 00:11:22:33:01:07
 XID : 0x0cbe9d53
 start time : 2013/07/12 11:45:37 (UTC)
 expires : 2013/07/21 11:45:37 (UTC)
 failctrl : local
 opt60 len : 3
 opt82 len : 0
```

Table 54: DHCP server persistence field descriptions

| Label    | Description                                               |
|----------|-----------------------------------------------------------|
| Filename | The name and location of the persistence information file |

| Label           | Description                                                                                                                                   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| ClientDescr     | The description of the client                                                                                                                 |
| UserDataSize    | The size of the user data, in bytes                                                                                                           |
| DataPadding     | The size of the data padding, in bytes                                                                                                        |
| NumberOfEntries | The number of entries in the persistence information file<br>It is a combination of leases given and may also contain DHCP servers configured |
| FileSize        | The total size of records in the persistence information file, in blocks of 512 bytes                                                         |
| Version         | The version of the persistence information file                                                                                               |
| Entries in use  | The number of entries currently in use                                                                                                        |
| State           | The state of the persistence information file                                                                                                 |
| Key             | The record key number                                                                                                                         |
| Last Update     | The date and time of the last record update                                                                                                   |
| Action          | The action taken during the last record update                                                                                                |
| Data            |                                                                                                                                               |
| service Id      | The service ID number                                                                                                                         |
| server          | The DHCP server name                                                                                                                          |
| IP              | The IP address of the lease                                                                                                                   |
| MAC             | The MAC address associated with the lease                                                                                                     |
| XID             | The transaction ID (XID) used in DHCPDISCOVER packets                                                                                         |
| start time      | The start time and date of the current lease                                                                                                  |
| expires         | The expiry time and date of the current lease                                                                                                 |
| failctrl        | The failure control (not supported on the 7705 SAR)                                                                                           |
| opt60 len       | The length of the DHCP option 60 message                                                                                                      |
| opt82 len       | The length of the DHCP option 82 message                                                                                                      |



summary

Syntax

summary

Context

tools>dump>persistence

Description

This command displays persistence summary information.

Default

n/a

Output

The following output is an example of persistence summary information, and [Table 55: Persistence summary field descriptions](#) describes the fields.

Output example

```
A:7705# tools dump persistence summary
=====
Persistence Summary on Slot A
=====
Client Location Entries in use Status

dhcp-server cf3:\dhcp_serv.001 2 ACTIVE

=====
Persistence Summary on Slot B
=====
Client Location Entries in use Status

dhcp-server cf3:\dhcp_serv.001 2 ACTIVE
```

Table 55: Persistence summary field descriptions

| Label          | Description                                               |
|----------------|-----------------------------------------------------------|
| Client         | The name of the client                                    |
| Location       | The name and location of the persistence information file |
| Entries in use | The number of entries in use                              |
| Status         | The status of the persistence information file            |

## port

### Syntax

**port** *port-id* **discard** [**clear**]

### Context

tools>dump

### Description

This command displays invalid Layer 2 packets that have been discarded for the specified port. Reasons for packet discards include an invalid VLAN identifier or an invalid Etype. The CLI shows the header for the invalid VLAN identifier and invalid Etype.

### Default

n/a

### Parameters

*port-id*

specifies the port ID in the format *slot/mda/port*

**clear**

clears the packets after viewing

## ppp

### Syntax

**ppp** *port-id*

### Context

tools>dump

### Description

This command displays PPP information for a port.

### Default

n/a

### Parameters

*port-id*

specifies the port ID

**Syntax:** *port-id* *slot/mda/port[.channel]*

*bundle* *bundle-type-slot/mda.bundle-num*

|            |          |
|------------|----------|
| bundle     | keyword  |
| type       | ima, ppp |
| bundle-num | 1 to 32  |

service

Syntax

service

Context

tools>dump

Description

This command enables the context to display service information.

Default

n/a

evpn

Syntax

evpn usage

Context

tools>dump>service  
tools>dump>service>id

Description

This command displays the consumed EVPN resources for the system or for a specified service.

Output

The following output is an example of EVPN usage for the system and a specified service.

Output example for the system:

```
*A:PE71# tools dump service evpn usage
EVPN usage statistics at 000 02:01:03.810:
MPLS-TEP : 5
VXLAN-TEP : 0
Total-TEP : 5/ 8191
Mpls Dests (TEP, Egress Label + ES + ES-BMAC) : 16
Vxlan Dests (TEP, Egress VNI) : 0
Total-Dest : 17/131071
```

```
Sdp Bind + Evpn Dests : 20/196607
ES L2/L3 PBR : 0/ 32767
*A:PE71#
```

**Output example for a specific service:**

```
*A:PE71# tools dump service id 7 evpn usage

Evpn Tunnel Interface IP Next Hop: N/A

*A:PE71#
```

id

**Syntax**

*id service-id*

**Context**

tools>dump>service

**Description**

This command enables the context to display information for the specified service.

**Default**

n/a

**Parameters**

*service-id*

specifies an existing service ID

**Values** 1 to 2147483647 or a name string up to 64 characters long

evpn-mpls

**Syntax**

*evpn-mpls [clear]*

**Context**

tools>dump>service>id

**Description**

This command displays the EVPN-MPLS data for the specified service.

## Parameters

### clear

clears the EVPN-MPLS data for the specified service

## ip-transport

## Syntax

**ip-transport** *ipt-id*

## Context

tools>dump>service>id

## Description

This command enables the context to display information for a specific IES or VPRN IP transport subservice.

## Default

n/a

## Parameters

### *ipt-id*

specifies the IP transport subservice physical port identifier

**Values** value in the format *slot/mda/port.channel*

## remote-host

## Syntax

**remote-host** *host-id* **check-tcp**

## Context

tools>dump>service>id>ip-transport

## Description

This command displays information for a TCP connection check to a remote host for the specified service.

## Default

n/a

## Parameters

### *host-id*

specifies the remote host identifier

**Values** 1 to 2147483647 or a name string up to 64 characters long

**check-tcp**  
displays information for a TCP connection check to a remote host

loopback

**Syntax**  
**loopback**

**Context**  
tools>dump>service>id

**Description**  
This command displays loopback information for a SAP or an SDP bind for the specified service.

**Default**  
n/a

sap

**Syntax**  
**sap** *sap-id*

**Context**  
tools>dump>service>id>loopback

**Description**  
This command displays loopback information for a specified SAP in the specified service.

**Default**  
n/a

**Parameters**  
*sap-id*  
specifies the SAP binding identifier

| Values | (see list below)                                                                          |
|--------|-------------------------------------------------------------------------------------------|
| null   | [ <i>port-id</i>   <i>bundle-id</i>   <i>lag-id</i>   <i>aps-id</i>   <i>mw-link-id</i> ] |
| dot1q  | [ <i>port-id</i>   <i>lag-id</i>   <i>aps-id</i>   <i>mw-link-id</i> ]: <i>qtag1</i>      |
| qinq   | [ <i>port-id</i>   <i>lag-id</i> ]: <i>qtag1.qtag2</i>                                    |

|         |                                |         |  |
|---------|--------------------------------|---------|--|
| port-id | <i>slot/mda/port[.channel]</i> |         |  |
| lag-id  | <i>lag-id</i>                  |         |  |
|         | lag                            | keyword |  |
|         | <i>id</i>                      | 1 to 32 |  |
| qtag1   | *, 0 to 4094                   |         |  |
| qtag2   | *, 0 to 4094                   |         |  |

sdp

Syntax

**sdp** *sdp-id:vc-id*

Context

tools>dump>service>id>loopback

Description

This command displays loopback information for a specified SDP binding in the specified service.

Default

n/a

Parameters

*sdp-id*  
specifies the SDP binding identifier  
**Values** 1 to 17407

*vc-id*  
the virtual circuit identifier  
**Values** 1 to 4294967295

mp-bgp

Syntax

**mp-bgp family vpn stats [clear]**

Context

tools>dump>service>id

Description

This command displays ingress MP-BGP statistics for a label in a VPRN service. The statistics include both NGE and non-NGE MP-BGP statistics.

The command is supported for VPRN services only and applies only to system-level statistics.

Default

n/a

Parameters

- clear**  
clears the statistics after displaying them
- family vpn**  
specifies the address family, always **vpn** (VPN-IPv4 or VPN-IPv6)
- stats**  
displays statistics associated with the VPRN service label

Output

The following output is an example of MP-BGP statistics.

Output example

```
*A:7705:Dut-A# tools dump service id 2 mp-bgp family vpn stats
=====
Service Id 2 MP-BGP VPN-IPv4/VPN-IPv6 Stats
=====
131070:
Rx Pkts : 4986 Rx Bytes: 887508
Tx Pkts : N/A Tx Bytes: N/A
=====
```

Table 56: MP-BGP statistics field descriptions

| Label                                              | Description                                                  |
|----------------------------------------------------|--------------------------------------------------------------|
| Service Id <i>n</i> MP-BGP VPN-IPv4/VPN-IPv6 Stats |                                                              |
| 131070                                             | Indicates the VPRN ingress label value (an example is shown) |
| Rx Pkts                                            | The number of received packets                               |
| Rx Bytes                                           | The number of received bytes                                 |
| Tx Pkts                                            | Not applicable                                               |
| Tx Bytes                                           | Not applicable                                               |



## network-latency-measurement

### Syntax

**network-latency-measurement** [clear]

### Context

tools>dump>service>id

### Description

This command displays minimum, current, and maximum latency measurement values.

### Default

n/a

### Parameters

**clear**

clears statistics after viewing

### Output

The following output is an example of network latency measurement information.

#### Output example

```
A:SAR18-11-2# tools dump service id 100 network-latency-measurement

Path Average Latency Measurements (us)

Spoke-sdp Min Current Max Last update
121:100 450 500 600 02/21/23 20:17:14
122:200 350 600 800 02/21/23 20:17:14
....
```



#### Note:

- The "Path Average Latency Measurements" output is only shown if the Cpipe has a timestamp. If a path is up but has not completed the first latency measurement, "N/A" is displayed. If a path that was up goes down, the last valid value is displayed.
- For Cpipes with PW redundancy, only the active path average latency measurement is shown; other paths are not shown.
- If a path is administratively down, "N/A" is displayed.
- If a path is transported over a non-Ethernet interface (that is, timestamping is not available), "N/A" is displayed.



**Note:** The maximum latency that can be measured is 34.3 seconds. For any latency above 34.3 seconds, the current latency is displayed as "Too High". If there is a clocking issue that results in a situation where the far-end timestamp is earlier than the near-end timestamp, the latency is negative. In this case, the current latency is displayed as "Too Low". In either case, the minimum

and maximum latencies are not updated, so the most recent minimum and maximum values are displayed.

The following is an example of network latency measurement information where the far-end timestamp is earlier than the near-end timestamp, resulting in a negative latency that is displayed as "Too Low".

Output example

|                                        |     |         |     |             |
|----------------------------------------|-----|---------|-----|-------------|
| =====                                  |     |         |     |             |
| Path Average Latency Measurements (us) |     |         |     |             |
| -----                                  |     |         |     |             |
| Spoke-sdp                              | Min | Cur     | Max | Last update |
| -----                                  |     |         |     |             |
| 321:1200                               | N/A | Too Low | N/A | Never       |
| =====                                  |     |         |     |             |

Table 57: Network latency measurement field descriptions

| Label                                  | Description                                              |
|----------------------------------------|----------------------------------------------------------|
| Path Average Latency Measurements (us) |                                                          |
| Spoke-sdp                              | Identifies the spoke SDP associated with the Cpipe       |
| Min                                    | The minimum latency value at the time of the last update |
| Current                                | The current latency value at the time of the last update |
| Max                                    | The maximum latency value at the time of the last update |
| Last-update                            | The time that the latency values were last updated       |

sap

Syntax

sap sap-id stats [clear]

Context

tools>dump>service>id

Description

This command displays SAP information for the specified service.

Default

n/a

Parameters

sap-id  
specifies the SAP binding identifier

**Values** (see list below)

|            |                                                                                                                      |
|------------|----------------------------------------------------------------------------------------------------------------------|
| null       | [ <i>port-id</i>   <i>bundle-id</i>   <i>lag-id</i>   <i>aps-id</i>   <i>mw-link-id</i> ]                            |
| dot1q      | [ <i>port-id</i>   <i>lag-id</i>   <i>aps-id</i>   <i>mw-link-id</i> ]: <i>qtag1</i>                                 |
| qinq       | [ <i>port-id</i>   <i>lag-id</i> ]: <i>qtag1.qtag2</i>                                                               |
| atm        | [ <i>port-id</i>   <i>aps-id</i> ][: <i>vpi/vci</i>   <i>vpi</i>   <i>vpi1.vpi2</i> ]                                |
| frame      | [ <i>port-id</i>   <i>aps-id</i> ]: <i>dldci</i>                                                                     |
| cisco-hdlc | <i>slot/mda/port.channel</i>                                                                                         |
| cem        | <i>slot/mda/port.channel</i>                                                                                         |
| ipcp       | <i>slot/mda/port.channel</i>                                                                                         |
| ima-grp    | <i>bundle-id</i> [: <i>vpi/vci</i>   <i>vpi</i>   <i>vpi1.vpi2</i> ]                                                 |
| hdlc       | <i>slot/mda/port.channel</i>                                                                                         |
| port-id    | <i>slot/mda/port</i> [ <i>.channel</i> ]                                                                             |
| SCADA      | <i>slot/mda/bridge-id.branch-id</i>                                                                                  |
| bridge     | <i>bridge-id</i> 1 to 16<br><i>branch-id</i> 1 to 32                                                                 |
| bundle-id  | <i>bundle-type-slot/mda.bundle-num</i><br><i>bundle</i> keyword<br><i>type</i> ima, ppp<br><i>bundle-num</i> 1 to 32 |
| aps-id     | <i>aps-group-id</i> [ <i>.channel</i> ]<br><i>aps</i> keyword<br><i>group-id</i> 1 to 24                             |
| mw-link-id | <i>mw-link-id</i><br><i>id</i> 1 to 24                                                                               |
| lag-id     | <i>lag-id</i><br><i>lag</i> keyword<br><i>id</i> 1 to 32                                                             |
| qtag1      | *, 0 to 4094                                                                                                         |
| qtag2      | *, 0 to 4094                                                                                                         |
| vpi        | NNI 0 to 4095<br>UNI 0 to 255                                                                                        |
| vci        | 1, 2, 5 to 65535                                                                                                     |

dlci            16 to 1022

tunnel-id      tunnel-*id*.*[private | public]:tag*

                tunnel        keyword

*id*            1 to 16 ("1" is the only valid value)

*tag*            0 to 4094

**clear**

clears the statistics after displaying them

**stats**

displays statistics associated with this SAP

Output

The following output is an example of the discard statistics, and [Table 58: Service SAP field descriptions](#) describes the fields.

Output example

```
A:7705# 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 58: Service SAP field descriptions

| 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             |

| Label                                               | Description                                                                                                                                         |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                     |
| 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** *sdp-id[:vc-id]* **stats** [**clear**]

**Context**

tools>dump>service>id

**Description**

This command displays SDP binding information for the specified service.

**Default**

n/a

**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 after displaying them

**stats**

displays statistics associated with the specified SDP

**ipsec-tunnel**

**Syntax**

**ipsec-tunnel** *ipsec-tunnel-name* **stats**

**Context**

tools>dump>service

**Description**

This command displays the IPSec tunnel information.

**Parameters**

*ipsec-tunnel-name*

the name of the IPSec tunnel

**stats**

displays statistics associated with the IPSec tunnel

Output

The following output is an example of IPSec tunnel information, and [Table 59: IPSec tunnel field descriptions](#) describes the fields.

Output example

```
*A:7705:Dut-A# tools dump service ipsec-tunnel tunnelPrivateSide_1.1 stats
=====
Discard Stats for Ipsec-Tunnel tunnelPrivateSide_1.1 (tunnelId 1 svcId 1001)
=====
Outbound Discard Stats:
 Security policy misses | 0
 Invalid security association | 0
 Sequence number wrap errors | 0
 Buffer exhaustion errors | 0
 IP-frag buffer exhaustion errors | 0
 Enqueue errors | 0
 Tunnel peer-ip-address not reachable | 0
 Tunnel peer-ip-address next-hop not reachable via IP | 0
 Egress uplink interface does not support encryption | 0
 Drop Too Big/Df-set Pkts | 0
 Other discards | 0
=====
Inbound Discard Stats:
 Authentication failures | 0
 Security policy misses | 0
 NATT UDP ports mismatch (src/dst) | 0
 IP Proto mismatch | 0
 Tunnel and SPI cross validation errors | 0
 IP fragmented packets (Unsupported) | 0
 Padding failures | 0
 NULL SeqNum | 0
 Enqueue errors | 0
 Sequence number too old in window (Anti-Replay) | 0
 Duplicated sequence number in window (Anti-Replay) | 0
 Buffer exhaustion errors | 0
 Other discards | 0
=====
```

Table 59: IPSec tunnel field descriptions

| Field                          | Description                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Outbound Discard Stats:</b> |                                                                                                                                                                                                                                                                                                                                               |
| Security policy misses         | The number of outbound packets discarded because of a security policy miss that can occur when a clear text packet source or destination IP address does not match any security policy entry for the IPSec tunnel. Discards are due to either an incorrect policy configuration or a packet that should have been denied entry to the tunnel. |
| Invalid security association   | The number of outbound packets discarded because of an invalid security association (SA). Discards can be due to an IKE failure to negotiate the SA, an incorrect configuration in the SA for manual keying, or incomplete IPSec tunnel negotiation.                                                                                          |

| Field                                                | Description                                                                                                                                                                                                                                 |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sequence number wrap errors                          | The number of outbound packets discarded because the IPSec tunnel anti-replay sequence number has exceeded the maximum value allowed prior to completion of an SA re-keying                                                                 |
| Buffer exhaustion errors                             | The number of outbound packets discarded because buffers were not available before packets were sent to the encryption engine queue. This condition can occur when the encrypting MDA is experiencing buffer congestion.                    |
| IP-frag buffer exhaustion errors                     | The number of outbound packets discarded because buffers were not available when fragmentation occurred before encryption on the packet. This condition can occur when the encrypting MDA is experiencing buffer congestion.                |
| Enqueue errors                                       | The number of outbound packets discarded because the encryption engine queue was full. This condition can occur when the encrypting MDA is experiencing buffer congestion.                                                                  |
| Tunnel peer-ip-address not reachable                 | The number of outbound packets discarded because a route to the peer gateway IP address cannot be found. This can occur due to a network design issue or a temporary network outage.                                                        |
| Tunnel peer-ip-address next-hop not reachable via IP | The number of outbound packets discarded because the IPSec tunnel peer gateway route next hop is not in the supported IP next-hop or MPLS tunnel next-hop list. This can occur due to a network design issue or a temporary network outage. |
| Egress uplink interface does not support encryption  | The number of outbound packets discarded because the outgoing interface for this IPSec tunnel is on an MDA that does not have encryption hardware. This can be due to a network design issue.                                               |
| Drop Too Big/Df-set Pkts                             | The number of outbound packets discarded because a clear text packet cannot be fragmented when the do-not-fragment (DF) flag is set in the IP packet header and the outgoing IP interface MTU is too small for the encrypted packet         |
| Other discards                                       | The number of outbound packets discarded because of miscellaneous internal errors related to: <ul style="list-style-type: none"> <li>• encryption engine</li> <li>• NAT-T session, IPSec tunnel, SA, or policy information</li> </ul>       |
| <b>Inbound Discard Stats:</b>                        |                                                                                                                                                                                                                                             |
| Authentication failures                              | The number of inbound packets discarded because of an inability to authenticate the packet with the current authentication key                                                                                                              |



| Field                                              | Description                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Security policy misses                             | The number of inbound packets discarded because either: <ul style="list-style-type: none"> <li>the source or destination IP address of the decrypted clear text packet does not match the source or destination IP address</li> <li>the IP version of the decrypted clear text packet does not match the IP version for the corresponding SPI</li> </ul> |
| NATT UDP ports mismatch (src/dst)                  | The number of inbound packets discarded because the source or destination UDP port for NAT-T is different from the configured UDP port                                                                                                                                                                                                                   |
| IP Proto mismatch                                  | The number of inbound packets discarded because of an IP protocol mismatch that can occur when NAT-T is configured and the protocol is not UDP or when NAT-T is not configured and the protocol is not ESP                                                                                                                                               |
| Tunnel and SPI cross validation errors             | The number of inbound packets discarded because the source or destination IP address of an encrypted packet does not match the expected IPsec gateway source or destination IP address for the SPI                                                                                                                                                       |
| IP fragmented packets (Unsupported)                | The number of inbound packets discarded because the encrypted packet was fragmented. Fragmentation is not supported on IPsec encrypted packets.                                                                                                                                                                                                          |
| Padding failures                                   | The number of inbound packets discarded because a padding error was detected on the encrypted packet                                                                                                                                                                                                                                                     |
| NULL SeqNum                                        | The number of inbound packets discarded because the sequence number is 0 (invalid as per RFC 4303)                                                                                                                                                                                                                                                       |
| Enqueue errors                                     | The number of inbound packets discarded because the decryption engine queue is full. This condition can occur when the decrypting MDA is experiencing buffer congestion.                                                                                                                                                                                 |
| Sequence number too old in window (Anti-Replay)    | The number of inbound packets discarded because the sequence number is lower than the lowest sequence number in the anti-replay window and therefore is considered too old                                                                                                                                                                               |
| Duplicated sequence number in window (Anti-Replay) | The number of inbound packets discarded because a packet's sequence number is duplicated. Duplicate sequence numbers are not allowed in an anti-replay window.                                                                                                                                                                                           |
| Buffer exhaustion errors                           | The number of inbound packets discarded because buffers were not available before packets were sent to the decryption engine queue. This condition can occur when the decrypting MDA is experiencing buffer congestion.                                                                                                                                  |
| Other discards                                     | The number of inbound packets discarded because of miscellaneous internal errors related to:                                                                                                                                                                                                                                                             |

| Field | Description                                                                                                   |
|-------|---------------------------------------------------------------------------------------------------------------|
|       | <ul style="list-style-type: none"><li>• decryption engine</li><li>• IPSec tunnel and SA information</li></ul> |

loopback

**Syntax**  
loopback

**Context**  
tools>dump>service

**Description**  
This command displays all active Ethernet SAP loopbacks on the node. Only internal loopback mode is supported.

**Default**  
n/a

system

**Syntax**  
bgp-evpn

**Context**  
tools>dump>service

**Description**  
This command enables the context for service system information.

bgp-evpn

**Syntax**  
bgp-evpn

**Context**  
tools>dump>service>system

**Description**  
This command enables the context for BGP-EVPN service system information.

## ethernet-segment

### Syntax

**ethernet-segment** *name* **evi** *value* **df**

### Context

tools>dump>service>system>bgp-evpn

### Description

This command displays information about the computed DF PE for a specified EVI.

### Parameters

*name*

specifies the name of the Ethernet segment

*value*

specifies the EVI

**Values** 1 to 65535

**df**

keyword for designated forwarder

### Output

The following output is an example of Ethernet segment information.

### Output example

```
*A:PE2# tools dump service system bgp-evpn ethernet-segment "ESI-71" evi 1 df
[07/15/2015 21:52:08] Computed DF: 192.0.2.72 (Remote) (Boot Timer Expired: Yes)
```

## security

### Syntax

**security**

### Context

tools>dump>system

### Description

This command enters the context to perform security operations.

## secure-boot

### Syntax

**secure-boot**

### Context

tools>dump>system>security

### Description

This command enables the context to display Secure Boot information.

## uefi-vars

### Syntax

**uefi-vars** *cpm-slot*

### Context

tools>dump>system>security>secure-boot

### Description

This command displays the Secure Boot Unified Extensible Firmware Interface (UEFI) variables.

### Parameters

*cpm-slot*

specifies the CSM slot

## support-mode

### Syntax

**support-mode**

### Context

tools>dump>system>security

### Description

This command enters the context to perform security support mode operations.

## nonce

### Syntax

**nonce**

### Context

tools>dump>system>security>support-mode

### Description

This command displays the system nonce.

### Output

The following output is an example of the system nonce information.

#### Output example

```
A:7705:DutA# tools dump system security support-mode nonce
Current System Nonce
System nonce: Y2wsVi/50qN32qr8QGE0PwUNfLCR0GQVYglq7Kavy/I=
A:7705:DutA#
```

## session-tokens

### Syntax

**session-tokens**

### Context

tools>dump>system>security>support-mode

### Description

This command displays the current kernel and shell session tokens on the system.

### Output

The following output is an example of session token information.

#### Output example

```
A:7705:DutA# tools dump system security support-mode session-tokens
No tokens in current session for shell
Current session tokens for kernel
Token:
Type: JWT
Algorithm: ES384
Version: 1
Scope: kernel
Email: noreply.ni-regression@nokia.com
Subject: SAR Support Access
Issued at: 1772558352
```

```
Not before: 1772558352
Exp: 1773767952
Nonce: NOT PRESENT
Issuer: support@nokia.com
Session Info: NOT PRESENT
```

vpls-fdb-stats

Syntax

vpls-fdb-stats [clear]

Context

tools>dump>service

Description

This command displays the VPLS FDB statistics.

Parameters

clear

clears the VPLS FDB statistics after viewing

Output

The following output is an example of VPLS FDB statistics.

Output example

```
*A:Sar18 Dut-B# tools dump service vpls-fdb-stats

Service Manager VPLS FDB info at 042 02:39:08.680:
Statistics last cleared at 000 00:00:00.000

Statistic	Count
FdbEntriesInUse | 0
TotalFdbEntries | 65535
FdbMimDestIdxInUse | 0
TotalFdbMimDestIdxEntries | 511
FdbIsidIdxInUse | 0
TotalFdbMimIsidIdxEntries | 16384
MacAddMsgs | 0
MacDeleteMsgs | 0
MacQueryMsgs | 0
UnknownMsgs | 0
MalformedMsgs | 0
FailedMsgs | 0
FdbHwTableFull | 0
FdbHwLimitExceeded | 0
FdbTableFull | 0
FdbLimitExceeded | 0
FdbMimDestIdxExhausted | 0
MacAddReqs | 0
DupMacAddReqs | 0
DroppedMacAddReqs | 0
FailedMacAddReqs | 0
```

|                   |  |   |
|-------------------|--|---|
| MacDelReqs        |  | 0 |
| DupMacDelReqs     |  | 0 |
| DroppedMacDelReqs |  | 0 |
| FailedMacDelReqs  |  | 0 |

## system-limits

### Syntax

**system-limits**

### Context

tools>dump

### Description

This command displays the resource limits of the current system configuration.



**Note:** The **system-limits** command is only available on the following 7705 SAR systems:

- 7705 SAR-8 Shelf V2
- 7705 SAR-18

### Default

n/a

### Output

The following output is an example of system limits information, and [Table 60: System limits field descriptions](#) describes the fields.

#### Output example

```
A:7705# tools dump system-limits
-----+-----
IPv4 FIB Table Size | 65536
IPv6 FIB Table Size | 32768
Max Number of Network Interfaces | 256
Max Number of Service Interfaces | 1024
Max Number of Total Interfaces | 1024
Max Number of IPv6 Network Interfaces | 255
Max Number of IPv6 Service Interfaces | 384
Max Number of IPv6 Total Interfaces | 384
VPRN Instances Supported | 62
VPLS Instances Supported | 64
Max Number of BGP Peers | 320
Max Number of IP/Mac Filters | 512
```

Table 60: System limits field descriptions

| Label                                 | Description                                                                                                                                                                                                                                                                                         |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IPv4 FIB Table Size                   | The maximum number of IPv4 addresses allowed in the forwarding information base table (FIB).<br><br>IPv4 router interfaces that are on cards equipped with hardware to support larger tables will have a higher maximum number of addresses than on cards that are not equipped with this hardware. |
| IPv6 FIB Table Size                   | The maximum number of IPv6 addresses allowed in the forwarding information base table (FIB).<br><br>IPv6 router interfaces that are on cards equipped with hardware to support larger tables will have a higher maximum number of addresses than on cards that are not equipped with this hardware. |
| Max Number of Network Interfaces      | The maximum number of IPv4 network interfaces allowed on an adapter card                                                                                                                                                                                                                            |
| Max Number of Service Interfaces      | The maximum number of IPv4 service interfaces allowed on an adapter card                                                                                                                                                                                                                            |
| Max Number of Total Interfaces        | The maximum number of total IPv4 interfaces allowed on a system                                                                                                                                                                                                                                     |
| Max Number of IPv6 Network Interfaces | The maximum number of IPv6 network interfaces allowed on an adapter card                                                                                                                                                                                                                            |
| Max Number of IPv6 Service Interfaces | The maximum number of IPv6 service interfaces allowed on an adapter card                                                                                                                                                                                                                            |
| Max Number of IPv6 Total Interfaces   | The maximum number of total IPv6 interfaces allowed on a system                                                                                                                                                                                                                                     |
| VPRN Instances Supported              | The total number of VPRN instances that are supported                                                                                                                                                                                                                                               |
| VPLS Instances Supported              | The total number of VPLS instances that are supported                                                                                                                                                                                                                                               |
| Max Number of BGP Peers               | The maximum number of BGP peers                                                                                                                                                                                                                                                                     |
| Max Number of IP/Mac Filters          | The maximum number of IP/MAC filters                                                                                                                                                                                                                                                                |



system-resources

Syntax

**system-resources** *slot-number*

Context

tools>dump

Description

This command displays system resource information.

Default

n/a

Parameters

*slot-number*  
specifies a specific slot to view system resources information

Output

The following output is an example of system resources information, and [Table 61: System resources field descriptions](#) describes the fields.

Output example

\*A:7705# tools>dump system-resources 1/1

Mda-1/1 Resource Usage

|                         | Total | Allocated | Free |
|-------------------------|-------|-----------|------|
| -----+-----+-----+----- |       |           |      |
| Access Ingress Queues   | 2048  | 0         | 2048 |
| Egress Queues           | 2112  | 0         | 2112 |
| Access Egress Queues    | 2048  | 0         | 2048 |
| Network Egress Queues   | 2048  | 0         | 2048 |
| SAP Objects             | 512   | 0         | 512  |
| VPLS SAP Objects        | 128   | 0         | 128  |
| (1/1/1)                 | 128   | 0         | 128  |
| (1/1/2)                 | 128   | 0         | 128  |
| (1/1/3)                 | 128   | 0         | 128  |
| (1/1/4)                 | 128   | 0         | 128  |
| (1/1/5)                 | 128   | 0         | 128  |
| (1/1/6)                 | 128   | 0         | 128  |
| (1/1/7)                 | 128   | 0         | 128  |
| (1/1/8)                 | 128   | 0         | 128  |
| Network Interfaces      | 128   | 0         | 128  |
| Filters                 | 32    | 0         | 32   |
| Service Interfaces      | 512   | 0         | 512  |
| IPv6 Network Interfaces | 128   | 0         | 128  |
| IPv6 Service Interfaces | 512   | 0         | 512  |
| Shaper Groups           | 64    | 0         | 64   |

Table 61: System resources field descriptions

| Label                   | Description                                                                                   |
|-------------------------|-----------------------------------------------------------------------------------------------|
| Access Ingress Queues   | The number of access ingress queues allowed on an adapter card (total, allocated, and free)   |
| Egress Queues           | The number of egress queues allowed on an adapter card (total, allocated, and free)           |
| Access Egress Queues    | The number of access egress queues allowed on an adapter card (total, allocated, and free)    |
| Network Egress Queues   | The number of network egress queues allowed on an adapter card (total, allocated, and free)   |
| SAP Objects             | The number of SAP objects allowed on an adapter card (total, allocated, and free)             |
| VPLS SAP Objects        | The number of VPLS SAP objects allowed on an adapter card (total, allocated, and free)        |
| Network Interfaces      | The number of network interfaces allowed on an adapter card (total, allocated, and free)      |
| Filters                 | The number of filters allowed on an adapter card (total, allocated, and free)                 |
| Service Interfaces      | The number of service interfaces allowed on an adapter card (total, allocated, and free)      |
| IPv6 Network Interfaces | The number of IPv6 network interfaces allowed on an adapter card (total, allocated, and free) |
| IPv6 Service Interfaces | The number of IPv6 service interfaces allowed on an adapter card (total, allocated, and free) |
| Shaper Groups           | The number of shaper groups allowed on an adapter card (total, allocated, and free)           |

## testhead

### Syntax

**testhead test-name** *test-name* [**test-owner** *test-owner*]

### Context

tools>dump

**Description**

This command displays Y.1564 test head debug statistics.

**Default**

n/a

**Parameters**

*test-name*

specifies a Y.1564 test by name

*test-owner*

specifies a Y.1564 test owner

**5.1.2.2.2 Dump test OAM commands**

test-oam

**Syntax**

test-oam

**Context**

tools>dump

**Description**

This command enables the context to display operations, administration, and maintenance information.

**Default**

n/a

testhead

**Syntax**

testhead test-name *test-name* [*test-owner test-owner*]

**Context**

tools>dump>test-oam

**Description**

This command displays Y.1564 test head debug statistics.

**Default**

n/a

**Parameters**

*name-of-the-test*

the name of the Y.1564 test

*owner-of-the-test*

the owner of the Y.1564 test

**twamp****Syntax**

**server error-counters**

**Context**

tools>dump>test-oam

**Description**

This command displays server information, specifically the number of protocol errors, for the TWAMP server. The output includes statistics for dropped connections, dropped connection states, rejected sessions, and dropped test packets.

**Default**

n/a

**5.1.2.2.3 Dump router commands****router****Syntax**

**router** *router-instance*

**router** **service-name** *service-name*

**Context**

tools>dump

**Description**

This command enables tools for the router instance.

**Default**

n/a

Parameters

|                                          |                     |                  |  |
|------------------------------------------|---------------------|------------------|--|
| <i>router-instance</i>                   |                     |                  |  |
| specifies the router name and service ID |                     |                  |  |
| <b>Values</b>                            | <i>router-name:</i> | Base, management |  |
|                                          | <i>service-id:</i>  | 1 to 2147483647  |  |
| <b>Default</b>                           | Base                |                  |  |
| <i>service-name</i>                      |                     |                  |  |
| specifies the service name               |                     |                  |  |

bgp

Syntax

bgp

Context

tools>dump>router

Description

This command enables dump tools for BGP.

Default

n/a

routes

Syntax

routes [*family*] received [*url file-url*]

Context

tools>dump>router>bgp

Description

This command displays information for BGP routes.

Default

n/a

Parameters

|                 |                                            |
|-----------------|--------------------------------------------|
| <b>received</b> | displays information about received routes |
|-----------------|--------------------------------------------|

family

specifies the family for which information is displayed

**Values**    ipv4, vpn-ipv4, ipv6, vpn-ipv6, or mvpn-ipv4

url file-url

the URL of the file

| Values        |                                                                                                                                                                                       |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| file-url:     | local-url   remote-url                                                                                                                                                                |
| local-url:    | [cflash-id]/[file-path]<br>200 chars max, including cflash-id<br>directory length 99 chars max each                                                                                   |
| remote-url:   | [{ftp://   tftp://}login:pswd@remote- locn][file-path]<br>255 chars max<br>directory length 99 chars max each                                                                         |
| remote-locn:  | [hostname   ipv4-address   ipv6-address]                                                                                                                                              |
| ipv4-address: | a.b.c.d                                                                                                                                                                               |
| ipv6-address: | x:x:x:x:x:x:x[-interface]<br>x:x:x:x:x:d.d.d.d[-interface]<br>x: [0 to FFFF]H<br>d: [0 to 255]D<br>interface: 32 chars max, for link local addresses                                  |
| cflash-id:    | (7705 SAR-18) cf1:   cf1-A:   cf1-B:   cf2:   cf2-A:  <br>cf2-B:   cf3:   cf3-A:   cf3-B:<br>(7705 SAR-8 Shelf V2) cf3:   cf3-A:   cf3-B:<br>(7705 SAR fixed platforms) cf3:   cf3-A: |

fib

Syntax

fib slot-number [ipv4 | ipv6] summary

Context

tools>dump>router

Description

This command displays information for the FIB.

**Default**

n/a

**Parameters**

- slot-number*  
specifies the slot number, always "1"
- ipv4 | ipv6**  
specifies the IP family
- summary**  
displays summary information

ldp

**Syntax**

ldp

**Context**

tools>dump>router

**Description**

This command enables dump tools for LDP.

**Default**

n/a

fec

**Syntax**

- fec vc-type** *vc-type* **agi** *agi*
- fec p2mp-id** *identifier* **root** *ip-address*
- fec root** *ip-address* **source** *ip-address* **group** *mcast-address* **inner-root** *ip-address*
- fec prefix** *ip-address[/mask]*
- fec root** *ip-address* **source** *ip-address* **group** *mcast-address* [**rd** *rd*]
- fec vc-type** *vc-type* **vc-id** *vc-id*
- fec p2mp-id** *identifier* **root** *ip-address* [**rd** *rd*] **inner-root** *ip-address*

**Context**

tools>dump>router>ldp

Description

This command displays information for an LDP FEC.

Parameters

- vc-type*

specifies the VC type

Values

ethernet, vlan, framerelay, atm-all5, atm-cell, hdlc, ppp, cem, atm-vcc, atm-vpc, ipipe, atm-vcc-1-1, atm-vpc-1-1, atm-aal5-pdu, fr, cep, e1-satop, t1-satop, e3-satop, t3-satop, cesopsn, tdmoip, cesopsn-cas, tdmoip-cas, fr-dlci, mirror
- agi*

specifies the attachment group identifier TLV associated with this service FEC

Values

*ip-addr:comm-val | 2byte-asnumber:ext-comm-val | 4byte-asnumber:comm-val*

ip-addr

:

a.b.c.d

comm-val

:

0 to 65535

2byte-asnumber

:

1 to 65535

ext-comm-val

:

0 to 4294967295

4byte-asnumber

:

1 to 4294967295

null - means all value is 0
- identifier*

specifies the identifier of the LDP point-to-multipoint LSP

Values

0 to 4294967295
- root** *ip-address*

specifies the root IP address
- source** *ip-address*

specifies the source IP address
- group** *mcast-address*

specifies the group multicast address
- inner-root** *ip-address*

specifies the inner root IP address of the FEC
- ip-address[/mask]*

specifies the IP prefix and prefix length associated with the prefix FEC
- rd*

specifies the route distinguisher value

Values

*ip-addr:comm-val | 2byte-asnumber:ext-comm-val | 4byte-asnumber:comm-val*



*vc-id*

specifies the VC identifier

**Values** 1 to 4294967295

## Output

The following output is an example of LDP FEC information.

### Output example

```
A:Dut-A# tools dump router ldp fec root 10.20.1.3 source 10.0.101.10 group
192.168.1.1 inner-root 10.20.1.6
P2MP: root: 10.20.1.3, T: 7, L: 21 (InnerRoot: 10.20.1.6 T: 3, L: 8, Src:
10.0.101.10, Grp: 192.168.1.1)
 Create Time : 01/27/16 16:39:04.097 (elapsed: 0d 03:20:24)
 Last Mod. Time: 01/27/16 16:39:04.097 (elapsed: 0d 03:20:24)
 FEC Flags : Pop UpStitched
 TunlIfId: 73728 (OperState : up)
 LSP ID : 0
 LSP ID Acct. : 0
 isIngressMtm : No HasLeaf : Yes
 isIngrItermdte: No
 CanProgIngress: No
 InPhopFrr : No
 isStitchedUp : Yes
 RslvdPhop(p) : 10.20.1.2:0 (seqNum 2)
 RslvdPhop(b) : 0.0.0.0:0 (seqNum 0)
 pri Upstream : 10.20.1.2:0, AdvLabel 262139
 mbb Upstream : None
 bkp Upstream : None
 AdvInLabel(p) : 262139
 AdvInLabel(b) : 0
 PrgInLabel(p) : 1
 Num Resolved Nhops : 1
 Num MBB Req. Nhops : 0
 Num Programmed Nhops : 1
 Programmed Nhop[01] : 0.0.0.0:0, OutLabel 0 (Leaf)(StitchedFec)
 Metric : 0 Mtu : 0
 Num of Peers : 1
 FEC Peer: 10.20.1.2:0
 Peer Flags: none (0x0)
 ModTime : 01/27/16 16:39:04.097 (elapsed.: 0d 03:20:24)
 ->Num Egress Labels:
 None
 <-Num Ingress Labels:
 <- (Label: 262139 Status: UsePop)
 Rej Status: OK
 Flow Label Tx: no, Rx: no
 Flow Label Tx Sent: no, Rx Sent: no
 <Resolved as CUR Upstream>
```

## instance

### Syntax

**instance**

**Context**

tools>dump>router>ldp

**Description**

This command displays information for an LDP instance.

**Default**

n/a

**interface****Syntax**

**interface** [*ip-int-name* | *ip-address*]

**Context**

tools>dump>router>ldp

**Description**

This command displays information for an LDP interface.

**Default**

n/a

**Parameters**

*ip-int-name*

specifies the interface name

*ip-address*

specifies the IP address

**memory-usage****Syntax**

**memory-usage**

**Context**

tools>dump>router>ldp

**Description**

This command displays memory usage information for LDP.

**Default**

n/a

**peer****Syntax**

**peer** *ip-address*

**Context**

tools>dump>router>ldp

**Description**

This command displays information for an LDP peer.

**Default**

n/a

**Parameters**

*ip-address*

specifies the IP address

**session****Syntax**

**session** [*ip-address* [:*label space*]] [**connection** | **peer** | **adjacency**]

**Context**

tools>dump>router>ldp

**Description**

This command displays information for an LDP session.

**Default**

n/a

**Parameters**

*ip-address*

specifies the IP address of the LDP peer

*label-space*

specifies the label space identifier that the router is advertising on the interface

**connection**

displays connection information

**peer**

displays peer information

**adjacency**

displays hello adjacency information

**sockets****Syntax**

**sockets**

**Context**

tools>dump>router>ldp

**Description**

This command displays information for all sockets being used by the LDP protocol.

**Default**

n/a

**timers****Syntax**

**timers**

**Context**

tools>dump>router>ldp

**Description**

This command displays timer information for LDP.

**Default**

n/a

**mpls****Syntax**

**mpls**

**Context**

tools>dump>router

**Description**

This command enables the context to display MPLS information.

**Default**

n/a

ftn

**Syntax**

**ftn** [**endpoint** *endpoint* | **sender** *sender* | **nexthop** *nexthop* | **lsp-id** *lsp-id* | **tunnel-id** *tunnel-id* | **label** *start-label end-label*]

**Context**

tools>dump>router>mpls

**Description**

This command displays FEC-to-NHLFE (FTN) dump information for MPLS. (NHLFE is the acronym for Next Hop Label Forwarding Entry.)

**Default**

n/a

**Parameters**

- endpoint*

specifies the IP address of the last hop
- sender*

specifies the IP address of the sender
- nexthop*

specifies the IP address of the next hop
- lsp-id*

specifies the label switched path that is signaled for this entry

**Values**    0 to 65535
- tunnel-id*

specifies the SDP ID

**Values**    0 to 65535
- start-label end-label*

specifies the label range for the information dump

**Values**    start-label – 32 to 131071  
              end-label – 32 to 131071

ilm

Syntax

ilm [**endpoint** *endpoint* | **sender** *sender* | **nexthop** *nexthop* | **lsp-id** *lsp-id* | **tunnel-id** *tunnel-id* | **label** *start-label end-label*]

Context

tools>dump>router>mpls

Description

This command displays incoming label map (ILM) information for MPLS.

Default

n/a

Parameters

- endpoint*  
specifies the IPv4 address of the last hop
- sender*  
specifies the IPv4 address of the sender
- nexthop*  
specifies the IPv4 address of the next hop
- lsp-id*  
specifies the label switched path that is signaled for this entry  
**Values**    0 to 65535
- tunnel-id*  
specifies the SDP ID  
**Values**    0 to 65535
- start-label end-label*  
specifies the label range for the information dump  
**Values**    start-label – 32 to 131071  
              end-label – 32 to 131071

## lspinfo

### Syntax

**lspinfo** [*lsp-name*] [**detail**]

### Context

tools>dump>router>mpls

### Description

This command displays LSP information for MPLS.

### Default

n/a

### Parameters

*lsp-name*

the LSP identifier

**detail**

displays detailed LSP information

## memory-usage

### Syntax

**memory-usage**

### Context

tools>dump>router>mpls

### Description

This command displays memory usage information for MPLS.

### Default

n/a

## ospf

### Syntax

**ospf**

**Context**

tools>dump>router

**Description**

This command enables the context to display tools information for OSPF.

**Default**

n/a

ospf3

**Syntax**

ospf3

**Context**

tools>dump>router

**Description**

This command enables the context to display tools information for OSPFv3.

**Default**

n/a

abr

**Syntax**

abr [detail]

**Context**

tools>dump>router>ospf

tools>dump>router>ospf3

**Description**

This command displays area border router (ABR) information for OSPF.

**Default**

n/a

**Parameters**

**detail**

displays detailed information about the ABR



## area-range

### Syntax

**area-range**

### Context

tools>dump>router>ospf

tools>dump>router>ospf3

### Description

This command displays area range information for OSPF.

### Default

n/a

## asbr

### Syntax

**asbr [detail]**

### Context

tools>dump>router>ospf

tools>dump>router>ospf3

### Description

This command displays autonomous system boundary router (ASBR) information for OSPF.

### Default

n/a

### Parameters

**detail**

displays detailed information about the ASBR

## bad-packet

### Syntax

**bad-packet** *interface-name*

**Context**

```
tools>dump>router>ospf
tools>dump>router>ospf3
```

**Description**

This command displays information about bad packets for OSPF.

**Default**

n/a

**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
```

**Description**

This command displays information about leaked routes for OSPF.

**Default**

summary

**Parameters**

**summary**

displays a summary of information about leaked routes for OSPF

**detail**

displays detailed information about leaked routes for OSPF

## memory-usage

**Syntax**

**memory-usage** [detail]

## Context

```
tools>dump>router>ospf
tools>dump>router>ospf3
```

## Description

This command displays memory usage information for OSPF.

## Default

n/a

## 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
```

## Description

This command displays request list information for OSPF.

## Default

n/a

## Parameters

### neighbor *ip-address*

displays OSPF neighbor information for the neighbor identified by the IP address

### neighbor *interface-name*

displays OSPFv3 neighbor information for the neighbor identified by the IP interface name

### detail

displays detailed information for the neighbor or virtual neighbor

**virtual-neighbor** *ip-address*

displays OSPF information for the virtual neighbor identified by the IP address

**virtual-neighbor** *router-id*

displays OSPFv3 information for the virtual neighbor identified by the IP router identifier

**area-id** *area-id*

displays OSPF information for 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 for 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

### Description

This command displays dump retransmission list information for OSPF.

### Default

n/a

### 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

**Description**

This command displays dump route summary information for OSPF.

**Default**

n/a

## 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

**Description**

This command displays dump information about routes learned through OSPF.

**Default**

n/a

## Parameters

*ip-prefix/mask*

the IPv4 prefix and mask for routes learned through OSPF

*ipv6-prefix/prefix-length*

the IPv6 prefix and prefix length for routes learned through OSPFv3

*type*

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

## sham-bad-packet

### Syntax

**sham-bad-packet** *interface-name*

### Context

tools>dump>router>ospf

### Description

This command displays OSPFv2 sham link bad packets.

## Parameters

*interface-name*

displays only the sham link bad packets identified by this interface name

## sr-adjacencies

### Syntax

**sr-adjacencies** [*ip-int-name* | *ip-address*] [**detail**]

**sr-adjacencies** [**remote** *ip-address*] [**detail**]

### Context

tools>dump>router>ospf

### Description

This command displays OSPFv2 segment routing (SR) adjacency information.

**Parameters**

- ip-int-name*  
the IP interface name
- ip-address*  
the IPv4 address of the neighbor
- detail**  
displays detailed information about SR adjacencies

sr-database

**Syntax**

**sr-database** [*sid sid*] [**detail**]

**Context**

tools>dump>router>ospf

**Description**

This command displays OSPFv2 segment routing (SR) database information.

**Parameters**

- sid*  
the segment routing identifier  
**Values** 0 to 524287
- detail**  
displays detailed information about learned routes

pim

**Syntax**

**pim**

**Context**

tools>dump>router

**Description**

This command enables the context to display PIM information.

**Default**

n/a

## iom-failures

### Syntax

**iom-failures** [**detail**]

### Context

tools>dump>router>pim

### Description

This command displays information about failures in programming IOMs.

Unlike the 7750 SR, when the maximum number of groups per node is exceeded, any additional groups are not stored at the CSM layer and an alarm is raised immediately.

### Default

n/a

### Parameters

**detail**

displays detailed information about IOM failures

## rsvp

### Syntax

**rsvp**

### Context

tools>dump>router

### Description

This command enables the context to display tools information for RSVP.

### Default

n/a

## neighbor

### Syntax

**neighbor** [*ip-address*] [**detail**]



**Context**

tools>dump>router>rsvp

**Description**

This command displays neighbor information for RSVP.

**Default**

n/a

**Parameters**

- ip-address*  
the IPv4 address of the neighbor
- detail**  
displays detailed information about the neighbor

psb

**Syntax**

**psb** [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** *tunnel-id*] [**lspid** *lsp-id*]

**Context**

tools>dump>router>rsvp

**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.

**Default**

n/a

**Parameters**

- endpoint-address*  
specifies the IP address of the last hop
  - sender-address*  
specifies the IP address of the sender
  - tunnel-id*  
specifies the SDP ID
- Values** 0 to 4294967295

*lsp-id*  
specifies the label switched path that is signaled for this entry  
**Values** 1 to 65535

rsb

**Syntax**  
**rsb** [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** *tunnel-id*] [**lspid** *lsp-id*]

**Context**  
tools>dump>router>rsvp

**Description**  
This command displays RSVP Reservation State Block (RSB) information.

**Default**  
n/a

**Parameters**  
*endpoint-address*  
specifies the IP address of the last hop  
*sender-address*  
specifies the IP address of the sender  
*tunnel-id*  
specifies the SDP ID  
**Values** 0 to 4294967295  
*lsp-id*  
specifies the label switched path that is signaled for this entry  
**Values** 1 to 65535

segment-routing

**Syntax**  
**segment-routing**

**Context**  
tools>dump>router

**Description**

This command enables the context to display tools information for segment routing.

tunnel

**Syntax**

tunnel

**Context**

tools>dump>router>segment-routing

**Description**

This command displays segment routing tunnel information.

static-route

**Syntax**

static-route

**Context**

tools>dump>router

**Description**

This command enables the context to display tools information for static routes.

**Default**

n/a

ldp-sync-status

**Syntax**

ldp-sync-status

**Context**

tools>dump>router>static-route

**Description**

This command displays the status of the LDP synchronization timers for static routes.

**Default**

n/a

## te-database

### Syntax

**te-database** [**adv-router** *adv-router*] [**neighbor** *neighbor*] [**detail**]

### Context

tools>dump>router

### Description

This command displays information for the traffic engineering database.

### Default

n/a

### Parameters

*adv-router*

*ip-address* or *isis-system-id*

*neighbor*

*ip-address* or *isis-system-id*

**detail**

displays detailed information about the neighbor

## isis

### Syntax

**isis** [**instance** *isis-instance*] [**level** *level*]

### Context

tools>dump>router>te-database

### Description

This command displays information for the IS-IS traffic engineering database.

### Default

n/a

### Parameters

*isis-instance*

0 to 31

*level*  
1 or 2

ospf

Syntax

**ospf** [**area** *area-id*] [**instance** *ospf-instance*]

Context

tools>dump>router>te-database

Description

This command displays information for the OSPF traffic engineering database.

Default

n/a

Parameters

*area-id*  
*ip-address* or (0 to 4294967295)  
*ospf-instance*  
a unique integer that identifies a specific instance of a version of the OSPF protocol running in the router instance specified by the virtual router identifier

**Values** 0 to 31

5.1.2.3 Tools perform commands

- [Perform commands](#)
- [Perform router commands](#)

5.1.2.3.1 Perform commands

perform

Syntax

**perform**

Context

tools

**Description**

This command enables the context to specify tools to perform specific tasks.

**Default**

n/a

**aps**

**Syntax**

**aps**

**Context**

tools>perform

**Description**

This command enables the context to perform APS operations.

**Default**

n/a

**clear**

**Syntax**

**clear** *aps-id* {**protect** | **working**}

**Context**

tools>perform>aps

**Description**

This command removes all APS operational commands.

**Default**

n/a

**Parameters**

**aps-id**

the specified APS group

**protect**

the physical port acting as a protection circuit for the APS group

**working**

the physical port acting as a working circuit for the APS group

## exercise

### Syntax

**exercise** *aps-id* {**protect** | **working**}

### Context

tools>perform>aps

### Description

This command performs an exercise request on the protection or working circuit.

### Default

n/a

### Parameters

**aps-id**

the specified APS group

**protect**

the physical port acting as a protection circuit for the APS group

**working**

the physical port acting as a working circuit for the APS group

## force

### Syntax

**force** *aps-id* {**protect** | **working**}

### Context

tools>perform>aps

### Description

This command forces a switch to either the protection or working circuit.

### Default

n/a

### Parameters

**aps-id**

the specified APS group

**protect**

the physical port acting as a protection circuit for the APS group

**working**

the physical port acting as a working circuit for the APS group

**lockout****Syntax**

**lockout** *aps-id*

**Context**

tools>perform>aps

**Description**

This command locks out the protection circuit in the specified APS group.

**Default**

n/a

**Parameters**

*aps-id*

the specified APS group

**request****Syntax**

**request** *aps-id* {**protect** | **working**}

**Context**

tools>perform>aps

**Description**

This command requests a manual switch to either the protection or working circuit.

**Default**

n/a

**Parameters**

*aps-id*

the specified APS group



**protect**

the physical port acting as a protection circuit for the APS group

**working**

the physical port acting as a working circuit for the APS group

**cron****Syntax**

**cron**

**Context**

tools>perform

**Description**

This command enables the context to perform CRON (scheduling) control operations.

**Default**

n/a

**action****Syntax**

**action**

**Context**

tools>perform>cron

**Description**

This command enables the context to stop the execution of a script started by CRON action. See the [stop](#) command.

**Default**

n/a

**stop****Syntax**

**stop** [*action-name*] [**owner** *action-owner*] [**all**]

**Context**

tools>perform>cron>action

**Description**

This command stops execution of a script started by CRON action.

**Default**

n/a

**Parameters**

- action-name*

specifies the action name

**Values**    maximum 32 characters
- action-owner*

specifies the owner name

**Default**    TiMOS CLI
- all**

specifies to stop all CRON scripts

cflowd

**Syntax**

cflowd

**Context**

tools>perform

**Description**

This command enables the context to perform cflowd control operations.

**Default**

n/a

manual-export

**Syntax**

manual-export

**Context**

tools>perform>cflowd

**Description**

This command manually exports cflowd flow data.

## eth-ring

### Syntax

**eth-ring**

### Context

tools>perform

### Description

This command enables the context to perform Ethernet ring operations.

### Default

n/a

## clear

### Syntax

**clear** *ring-index*

### Context

tools>perform>eth-ring

### Description

This command is used for the following operations on an Ethernet ring node:

- clearing an active local administrative command (for example, forced switch or manual switch)
- triggering reversion before the WTR or WTB timer expires in case of revertive operation
- triggering reversion in case of non-revertive operation

### Default

n/a

### Parameters

*ring-index*

specifies the Ethernet ring index

**Values** 1 to 128

## force

### Syntax

**clear** *ring-index* **path** {**a** | **b**}

### Context

tools>perform>eth-ring

### Description

This command forces a block on the ring port where the command is issued.

### Default

n/a

### Parameters

*ring-index*

specifies the Ethernet ring index

**Values** 1 to 128

**path** {**a** | **b**}

displays information for the specified path

## manual

### Syntax

**clear** *ring-index* **path** {**a** | **b**}

### Context

tools>perform>eth-ring

### Description

In the absence of a failure or FS, this command forces a block on the Ethernet ring port where the command is issued.

### Default

n/a

### Parameters

*ring-index*

specifies the Ethernet ring index

**Values** 1 to 128

**path {a | b}**  
displays information for the specified path

ima

**Syntax**  
ima

**Context**  
tools>perform

**Description**  
This command enables the context to perform IMA operations.

**Default**  
n/a

reset

**Syntax**  
reset *bundle-id*

**Context**  
tools>perform>ima

**Description**  
This command resets an IMA bundle in the startup state.

**Default**  
n/a

**Parameters**  
*bundle-id*  
specifies the IMA bundle ID

**Syntax:**      *bundle-ima-slot/mda.bundle-num*  
                 bundle-ima      keyword  
                 *bundle-num*      1 to 32

lag

Syntax

lag

Context

tools>perform

Description

This command configures tools to control LAG.

Default

n/a

clear-force

Syntax

clear-force all-mc

clear-force lag-id lag-id [sub-group sub-group-id]

clear-force peer-mc ip-address

Context

tools>perform>lag

Description

This command clears a forced status.

Default

n/a

Parameters

all-mc

clears all multi-chassis LAG information

lag-id

specifies an existing LAG ID

Values 1 to 32

sub-group-id

specifies a LAG subgroup

Values 1 or 2 (for access ports), 1 to 4 (for network ports)

*ip-address*  
specifies the IP address of a multi-chassis peer

force

Syntax

**force all-mc** {**active** | **standby**}  
**force lag-id** *lag-id* [**sub-group** *sub-group-id*] {**active** | **standby**}  
**force peer-mc** *peer-ip-address* {**active** | **standby**}

Context

tools>perform>lag

Description

This command forces an active or standby status.

Default

n/a

Parameters

- all-mc**  
forces an active or standby status for all multi-chassis LAGs
- peer-ip-address*  
specifies a multi-chassis peer by its IP address
- lag-id*  
specifies an existing LAG ID  
**Values** 1 to 32
- sub-group-id*  
specifies a LAG subgroup  
**Values** 1 or 2 (for access ports), 1 to 4 (for network ports)
- active**  
forces the specified LAG, LAG subgroup, multi-chassis LAG peer, or all multi-chassis LAGs to active status
- standby**  
forces the specified LAG, LAG subgroup, multi-chassis LAG peer, or all multi-chassis LAGs to standby status

## lcr

### Syntax

**lcr**

### Context

tools>perform

### Description

This command enables the context to perform T1/E1 Line Card Redundancy (LCR) operations.

### Default

n/a

## clear

### Syntax

**clear lcr-id {protect | working}**

### Context

tools>perform>lcr

### Description

This command removes all LCR operational commands from either the protection adapter card or the working adapter card in the specified LCR group.

### Default

n/a

### Parameters

**lcr-id**

the specified LCR group, from 1 to 6

**protect**

clears operational commands from the adapter card acting as a protection card for the LCR group

**working**

clears operational commands from the adapter card acting as a working card for the LCR group



## force

### Syntax

**force lcr-id {protect | working}**

### Context

tools>perform>lcr

### Description

This command forces activity away from either the protection adapter card or the working adapter card in the specified LCR group.

### Default

n/a

### Parameters

**lcr-id**

the specified LCR group, from 1 to 6

**protect**

forces activity away from the adapter card acting as a protection card for the LCR group

**working**

forces activity away from the adapter card acting as a working card for the LCR group

## lockout

### Syntax

**lockout lcr-id**

### Context

tools>perform>lcr

### Description

This command locks out the protection adapter card. Locking out the protection card means that activity cannot be switched to the protection card even if the working adapter card has failed.

### Default

n/a

### Parameters

**lcr-id**

the specified LCR group, from 1 to 6

## log

### Syntax

log

### Context

tools>perform

### Description

This command enables event logging tools.

### Default

n/a

## test-event

### Syntax

test-event

### Context

tools>perform>log

### Description

This command generates a test event.

### Default

n/a

## mda-table-refresh

### Syntax

mda-table-refresh

### Context

tools>perform

### Description

This command causes a complete FIB refresh. The command can be used to restore a FIB that is in a failed state. For information about FIB failures, see the 7705 SAR Router Configuration Guide, "Troubleshooting the FIB".

**Default**

n/a

mw

**Syntax**

mw

**Context**

tools>perform

**Description**

This command enables the context to perform microwave operations.

**Default**

n/a

clear

**Syntax**

**clear** *mw-link-id* {**main** | **spare**} {**eps** | **tps** | **rps**}

**Context**

tools>perform>mw

**Description**

This command removes all microwave link operational commands.

**Default**

n/a

**Parameters**

*mw-link-id*

specifies an existing microwave link ID

**Values**     *id* = 1 to 24

**main**

specifies that the role of the MPR-e radio in a 1+1 HSB configuration is main

**spare**

specifies that the role of the MPR-e radio in a 1+1 HSB configuration is spare

- eps**  
specifies that the protection scheme in a 1+1 HSB configuration is Equipment Protection Switching
- tps**  
specifies that the protection scheme in a 1+1 HSB configuration is Transmission Protection Switching
- rps**  
specifies that the protection scheme in a 1+1 HSB configuration is Radio Protection Switching

force

Syntax

```
force mw-link-id {eps | tps | rps}
```

Context

```
tools>perform>mw
```

Description

This command forces the spare MPR-e radio to become the main MPR-e radio in a 1+1 HSB configuration, even though it might not be in a fit state to assume the role. Once a forced switch operation is issued, it overrides any manual switch or automatic switch operation that is already in place.

Default

```
n/a
```

Parameters

- mw-link-id*  
specifies an existing microwave link ID

**Values**    *id* = 1 to 24

- eps**  
specifies that the protection scheme in a 1+1 HSB configuration is Equipment Protection Switching
- tps**  
specifies that the protection scheme in a 1+1 HSB configuration is Transmission Protection Switching
- rps**  
specifies that the protection scheme in a 1+1 HSB configuration is Radio Protection Switching

## lockout

### Syntax

**lockout** *mw-link-id* {**eps** | **tps** | **rps**}

### Context

tools>perform>mw

### Description

This command prevent the spare MPR-e radio in a 1+1 HSB configuration from ever becoming the main radio, even when the main MPR-e radio fails.

### Default

n/a

### Parameters

*mw-link-id*

specifies an existing microwave link ID

**Values**    *id* = 1 to 24

**eps**

specifies that the protection scheme in a 1+1 HSB configuration is Equipment Protection Switching

**tps**

specifies that the protection scheme in a 1+1 HSB configuration is Transmission Protection Switching

**rps**

specifies that the protection scheme in a 1+1 HSB configuration is Radio Protection Switching

## manual

### Syntax

**manual** *mw-link-id* {**main** | **spare**} {**eps** | **tps** | **rps**}

### Context

tools>perform>mw

### Description

This command attempts to switch the main/spare status of an MPR-e radio in a 1+1 HSB configuration; however, should certain operational conditions pertaining to the radio channel or radio hardware not allow

the switchover (such as port failures, equipment failures, and reception failures), an automatic switch operation overriding the manual switch attempt is triggered.

### Default

n/a

### Parameters

*mw-link-id*

specifies an existing microwave link ID

**Values**    *id* = 1 to 24

**main**

specifies that the role of the MPR-e radio in a 1+1 HSB configuration is main

**spare**

specifies that the role of the MPR-e radio in a 1+1 HSB configuration is spare

**eps**

specifies that the protection scheme in a 1+1 HSB configuration is Equipment Protection Switching

**tps**

specifies that the protection scheme in a 1+1 HSB configuration is Transmission Protection Switching

**rps**

specifies that the protection scheme in a 1+1 HSB configuration is Radio Protection Switching

## software-download

### Syntax

**software-download [force]**

### Context

tools>perform>mw

### Description

This command performs a software download to all MPR-e radios in the system that are not currently running the correct software. The software is downloaded to the inactive software bank of the MPR-e radios, in preparation of a software upgrade (the command does not activate a system upgrade).

This command allows operators to minimize outage times during a 7705 SAR system software upgrade (with Microwave Awareness). Before the software upgrade is performed, the operator runs this command to download the software to the radios while they are in service. Next, the operator performs the software upgrade. During the 7705 SAR system reboot, the new radio software is activated at the same time as the new system software, thus allowing both the system software and the MPR-e radio software to boot into the new load simultaneously.

**Default**

n/a

**Parameters**

**force**

forces a software download to all MPR-e radios regardless of the software version that they are currently running

ptp

**Syntax**

**ptp reset-clk-rec clock-id** *clock-id*

**Context**

tools>perform

**Description**

This command resets a PTP clock that is transmitting and receiving PTP messages using IPv4 or IPv6 encapsulation or using Ethernet encapsulation. Resetting the PTP clock also resets the frequency offset value stored in the non-volatile memory.

**Default**

n/a

**Parameters**

*clock-id*

specifies the PTP clock ID

**Values**    1 to 16 for PTP clocks that use IPv4 or IPv6 encapsulation  
**esm** for a PTP clock that uses Ethernet encapsulation

security

**Syntax**

**security**

**Context**

tools>perform

**Description**

This command provides tools for testing security.

Default

n/a

authentication-server-check

Syntax

**authentication-server-check** **server-address** *ip-address* [**port** *port*] {{**user-name** *user-name* **password** *password*} | **attr-from-file** *file-url*}} **secret** *key* [**source-address** *ip-address*] [**timeout** *seconds*] [**router** *router-instance* | **service-name** *service-name*]

Context

tools>perform>security

Description

This command checks connection to the RADIUS server.

Default

n/a

Parameters

- ip-address*

specifies the source IP address of the DHCP relay messages
- port*

specifies the port ID

**Values** 1 to 65535
- user-name*

specifies the DHCP client
- password*

specifies the CLI access password
- key*

specifies the authentication key
- seconds*

specifies the timeout in seconds

**Values** 1 to 90
- router-instance*

specifies the router name or service ID

**Values**

*router-name:*

Base, management

*service-id:*

1 to 2147483647



|                     | Default                    | Base                                                                                                                                                                               |
|---------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>service-name</i> |                            |                                                                                                                                                                                    |
|                     | specifies the service name |                                                                                                                                                                                    |
| <i>file-url</i>     |                            |                                                                                                                                                                                    |
|                     | the URL of the file        |                                                                                                                                                                                    |
|                     | Values                     |                                                                                                                                                                                    |
|                     | <i>file-url:</i>           | <i>local-url</i>   <i>remote-url</i>                                                                                                                                               |
|                     | <i>local-url:</i>          | <i>[cflash-id]/[file-path]</i><br>200 chars max, including cflash-id<br>directory length 99 chars max each                                                                         |
|                     | <i>remote-url:</i>         | <i>[{ftp://   tftp://}login:pswd@remote- locn][file-path]</i><br>255 chars max<br>directory length 99 chars max each                                                               |
|                     | <i>remote-locn:</i>        | <i>[hostname   ipv4-address   ipv6-address]</i>                                                                                                                                    |
|                     | <i>ipv4-address:</i>       | a.b.c.d                                                                                                                                                                            |
|                     | <i>ipv6-address:</i>       | <i>x:x:x:x:x:x[-interface]</i><br><i>x:x:x:x:x:d.d.d[-interface]</i><br>x: [0 to FFFF]H<br>d: [0 to 255]D<br><i>interface:</i> 32 chars max, for link local addresses              |
|                     | <i>cflash-id:</i>          | (7705 SAR-18) cf1:   cf1-A:   cf1-B:   cf2:   cf2-A:   cf2-B:   cf3:   cf3-A:   cf3-B:<br>(7705 SAR-8 Shelf V2) cf3:   cf3-A:   cf3-B:<br>(7705 SAR fixed platforms) cf3:   cf3-A: |

service

Syntax

service

Context

tools>perform

Description

This command enables the context to configure tools for services.

## id

### Syntax

**id** *service-id*

### Context

tools>perform>service

### Description

This command enables the context to configure tools for a specific service.

### Parameters

*service-id*

specifies an existing service ID

**Values** 1 to 2147483647 or a name string up to 64 characters long

## endpoint

### Syntax

**endpoint** *endpoint-name*

### Context

tools>perform>service>id

### Description

This command enables the context to configure tools for a specific service endpoint.

### Parameters

*endpoint-name*

specifies an existing service endpoint name

## force-switchover

### Syntax

**force-switchover** *sdp-id:vc-id*

**no force-switchover**

### Context

tools>perform>service>id

**Description**

This command forces a switch of the active spoke SDP for the specified service.

**Parameters**

|               |                                                 |                 |
|---------------|-------------------------------------------------|-----------------|
|               | <i>sdp-id:vc-id</i>                             |                 |
|               | specifies an existing spoke SDP for the service |                 |
| <b>Values</b> | <i>sdp-id:</i>                                  | 1 to 17407      |
|               | <i>vc-id:</i>                                   | 1 to 4294967295 |

ip-transport

**Syntax**

**ip-transport** *ipt-id*

**Context**

tools>perform>service>id

**Description**

This command enables the context to configure tools for a specific IES or VPRN IP transport subservice.

**Parameters**

|               |                                                                |  |
|---------------|----------------------------------------------------------------|--|
|               | <i>ipt-id</i>                                                  |  |
|               | specifies the IP transport subservice physical port identifier |  |
| <b>Values</b> | value in the format <i>slot/mda/port.channel</i>               |  |

remote-host

**Syntax**

**remote-host** *host-id* **check-tcp**

**Context**

tools>perform>service>id>ip-transport

**Description**

This command establishes a TCP connection to the remote host. The connection is torn down upon being successfully established. This command does not abide by the **max-retries** or **retry-interval** configured for the IP transport subservice; only one connection attempt, with a timeout of 5 seconds, is made when this command is executed.

If a TCP connection is already established to the remote host, this command does not impact that connection. It returns a successful status indication, with an explanation that a TCP connection was already established.

Default

n/a

Parameters

*host-id*  
the remote host identifier

**Values** 1 to 2147483647 or a name string up to 64 characters long

**check-tcp**  
establishes a TCP connection to the remote host

sap

Syntax

**sap** *sap-id* **cem** **asym-delay-adjust**

Context

tools>perform>service>id

Description

This command performs a one-time asymmetric delay control (ADC) analysis on a TDM PW without having to shut down the service. This analysis is done with live traffic (that is, not with all-ones or the **idle-payload-fill** value). If the difference between the calculated average latency and the expected latency is greater than the **threshold-repeat** value configured with the **asym-delay-control** command, octets are added or dropped as necessary.

The service must already be enabled for ADC. If ADC repeat is also enabled on the service when this command is run, the timer for the next repeat period starts when the on-demand analysis ends.

Default

n/a

Parameters

*sap-id*  
the Cpipe SAP ID

|               |           |                          |
|---------------|-----------|--------------------------|
| <b>Values</b> | cem       | <i>port-id bridge-id</i> |
|               | port-id   | slot/mda/port            |
|               | bridge-id | slot/mda/bridge.branch   |

**cem asym-delay-adjust**

performs an ADC analysis on the service

**system****Syntax**

**system**

**Context**

tools>perform

**Description**

This command enables the context to use tools that control the system.

**management-interface****Syntax**

**management-interface**

**Context**

tools>perform>system

**Description**

This command enables access to the management interface tools.

**snmp****Syntax**

**snmp**

**Context**

tools>perform>system>management-interface

**Description**

This command enables access to the SNMPv3 tools.

**change-key****Syntax**

**change-key authentication authentication-protocol old-authentication-key new-authentication-key**

**change-key authentication** *authentication-protocol* **privacy** *privacy-protocol old-privacy-key new-privacy-key*

## Context

tools>perform>system>management-interface>snmp

## Description

This command generates KeyChange strings to change SNMPv3 authentication or privacy keys. The SNMP engine ID is not needed because localized keys are required as input. The KeyChange algorithm uses a random string so the output is different each time the command is run.

## Parameters

*authentication-protocol*

specifies the SNMPv3 authentication protocol

- Values**
- hmac-md5-96** – specifies use of the HMAC-MD5-96 authentication protocol
  - hmac-sha1-96** – specifies use of the HMAC-SHA1-96 authentication protocol
  - hmac-sha2-224** – specifies use of the HMAC-SHA2-224 authentication protocol
  - hmac-sha2-256** – specifies use of the HMAC-SHA2-256 authentication protocol
  - hmac-sha2-384** – specifies use of the HMAC-SHA2-384 authentication protocol
  - hmac-sha2-512** – specifies use of the HMAC-SHA2-512 authentication protocol

*old-authentication-key*

specifies the old localized authentication key

*new-authentication-key*

specifies the new localized authentication key

*privacy-protocol*

specifies the SNMPv3 privacy protocol

- Values**
- cbc-des** – specifies use of the CBC-DES privacy protocol
  - cfb128-aes-128** – specifies use of the CFB128-AES-128 privacy protocol
  - cfb128-aes-192** – specifies use of the CFB128-AES-192 privacy protocol
  - cfb128-aes-256** – specifies use of the CFB128-AES-256 privacy protocol

*old-privacy-key*

specifies the old localized privacy key

*new-privacy-key*  
specifies the new localized privacy key

generate-key

Syntax

**generate-key authentication authentication-protocol authentication-password [privacy privacy-protocol privacy-password] [engine-id identifier]**

Context

tools>perform>system>management-interface>snmp

Description

This command generates localized SNMPv3 authentication and privacy keys, which are a hash of the SNMP engine ID and a password. The SNMP engine ID can be displayed with the **show system information | match "SNMP Engine ID"** command and does not need to be entered. If keys are being generated for a different system, its SNMP engine ID must be specified.

Parameters

*authentication-protocol*  
specifies the SNMPv3 authentication protocol

- Values**
- hmac-md5-96** – specifies use of the HMAC-MD5-96 authentication protocol
  - hmac-sha1-96** – specifies use of the HMAC-SHA1-96 authentication protocol
  - hmac-sha2-224** – specifies use of the HMAC-SHA2-224 authentication protocol
  - hmac-sha2-256** – specifies use of the HMAC-SHA2-256 authentication protocol
  - hmac-sha2-384** – specifies use of the HMAC-SHA2-384 authentication protocol
  - hmac-sha2-512** – specifies use of the HMAC-SHA2-512 authentication protocol

*authentication-password*  
specifies the password used to generate the authentication key, from 8 to 255 characters

*privacy-protocol*  
specifies the SNMPv3 privacy protocol

- Values**
- cbc-des** – specifies use of the CBC-DES privacy protocol
  - cfb128-aes-128** – specifies use of the CFB128-AES-128 privacy protocol

**cfb128-aes-192** – specifies use of the CFB128-AES-192 privacy protocol

**cfb128-aes-256** – specifies use of the CFB128-AES-256 privacy protocol

*privacy-password*

specifies the privacy password, from 8 to 255 characters

*identifier*

specifies an SNMP engine ID; must be a hexadecimal string from 10 to 64 digits

## script-control

### Syntax

**script-control**

### Context

tools>perform>system

### Description

This command enables the script-control context to access script policy commands.

## script-policy

### Syntax

**script-policy**

### Context

tools>perform>system>script-control

### Description

This command enables the script-policy context to access script policy tools.

## stop

### Syntax

**stop** [*policy-name*] [**owner** *policy-owner*] [**all**]

### Context

tools>perform>system>script-control>script-policy



## Description

This command stops the execution of scripts.

## Parameters

*policy-name*

specifies to only stop scripts with the specified script policy name

*policy-owner*

specifies to only stop scripts for script policies with the specified owner

**all**

specifies to stop all running scripts

## security

## Syntax

**security**

## Context

tools>perform>system

## Description

This command enters the context to perform security operations.

## support-mode

## Syntax

**support-mode**

## Context

tools>perform>system>security

## Description

This command enters the context to perform security support mode operations.

## generate-new-nonce

## Syntax

**generate-new-nonce**

## Context

tools>perform>system>security>support-mode

Description

This command generates a new system nonce. This operation invalidates all existing tokens on the system. The following prompt appears:

```
A:7705:DutA# tools perform system security support-mode generate-new-nonce
Generating a new nonce will invalidate all existing tokens for this node. Are you sure (y/n)? y
New System Nonce
System nonce: A701/tql9k175tJx4nTD2xhkSR7Q/xJrnIjihnqw0EE=
```

5.1.2.3.2 Perform router commands

```
router
```

Syntax

**router** *router-instance*  
**router** **service-name** *service-name*

Context

tools>perform

Description

This command enables tools for the router instance.

Default

n/a

Parameters

*router-instance*  
specifies the router name and service ID

|                |                     |                  |
|----------------|---------------------|------------------|
| <b>Values</b>  | <i>router-name:</i> | Base, management |
|                | <i>service-id:</i>  | 1 to 2147483647  |
| <b>Default</b> |                     | Base             |

*service-name*  
specifies the service name

```
isis
```

Syntax

**isis** [*isis-instance*]

**Context**

tools>perform>router

**Description**

This command enables the context to perform specific IS-IS tasks.

**Default**

n/a

**Parameters**

*isis-instance*

specifies the IS-IS protocol instance ID. If no *isis-instance* is specified, instance 0 is used.

**Values** 1 to 31

mpls

**Syntax**

mpls

**Context**

tools>perform>router

**Description**

This command enables the context to perform specific MPLS tasks.

**Default**

n/a

cspf

**Syntax**

**cspf** to *ip-addr* [**from** *ip-addr*] [**bandwidth** *bandwidth*] [**include-bitmap** *bitmap*] [**exclude-bitmap** *bitmap*] [**hop-limit** *limit*] [**exclude-address** *excl-addr* [*excl-addr*...(up to 8 max)]] [**use-te-metric**] [**strict-srlg**] [**srlg-group** *grp-id*...(up to 8 max)] [**exclude-node** *excl-node-id* [*excl-node-id*...(up to 8 max)]] [**skip-interface** *interface-name*] [**cspf-req-type** *req-type*] [**least-fill-min-thd** *thd*]

**Context**

tools>perform>router>mpls

**Description**

This command computes a CSPF path with specified user constraints.

**Default**

n/a

**Parameters****to** *ip-addr*

the destination IPv4 address

**from** *ip-addr*

the originating IPv4 address

**bandwidth**

the amount of bandwidth in megabits per second (Mb/s) to be reserved

**Values** 0 to 4294967295 (values can be expressed in decimal, hexadecimal, or binary)

**include-bitmap** *bitmap*

specifies to include a bitmap that lists the admin groups that should be included during the CSPF computation

**exclude-bitmap** *bitmap*

specifies to exclude a bitmap that lists the admin groups that should be included during the CSPF computation

**limit**

the total number of hops an FRR bypass or detour LSP can take before merging back onto the main LSP path

**Values** 1 to 255

**excl-addr**

an IP address to exclude from the CSPF computation (up to a maximum of eight addresses in one command)

**use-te-metric**

specifies to use the traffic engineering metric used on the interface

**strict-srlg**

specifies to use strict frr-srlg to compute a new CSPF path

**grp-id**

specifies to use up to eight SRLGs to compute a new CSPF path

**Values** 0 to 4294967295

**excl-node-id**

a node to exclude from the CSPF computation (up to a maximum of eight nodes in one command)

**interface-name**

a local interface name (rather than the address) to exclude from the CSPF computation

**req-type**

the CSPF request type

**Values** all – all ECMP paths  
 random – random ECMP paths  
 least-fill – specifies whether the use of the least-fill path selection method for the computation of the path for this CSPF request is enabled

*thd*

the percentage difference below which two links are considered equal for least-fill bandwidth comparison. When comparing the percentages of least available link bandwidth across available paths, whenever two percentages differ by less than the value configured as the least-fill minimum threshold, CSPF considers them to be equal and applies a random number generator to select the path.

**Values** 1 to 100

## resignal

### Syntax

**resignal** {**lsp** *lsp-name* **path** *path-name* | **delay** *minutes*}

**resignal** {**sr-te-lsp** *srte-lsp-name* **path** *path-name* | **sr-te-delay** *minutes*}

### Context

tools>perform>router>mpls

### Description

This command resignals specified LSP paths. If the **lsp** or **sr-te-lsp** parameters are used, the specified LSP path is resigned immediately. The **delay** or **sr-te-delay** parameter is used to override the global timer to resignal all LSPs of the corresponding type. The resignal timer is the time before resignaling occurs after the resignal condition occurs. For the delay option to work, the resignal time in the **config>router>mpls** context must be set.

The resignal timer is then reset to its configured value in the MPLS configuration. In this case, the new path is programmed in the datapath only if the metric of the new path is different from the metric of the current path.

### Default

n/a

### Parameters

*lsp-name*

specifies the name of an existing LSP

*path-name*

specifies the path name that is used for the LSP; this path must already have been configured

*minutes*

specifies the delay interval, in minutes, before all LSPs of the corresponding type are resignaled. If the value 0 is entered, all LSPs of the corresponding type are resignaled immediately.

**Values** 0 to 30

*srte-lsp-name*

specifies the name of an existing SR-TE LSP

## resignal-bypass

**Syntax**

**resignal-bypass delay** *minutes*

**resignal-bypass lsp** *bypass-lsp-name* [**force**]

**Context**

tools>perform>router>mpls

**Description**

This command performs a manual reoptimization of a specific dynamic or manual bypass LSP or of all dynamic bypass LSPs.

The manual bypass LSP name is user-configured. The dynamic bypass LSP name is shown in the output of the **show>router>mpls>bypass-tunnel dynamic detail** command.

The **delay** option triggers the global reoptimization of all dynamic bypass LSPs at the expiry of the specified delay. This option forces the global bypass resignal timer to expire after an amount of time equal to the value of the delay parameter. This option does not apply to a manual bypass LSP.

When a bypass LSP name is specified, that dynamic or manual bypass LSP is not signaled and the associations are not evaluated even if the new bypass LSP path has the same cost as the current one. This is a different behavior from the **resignal** command for the primary or secondary path of an LSP, because a bypass LSP can have a large number of PSB associations.

If the specified LSP is a manual bypass LSP with no PSB associations, the LSP is torn down and resignaled using the new path provided by CSPF. If there are one or more PSB associations but the PLR is not active, the command fails and the user is asked to explicitly enter the **force** option. In this case, the manual bypass LSP is torn down and resignaled, leaving the associated LSP primary paths temporarily unprotected. If there are any active PLRs associated with the manual bypass LSP, the command fails

**Default**

n/a

**Parameters***minutes*

the time that MPLS waits before attempting to resignal dynamic bypass LSP paths originated on the system

**Values** 0 to 30

*bypass-lsp-name*

the name of the dynamic or manual bypass LSP

**force**

required when the LSP is a manual bypass LSP with PSB associations

## sr-te-cspf

### Syntax

**sr-te-cspf** [**path-computation-method** *path-computation-method*] **to** *ip-address* [**path** *path-name*] [**from** *ip-address*] [**include-bitmap** *bitmap*] [**exclude-bitmap** *bitmap*] [**hop-limit** *limit*] [**metric-type-te**] [**strict-srlg**] [**srlg-group** *group-id*] [**local-sr-protection** *local-sr-protection*] [ **label-stack-reduction**] [**max-sr-labels** *label-stack-size*]

### Context

tools>perform>router>mpls

### Description

This command computes and returns the segment routing label stack for any user-specified MPLS path to a destination router.

By default, or when the **path-computation-method** is set to **ip-to-label**, MPLS passes the path information specified with the **to** and **from** parameters to the TE-DB, which converts the list of hops to a label stack by scanning the database for adjacency and node SID information that belongs to the router or link identified by each hop address. If the conversion is successful, the database returns the actual selected hop SIDs plus labels, as well as the configured path hop addresses that were used as the input for this conversion. None of the TE constraint parameters are used in this path computation method.

When the user specifies the value of **local-cspf** for the **path-computation-method** parameter, MPLS passes all parameters of the **tools** command, including the TE constraint parameters. In this case, a full local CSPF is run using these parameters.

When the user specifies a path name with this command, CSPF returns a single path, which is selected randomly similar to a configured SR-TE LSP, with the **path-computation-method local-cspf** command enabled. When no path name is specified with this command, CSPF returns the set of candidate ECMP paths.

### Parameters

*path-computation-method*

specifies the path computation method of the LSP path

**Values** ip-to-label, local-cspf

**to** *ip-address*

specifies the destination IP address

*path-name*

specifies the path name

**from ip-address**

specifies the originating IP address

**bitmap**

specifies a decimal, hexadecimal, or binary bit-map of the admin groups that should be included in or excluded from the path computation

**Values** 0 to 4294967295

**hop-limit**

specifies the maximum number of hops for the path

**Values** 0 to 255

**metric-type-te**

specifies the use of the traffic engineering metric to optimize the path. By default, the link IGP metric is used.

**strict-srlg**

specifies the computation of a path that is strictly disjoint from links which are members of the entered SRLG

**group-id**

specifies up to eight SRLGs that path computation should avoid, or must avoid if the **strict-srlg** option is enabled

**Values** 0 to 4294967295

**local-sr-protection**

specifies the local LFA protection for the CSPF-computed explicit path with adjacency SIDs

**Values** preferred, mandatory, none

**label-stack-reduction**

applies label stack reduction to the CSPF-computed explicit path with adjacency SIDs

**label-stack-size**

specifies the maximum label stack size of the CSPF-computed path with or without label stack reduction

**Values** 1 to 11

## trap-suppress

### Syntax

**trap-suppress** *number-of-traps time-interval*

### Context

tools>perform>router>mpls



## Description

This command modifies thresholds for trap suppression. The command is used to suppress traps after the specified number of traps has been raised within the specified period of time.

## Default

n/a

## Parameters

*number-of-traps*

specifies the number of traps in multiples of 100. An error message is generated if an invalid value is entered.

**Values** 100 to 1000

*time-interval*

specifies the time interval in seconds

**Values** 1 to 300

## update-path

## Syntax

**update-path** {**lsp** *lsp-name* **path** *current-path-name* **new-path** *new-path-name*}

## Context

tools>perform>router>mpls

## Description

This command instructs MPLS to replace the path of a primary or secondary LSP. The primary or secondary LSP path is indirectly identified with the *current-path-name* value. The same path name cannot be used more than once for an LSP name.

This command applies to both a CSPF LSP and a non-CSPF LSP. The command only works when the specified *current-path-name* has the adaptive option enabled. The adaptive option can be enabled at the LSP level or the path level.

The new path must have been configured in the CLI or provided via SNMP. The CLI command for entering the path is **config>router>mpls>path** *path-name*.

The command fails if any of the following conditions exist:

- the specified *current-path-name* of this LSP does not have the adaptive option enabled
- the specified *new-path-name* value does not correspond to a previously defined path
- the specified *new-path-name* value exists but is being used by any path of the same LSP, including this one

When you execute this command, MPLS performs the following procedures.

- MPLS performs a single MBB attempt to move the LSP path to the new path.

- If the MBB is successful, MPLS updates the new path.
  - MPLS writes the corresponding NHLFE in the data path if this path is the current backup path for the primary path.
  - If the current path is the active LSP path, MPLS will update the path and write the new NHLFE in the data path, which will cause traffic to switch to the new path.
- If the MBB is not successful, the path retains its current value.

The update-path MBB has the same priority as the manual resignal MBB.

## Parameters

*lsp-name*

specifies the administrative name for this LSP

*current-path-name*

specifies the name of the current path

*new-path-name*

specifies the name of the new path

ospf

## Syntax

ospf

## Context

tools>perform>router

## Description

This command enables the context to perform specific OSPF tasks.

## Default

n/a

ldp-sync-exit

## Syntax

ldp-sync-exit

## Context

tools>perform>router>ospf

tools>perform>router>isis

**Description**

This command terminates IGP-LDP synchronization. OSPF or IS-IS then advertises the actual cost value of the link for all interfaces that have IGP-LDP synchronization enabled, if the currently advertised cost is different.

**Default**

n/a

refresh-lsas

**Syntax**

**refresh-lsas** [*lsa-type*] [*area-id*]

**Context**

tools>perform>router>ospf

**Description**

This command refreshes LSAs for OSPF.

**Default**

n/a

**Parameters**

*lsa-type*

the specified LSA type

**Values** router, network, summary, asbr, extern, nssa, opaque

*area-id*

the OSPF area ID expressed in dotted-decimal notation or as a 32-bit integer

**Values** 0.0.0.0 to 255.255.255.255 (dotted-decimal), 0 to 4294967295 (decimal integer)

run-manual-spf

**Syntax**

**run-manual-spf** [externals-only]

**Context**

tools>perform>router>ospf

tools>perform>router>isis

**Description**

This command runs the shortest path first (SPF) algorithm for OSPF or IS-IS.

The **externals-only** parameter applies only to OSPF.

**Default**

n/a

**Parameters****externals-only**

specifies the route preference for OSPF external routes

## 5.1.2.4 Tools ADP commands

### auto-discovery

**Syntax**

**auto-discovery** [retry] [terminate]

**Context**

tools

**Description**

This command is used to control ADP while it is running.

The **retry** keyword restarts ADP if it has been halted due to errors. Executing this command clears the rejected DHCP server list for all ports and retries any processing that failed.

The **terminate** keyword terminates ADP and removes the ADP keyword from the BOF. The router returns to normal operations and any temporary configuration is removed. Network configuration and remote access remain enabled to allow the router to be manually provisioned remotely. ADP will not run again on future system restarts unless it is re-enabled via the CLI.

**Default**

n/a

**Parameters****retry**

resumes ADP after being halted for errors

**terminate**

terminates ADP and removes the ADP keyword from the BOF

## auto-discovery echo

### Syntax

[no] **auto-discovery echo** [**debugger**]

### Context

tools

### Description

This command enables ADP echoing, which sends periodic updates to the console. The default is for ADP to echo progress summaries and major events. For troubleshooting, the optional **debugger** parameter causes ADP to echo detailed progress reports with events and timestamps. The command reverts to the default settings each time ADP is run on the system.

The **no** form of this command disables ADP echoing.

### Default

auto-discovery echo

### Parameters

**debugger**

enables ADP echoing of detailed progress reports with events and timestamps

## 6 List of acronyms

Table 62: Acronyms

| Acronym  | Expansion                                       |
|----------|-------------------------------------------------|
| 2G       | second-generation wireless telephone technology |
| 3DES     | triple DES (data encryption standard)           |
| 3G       | third-generation mobile telephone technology    |
| 6VPE     | IPv6 on virtual private edge router             |
| 7705 SAR | 7705 Service Aggregation Router                 |
| 7750 SR  | 7750 Service Router                             |
| 8 PSK    | eight phase shift keying                        |
| 16 QAM   | 16-state quadrature amplitude modulation        |
| 32 QAM   | 32-state quadrature amplitude modulation        |
| 64 QAM   | 64-state quadrature amplitude modulation        |
| 128 QAM  | 128-state quadrature amplitude modulation       |
| 256 QAM  | 256-state quadrature amplitude modulation       |
| ABR      | area border router<br>available bit rate        |
| AC       | alternating current<br>attachment circuit       |
| ACK      | acknowledge                                     |
| ACL      | access control list                             |
| ACR      | adaptive clock recovery                         |
| AD       | auto-discovery                                  |
| ADC      | asymmetric delay control                        |
| ADM      | add/drop multiplexer                            |
| ADP      | automatic discovery protocol                    |
| AES      | advanced encryption standard                    |

| Acronym | Expansion                                         |
|---------|---------------------------------------------------|
| AFI     | authority and format identifier                   |
| AIGP    | accumulated IGP                                   |
| AIS     | alarm indication signal                           |
| ALG     | application level gateway                         |
| AMP     | active multipath                                  |
| AN      | association number                                |
| ANSI    | American National Standards Institute             |
| Apipe   | ATM VLL                                           |
| APS     | automatic protection switching                    |
| ARP     | address resolution protocol                       |
| A/S     | active/standby                                    |
| AS      | autonomous system                                 |
| ASAP    | any service, any port                             |
| ASBR    | autonomous system boundary router                 |
| ASM     | any-source multicast<br>autonomous system message |
| ASN     | autonomous system number                          |
| ATM     | asynchronous transfer mode                        |
| ATM PVC | ATM permanent virtual circuit                     |
| AU      | administrative unit                               |
| AUG     | administrative unit group                         |
| B3ZS    | bipolar with three-zero substitution              |
| Batt A  | battery A                                         |
| B-bit   | beginning bit (first packet of a fragment)        |
| BBE     | background block errors                           |
| Bc      | committed burst size                              |
| Be      | excess burst size                                 |
| BECN    | backward explicit congestion notification         |

| Acronym  | Expansion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bellcore | Bell Communications Research                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| BFD      | bidirectional forwarding detection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| BGP      | border gateway protocol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| BGP-LS   | border gateway protocol link state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| BGP-LU   | border gateway protocol labeled unicast                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| BITS     | building integrated timing supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BTCA     | best timeTransmitter clock algorithm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| BMU      | broadcast, multicast, and unknown traffic<br>Traffic that is not unicast. Any nature of multipoint traffic: <ul style="list-style-type: none"> <li>• broadcast (that is, all 1s as the destination IP to represent all destinations within the subnet)</li> <li>• multicast (that is, traffic typically identified by the destination address, uses special destination address); for IP, the destination must be 224.0.0.0 to 239.255.255.255</li> <li>• unknown (that is, the destination is typically a valid unicast address but the destination port/interface is not yet known; therefore, traffic needs to be forwarded to all destinations; unknown traffic is treated as broadcast)</li> </ul> |
| BNM      | bandwidth notification message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| BOF      | boot options file                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BoS      | bottom of stack                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| BPDU     | bridge protocol data unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| BRAS     | Broadband Remote Access Server                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| BSC      | Base Station Controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| BSM      | bootstrap message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BSR      | bootstrap router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| BSTA     | Broadband Service Termination Architecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| BTS      | base transceiver station                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| CA       | certificate authority<br>connectivity association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| CAK      | connectivity association key                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



| Acronym     | Expansion                                                                                                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CAS         | channel associated signaling                                                                                                                                                                                              |
| CBN         | common bonding networks                                                                                                                                                                                                   |
| CBS         | committed buffer space                                                                                                                                                                                                    |
| CC          | continuity check<br>control channel                                                                                                                                                                                       |
| CCM         | continuity check message                                                                                                                                                                                                  |
| CCTV        | closed-circuit television                                                                                                                                                                                                 |
| CE          | circuit emulation<br>customer edge                                                                                                                                                                                        |
| CEM         | circuit emulation                                                                                                                                                                                                         |
| CES         | circuit emulation services                                                                                                                                                                                                |
| CESoPSN     | circuit emulation services over packet switched network                                                                                                                                                                   |
| CFM         | connectivity fault management                                                                                                                                                                                             |
| cHDLC       | Cisco high-level data link control protocol                                                                                                                                                                               |
| CIDR        | classless inter-domain routing                                                                                                                                                                                            |
| CIR         | committed information rate                                                                                                                                                                                                |
| CKN         | connectivity association key name                                                                                                                                                                                         |
| CLI         | command line interface                                                                                                                                                                                                    |
| CLP         | cell loss priority                                                                                                                                                                                                        |
| CMP         | certificate management protocol                                                                                                                                                                                           |
| CMV         | Cryptographic Module version                                                                                                                                                                                              |
| C-multicast | customer multicast                                                                                                                                                                                                        |
| CoS         | class of service                                                                                                                                                                                                          |
| CPE         | customer premises equipment                                                                                                                                                                                               |
| Cpipe       | circuit emulation (or TDM) VLL                                                                                                                                                                                            |
| CPM         | Control and Processing Module (CPM is used instead of CSM when referring to CSM filtering to align with CLI syntax used with other SR products). CSM management ports are referred to as CPM management ports in the CLI. |

| Acronym | Expansion                                             |
|---------|-------------------------------------------------------|
| CPROTO  | C prototype                                           |
| CPU     | central processing unit                               |
| C/R     | command/response                                      |
| CRC     | cyclic redundancy check                               |
| CRC-32  | 32-bit cyclic redundancy check                        |
| CRL     | certificate revocation list                           |
| CRON    | a time-based scheduling service (from chronos = time) |
| CRP     | candidate RP                                          |
| CSM     | Control and Switching Module                          |
| CSNP    | complete sequence number PDU                          |
| CSPF    | constrained shortest path first                       |
| C-tag   | customer VLAN tag                                     |
| CV      | connection verification<br>customer VLAN (tag)        |
| CW      | control word                                          |
| CWDM    | coarse wavelength-division multiplexing               |
| DA/FAN  | distribution automation and field area network        |
| DC      | direct current                                        |
| DC-C    | DC return - common                                    |
| DCE     | data communications equipment                         |
| DC-I    | DC return - isolated                                  |
| DCO     | digitally controlled oscillator                       |
| DCR     | differential clock recovery                           |
| DDoS    | distributed DoS                                       |
| DE      | discard eligibility                                   |
| DER     | distinguished encoding rules                          |
| DES     | data encryption standard                              |
| DF      | do not fragment                                       |

| Acronym | Expansion                                                                                                           |
|---------|---------------------------------------------------------------------------------------------------------------------|
|         | designated forwarder                                                                                                |
| DH      | Diffie-Hellman                                                                                                      |
| DHB     | decimal, hexadecimal, or binary                                                                                     |
| DHCP    | dynamic host configuration protocol                                                                                 |
| DHCPv6  | dynamic host configuration protocol for IPv6                                                                        |
| DIS     | designated intermediate system                                                                                      |
| DLCI    | data link connection identifier                                                                                     |
| DLCMI   | data link connection management interface                                                                           |
| DM      | delay measurement                                                                                                   |
| DNS     | domain name server                                                                                                  |
| DNU     | do not use                                                                                                          |
| DoS     | denial of service                                                                                                   |
| dot1p   | IEEE 802.1p bits, in Ethernet or VLAN ingress packet headers, used to map traffic to up to eight forwarding classes |
| dot1q   | IEEE 802.1q encapsulation for Ethernet interfaces                                                                   |
| DPD     | dead peer detection                                                                                                 |
| DPI     | deep packet inspection                                                                                              |
| DPLL    | digital phase locked loop                                                                                           |
| DR      | designated router                                                                                                   |
| DS      | digital signature                                                                                                   |
| DSA     | digital signal algorithm                                                                                            |
| DSCP    | differentiated services code point                                                                                  |
| DSL     | digital subscriber line                                                                                             |
| DSLAM   | digital subscriber line access multiplexer                                                                          |
| DTE     | data termination equipment                                                                                          |
| DU      | downstream unsolicited                                                                                              |
| DUID    | DHCP unique identifier                                                                                              |
| DUS     | do not use for synchronization                                                                                      |

| Acronym     | Expansion                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------|
| DV          | delay variation                                                                                                             |
| DVMRP       | distance vector multicast routing protocol                                                                                  |
| e911        | enhanced 911 service                                                                                                        |
| EAP         | Extensible Authentication Protocol                                                                                          |
| EAPOL       | EAP over LAN                                                                                                                |
| E-bit       | ending bit (last packet of a fragment)                                                                                      |
| E-BSR       | elected BSR                                                                                                                 |
| ECMP        | equal cost multipath                                                                                                        |
| EE          | end entity                                                                                                                  |
| EFM         | Ethernet in the first mile                                                                                                  |
| EGP         | exterior gateway protocol                                                                                                   |
| EIA/TIA-232 | Electronic Industries Alliance/Telecommunications Industry Association Standard 232 (also known as <a href="#">RS-232</a> ) |
| EIR         | excess information rate                                                                                                     |
| EJBCA       | Enterprise Java Beans Certificate Authority                                                                                 |
| E-LAN       | Ethernet local area network                                                                                                 |
| E-Line      | Ethernet virtual private line                                                                                               |
| EL          | entropy label                                                                                                               |
| eLER        | egress label edge router                                                                                                    |
| ELI         | entropy label indicator                                                                                                     |
| E&M         | ear and mouth<br>earth and magneto<br>exchange and multiplexer                                                              |
| eMBMS       | evolved MBMS                                                                                                                |
| EOP         | end of packet                                                                                                               |
| EPC         | evolved packet core                                                                                                         |
| EPD         | early packet discard                                                                                                        |
| Epipe       | Ethernet VLL                                                                                                                |

| Acronym  | Expansion                                                  |
|----------|------------------------------------------------------------|
| EPL      | Ethernet private line                                      |
| EPON     | Ethernet Passive Optical Network                           |
| EPS      | equipment protection switching                             |
| ERO      | explicit route object                                      |
| ES       | Ethernet segment<br>errored seconds                        |
| ESD      | electrostatic discharge                                    |
| ESI      | Ethernet segment identifier                                |
| ESMC     | Ethernet synchronization message channel                   |
| ESN      | extended sequence number                                   |
| ESP      | encapsulating security payload                             |
| ESPI     | encapsulating security payload identifier                  |
| ESV      | Entropy Source version                                     |
| ETE      | end-to-end                                                 |
| ETH-BN   | Ethernet bandwidth notification                            |
| ETH-CFM  | Ethernet connectivity fault management (IEEE 802.1ag)      |
| EVC      | Ethernet virtual connection                                |
| EVDO     | evolution - data optimized                                 |
| EVI      | EVPN instance                                              |
| EVPL     | Ethernet virtual private link                              |
| EVPN     | Ethernet virtual private network                           |
| EXP bits | experimental bits (currently known as <a href="#">TC</a> ) |
| FC       | forwarding class                                           |
| FCS      | frame check sequence                                       |
| FD       | frequency diversity                                        |
| FDB      | forwarding database                                        |
| FDL      | facilities data link                                       |
| FEAC     | far-end alarm and control                                  |

| Acronym | Expansion                                    |
|---------|----------------------------------------------|
| FEC     | forwarding equivalence class                 |
| FECN    | forward explicit congestion notification     |
| FeGW    | far-end gateway                              |
| FEP     | front-end processor                          |
| FF      | fixed filter                                 |
| FFD     | fast fault detection                         |
| FIB     | forwarding information base                  |
| FIFO    | first in, first out                          |
| FIPS    | Federal Information Processing Standard      |
| FM      | fault management                             |
| FNG     | fault notification generator                 |
| FOM     | figure of merit                              |
| Fpipe   | frame relay VLL                              |
| FPV     | FIPS Provider version                        |
| FQDN    | fully qualified domain name                  |
| FR      | frame relay                                  |
| FRG bit | fragmentation bit                            |
| FRR     | fast reroute                                 |
| FTN     | FEC-to-NHLFE                                 |
| FTP     | file transfer protocol                       |
| FXO     | foreign exchange office                      |
| FXS     | foreign exchange subscriber                  |
| GFP     | generic framing procedure                    |
| GigE    | Gigabit Ethernet                             |
| GLONASS | Global Navigation Satellite System (Russia)  |
| GNSS    | global navigation satellite system (generic) |
| GPON    | Gigabit Passive Optical Network              |

| Acronym | Expansion                                    |
|---------|----------------------------------------------|
| GPRS    | general packet radio service                 |
| GPS     | Global Positioning System                    |
| GRE     | generic routing encapsulation                |
| GRT     | global routing table                         |
| GSM     | Global System for Mobile Communications (2G) |
| GTP-U   | GPRS tunneling protocol user plane           |
| GW      | gateway                                      |
| HA      | high availability                            |
| HCM     | high capacity multiplexing                   |
| HDB3    | high density bipolar of order 3              |
| HDLC    | high-level data link control protocol        |
| HEC     | header error control                         |
| HMAC    | hash message authentication code             |
| Hpipe   | HDLC VLL                                     |
| H-QoS   | hierarchical quality of service              |
| HSB     | hot standby                                  |
| HSDPA   | high-speed downlink packet access            |
| HSPA    | high-speed packet access                     |
| H-VPLS  | hierarchical virtual private line service    |
| IANA    | Internet Assigned Numbers Authority          |
| IBN     | isolated bonding networks                    |
| ICB     | inter-chassis backup                         |
| ICK     | integrity connection value key               |
| ICMP    | Internet control message protocol            |
| ICMPv6  | Internet control message protocol for IPv6   |
| ICP     | IMA control protocol cells                   |
| ICV     | integrity connection value                   |
| IDS     | intrusion detection system                   |

| Acronym     | Expansion                                                            |
|-------------|----------------------------------------------------------------------|
| IDU         | indoor unit                                                          |
| IED         | intelligent end device                                               |
| IEEE        | Institute of Electrical and Electronics Engineers                    |
| IEEE 1588v2 | Institute of Electrical and Electronics Engineers standard 1588-2008 |
| IES         | Internet enhanced service                                            |
| IETF        | Internet Engineering Task Force                                      |
| IGMP        | Internet group management protocol                                   |
| IGP         | interior gateway protocol                                            |
| IID         | instance ID                                                          |
| IKE         | Internet key exchange                                                |
| iLER        | ingress label edge router                                            |
| ILM         | incoming label map                                                   |
| IMA         | inverse multiplexing over ATM                                        |
| IMET-IR     | inclusive multicast Ethernet tag—ingress replication                 |
| INVARP      | inverse address resolution protocol                                  |
| IOM         | input/output module                                                  |
| IP          | Internet protocol                                                    |
| IPCP        | Internet protocol control protocol                                   |
| IPIP        | IP in IP                                                             |
| Ipipe       | IP interworking VLL                                                  |
| I-PMSI      | inclusive PMSI                                                       |
| IPoATM      | IP over ATM                                                          |
| IPS         | intrusion prevention system                                          |
| IPSec       | Internet protocol security                                           |
| IR          | ingress replication                                                  |
| IRB         | integrated routing and bridging                                      |
| ISA         | integrated services adapter                                          |



| Acronym  | Expansion                                                 |
|----------|-----------------------------------------------------------|
| ISAKMP   | Internet security association and key management protocol |
| IS-IS    | Intermediate System-to-Intermediate System                |
| IS-IS-TE | IS-IS-traffic engineering (extensions)                    |
| ISO      | International Organization for Standardization            |
| IW       | interworking                                              |
| JP       | join prune                                                |
| KEK      | key encryption key                                        |
| KG       | key group                                                 |
| LB       | loopback                                                  |
| lbf-in   | pound force inch                                          |
| LBM      | loopback message                                          |
| LBO      | line buildout                                             |
| LBR      | loopback reply                                            |
| LCP      | link control protocol                                     |
| LDP      | label distribution protocol                               |
| LER      | label edge router                                         |
| LFA      | loop-free alternate                                       |
| LFIB     | label forwarding information base                         |
| LIB      | label information base                                    |
| LLDP     | link layer discovery protocol                             |
| LLDPDU   | link layer discovery protocol data unit                   |
| LLF      | link loss forwarding                                      |
| LLID     | loopback location ID                                      |
| LM       | loss measurement                                          |
| LMI      | local management interface                                |
| LOS      | line-of-sight<br>loss of signal                           |
| LSA      | link-state advertisement                                  |

| Acronym  | Expansion                                                              |
|----------|------------------------------------------------------------------------|
| LSDB     | link-state database                                                    |
| LSP      | label switched path<br>link-state PDU (for IS-IS)                      |
| LSPA     | LSP attributes                                                         |
| LSR      | label switching router<br>link-state request                           |
| LSU      | link-state update                                                      |
| LT       | linktrace                                                              |
| LTE      | long term evolution<br>line termination equipment                      |
| LTM      | linktrace message                                                      |
| LTN      | LSP ID to NHLFE                                                        |
| LTR      | link trace reply                                                       |
| MA       | maintenance association                                                |
| MAC      | media access control                                                   |
| MACsec   | media access control security                                          |
| MA-ID    | maintenance association identifier                                     |
| MBB      | make-before-break                                                      |
| MBGP     | multicast BGP<br>multiprotocol BGP<br>multiprotocol extensions for BGP |
| MBMS     | multimedia broadcast multicast service                                 |
| MBS      | maximum buffer space<br>maximum burst size<br>media buffer space       |
| MBSP     | mobile backhaul service provider                                       |
| MCAC     | multicast connection admission control                                 |
| MC-APS   | multi-chassis automatic protection switching                           |
| MC-MLPPP | multiclass multilink point-to-point protocol                           |

| Acronym  | Expansion                                         |
|----------|---------------------------------------------------|
| MCS      | multicast server<br>multi-chassis synchronization |
| MCT      | MPT craft terminal                                |
| MD       | maintenance domain                                |
| MD5      | message digest version 5 (algorithm)              |
| MDA      | media dependent adapter                           |
| MDDDB    | multidrop data bridge                             |
| MDL      | maintenance data link                             |
| MDT      | multicast distribution tree                       |
| ME       | maintenance entity                                |
| MED      | multi-exit discriminator                          |
| MEF      | Metro Ethernet Forum                              |
| MEG      | maintenance entity group                          |
| MEG-ID   | maintenance entity group identifier               |
| MEN      | Metro Ethernet network                            |
| MEP      | maintenance association endpoint                  |
| MFC      | multi-field classification                        |
| MHD      | multi-homed device                                |
| MHF      | MIP half function                                 |
| MHN      | multi-homed network                               |
| MI       | member identifier                                 |
| MIB      | management information base                       |
| MI-IS-IS | multi-instance IS-IS                              |
| MIR      | minimum information rate                          |
| MKA      | MACsec key agreement                              |
| MLD      | multicast listener discovery                      |
| mLDP     | multicast LDP                                     |
| MLPPP    | multilink point-to-point protocol                 |

| Acronym          | Expansion                                                                                               |
|------------------|---------------------------------------------------------------------------------------------------------|
| mLSP             | multicast LSP                                                                                           |
| MoFRR            | multicast-only fast reroute                                                                             |
| MP               | merge point<br>multilink protocol<br>multipoint                                                         |
| MP-BGP           | multiprotocol border gateway protocol                                                                   |
| MPLS             | multiprotocol label switching                                                                           |
| MPLSCP           | multiprotocol label switching control protocol                                                          |
| MPP              | MPT protection protocol                                                                                 |
| MPR              | see <a href="#">Wavence</a>                                                                             |
| MPR-e            | Microwave Packet Radio (standalone mode)                                                                |
| MPT-HC V2/9558HC | Microwave Packet Transport, High Capacity version 2                                                     |
| MPT-HLC          | Microwave Packet Transport, High-Capacity Long-Haul Cubic (ANSI)                                        |
| MPT-HQAM         | Microwave Packet Transport, High Capacity (MPT-HC-QAM) or Extended Power (MPT-XP-QAM) with 512/1024 QAM |
| MPT-MC           | Microwave Packet Transport, Medium Capacity                                                             |
| MPT-XP           | Microwave Packet Transport, High Capacity (very high power version of MPT-HC V2/9558HC)                 |
| MRAI             | minimum route advertisement interval                                                                    |
| MRRU             | maximum received reconstructed unit                                                                     |
| MRU              | maximum receive unit                                                                                    |
| MSDP             | Multicast Source Discovery Protocol                                                                     |
| MSDU             | MAC Service Data Unit                                                                                   |
| MSK              | master session key                                                                                      |
| MSO              | multi-system operator                                                                                   |
| MS-PW            | multi-segment pseudowire                                                                                |
| MSS              | maximum segment size<br>Microwave Service Switch                                                        |

| Acronym | Expansion                                              |
|---------|--------------------------------------------------------|
| MTIE    | maximum time interval error                            |
| MTSO    | mobile trunk switching office                          |
| MTU     | maximum transmission unit<br>multi-tenant unit         |
| M-VPLS  | management virtual private line service                |
| MVPN    | multicast VPN                                          |
| MVR     | multicast VPLS registration                            |
| MW      | microwave                                              |
| MWA     | microwave awareness                                    |
| N·m     | newton meter                                           |
| NAT     | network address translation                            |
| NAT-T   | network address translation traversal                  |
| NBMA    | non-broadcast multiple access (network)                |
| ND      | neighbor discovery                                     |
| NDcPP   | Network Device Protection Profile                      |
| NE      | network element                                        |
| NET     | network entity title                                   |
| NFM-P   | Network Functions Manager - Packet (formerly 5620 SAM) |
| NGE     | network group encryption                               |
| NG-MVPN | next generation MVPN                                   |
| NH      | next hop                                               |
| NHLFE   | next hop label forwarding entry                        |
| NHOP    | next-hop                                               |
| NIAP    | National Information Assurance Partnership             |
| NLOS    | non-line-of-sight                                      |
| NLPID   | network level protocol identifier                      |
| NLRI    | network layer reachability information                 |
| NNHOP   | next next-hop                                          |

| Acronym | Expansion                                                                                                        |
|---------|------------------------------------------------------------------------------------------------------------------|
| NNI     | network-to-network interface                                                                                     |
| Node B  | similar to BTS but used in 3G networks — term is used in UMTS (3G systems) while BTS is used in GSM (2G systems) |
| NOC     | network operations center                                                                                        |
| NPAT    | network port address translation                                                                                 |
| NRC-F   | Network Resource Controller - Flow                                                                               |
| NRC-P   | Network Resource Controller - Packet                                                                             |
| NRC-T   | Network Resource Controller - Transport                                                                          |
| NRC-X   | Network Resource Controller - Cross Domain                                                                       |
| NSAP    | network service access point                                                                                     |
| NSD     | Network Services Director                                                                                        |
| NSP     | native service processing<br>Network Services Platform                                                           |
| NSSA    | not-so-stubby area                                                                                               |
| NTP     | Network Time Protocol                                                                                            |
| NTR     | network timing reference                                                                                         |
| OADM    | optical add/drop multiplexer                                                                                     |
| OAM     | operations, administration, and maintenance                                                                      |
| OAMPDU  | OAM protocol data units                                                                                          |
| OC3     | optical carrier level 3                                                                                          |
| OCSP    | online certificate status protocol                                                                               |
| ODU     | outdoor unit                                                                                                     |
| OIF     | outgoing interface                                                                                               |
| OLT     | optical line termination                                                                                         |
| OMC     | optical management console                                                                                       |
| ONT     | optical network terminal                                                                                         |
| OOB     | out-of-band                                                                                                      |
| OPX     | off premises extension                                                                                           |

| Acronym | Expansion                                       |
|---------|-------------------------------------------------|
| ORF     | outbound route filtering                        |
| OS      | operating system                                |
| OSI     | Open Systems Interconnection (reference model)  |
| OSINLCP | OSI Network Layer Control Protocol              |
| OSPF    | open shortest path first                        |
| OSPF-TE | OSPF-traffic engineering (extensions)           |
| OSS     | operations support system                       |
| OSSP    | organization specific slow protocol             |
| OTP     | one time password                               |
| OWAMP   | one-way active measurement protocol             |
| P2MP    | point to multipoint                             |
| PADI    | PPPoE active discovery initiation               |
| PADR    | PPPoE active discovery request                  |
| PAE     | port authentication entities                    |
| PSB     | path state block                                |
| PBO     | packet byte offset                              |
| PBR     | policy-based routing                            |
| PBX     | private branch exchange                         |
| PCAP    | packet capture                                  |
| PCC     | path computation client                         |
| PCE     | path computation element                        |
| PCEP    | Path Computation Element Communication Protocol |
| PCM     | pulse code modulation                           |
| PCP     | priority code point                             |
| PCR     | proprietary clock recovery                      |
| PDU     | power distribution unit<br>protocol data units  |
| PDV     | packet delay variation                          |

| Acronym     | Expansion                                                |
|-------------|----------------------------------------------------------|
| PDVT        | packet delay variation tolerance                         |
| PE          | provider edge router                                     |
| PEAPv0      | protected extensible authentication protocol version 0   |
| PEM         | privacy enhanced mail                                    |
| PFoE        | power feed over Ethernet                                 |
| PFS         | perfect forward secrecy                                  |
| PHB         | per-hop behavior                                         |
| PHP         | penultimate hop popping                                  |
| PHY         | physical layer                                           |
| PIC         | prefix independent convergence                           |
| PID         | protocol ID                                              |
| PIM SSM     | protocol independent multicast—source-specific multicast |
| PIR         | peak information rate                                    |
| PKCS        | public key cryptography standards                        |
| PKI         | public key infrastructure                                |
| PLAR        | private line automatic ringdown                          |
| PLCP        | Physical Layer Convergence Protocol                      |
| PLR         | point of local repair                                    |
| PLSP        | path LSP                                                 |
| PM          | performance monitoring                                   |
| PMSI        | P-multicast service interface                            |
| P-multicast | provider multicast                                       |
| PN          | packet number                                            |
| PoE         | power over Ethernet                                      |
| PoE+        | power over Ethernet plus                                 |
| POH         | path overhead                                            |
| POI         | purge originator identification                          |



| Acronym | Expansion                                                                               |
|---------|-----------------------------------------------------------------------------------------|
| PoP     | point of presence                                                                       |
| POS     | packet over SONET                                                                       |
| PPP     | point-to-point protocol                                                                 |
| PPPoE   | point-to-point protocol over Ethernet                                                   |
| PPS     | pulses per second                                                                       |
| PRC     | primary reference clock                                                                 |
| PRS     | primary reference source                                                                |
| PRTC    | primary reference time clock                                                            |
| PSE     | power sourcing equipment                                                                |
| PSK     | pre-shared key                                                                          |
| PSN     | packet switched network                                                                 |
| PSNP    | partial sequence number PDU                                                             |
| PTA     | PMSI tunnel attribute                                                                   |
| PTM     | packet transfer mode                                                                    |
| PTP     | performance transparency protocol<br>Precision Time Protocol                            |
| PuTTY   | an open-source terminal emulator, serial console, and network file transfer application |
| PVC     | permanent virtual circuit                                                               |
| PVCC    | permanent virtual channel connection                                                    |
| PW      | pseudowire                                                                              |
| PWE     | pseudowire emulation                                                                    |
| PWE3    | pseudowire emulation edge-to-edge                                                       |
| Q.922   | ITU-T Q-series Specification 922                                                        |
| QL      | quality level                                                                           |
| QoS     | quality of service                                                                      |
| QPSK    | quadrature phase shift keying                                                           |
| RADIUS  | Remote Authentication Dial In User Service                                              |

| Acronym | Expansion                                                             |
|---------|-----------------------------------------------------------------------|
| RAN     | radio access network                                                  |
| RBS     | robbed bit signaling                                                  |
| RD      | route distinguisher                                                   |
| RDI     | remote defect indication                                              |
| RED     | random early discard                                                  |
| RESV    | reservation                                                           |
| RIB     | routing information base                                              |
| RIP     | routing information protocol                                          |
| RJ45    | registered jack 45                                                    |
| RMON    | remote network monitoring                                             |
| RNC     | radio network controller                                              |
| RP      | rendezvous point                                                      |
| RPF RTM | reverse path forwarding RTM                                           |
| RPS     | radio protection switching                                            |
| RPT     | rendezvous-point tree                                                 |
| RR      | route reflector                                                       |
| RRO     | record route object                                                   |
| RS-232  | Recommended Standard 232 (also known as <a href="#">EIA/TIA-232</a> ) |
| RSA     | Rivest, Shamir, and Adleman (authors of the RSA encryption algorithm) |
| RSHG    | residential split horizon group                                       |
| RSTP    | rapid spanning tree protocol                                          |
| RSVP-TE | resource reservation protocol - traffic engineering                   |
| RT      | receive/transmit                                                      |
| RTC     | route target constraint                                               |
| RTM     | routing table manager                                                 |
| RTN     | battery return                                                        |
| RTP     | real-time protocol                                                    |

| Acronym | Expansion                                       |
|---------|-------------------------------------------------|
| R&TTE   | Radio and Telecommunications Terminal Equipment |
| RTU     | remote terminal unit                            |
| RU      | rack unit                                       |
| r-VPLS  | routed virtual private LAN service              |
| SA      | security association<br>source-active           |
| SAA     | service assurance agent                         |
| SAFI    | subsequent address family identifier            |
| SAK     | security association key                        |
| SAP     | service access point                            |
| SAToP   | structure-agnostic TDM over packet              |
| SCADA   | supervisory control and data acquisition        |
| SC-APS  | single-chassis automatic protection switching   |
| SCI     | secure channel identifier                       |
| SCP     | secure copy                                     |
| SCTP    | Stream Control Transmission Protocol            |
| SD      | signal degrade<br>space diversity               |
| SDH     | synchronous digital hierarchy                   |
| SDI     | serial data interface                           |
| SDN     | software defined network                        |
| SDP     | service destination point                       |
| SE      | shared explicit                                 |
| SeGW    | secure gateway                                  |
| SES     | severely errored seconds                        |
| SETS    | synchronous equipment timing source             |
| SF      | signal fail                                     |
| SFP     | small form-factor pluggable (transceiver)       |

| Acronym | Expansion                                       |
|---------|-------------------------------------------------|
| SFTP    | SSH file transfer protocol                      |
| (S,G)   | (source, group)                                 |
| SGT     | self-generated traffic                          |
| SHA-1   | secure hash algorithm                           |
| SHG     | split horizon group                             |
| SID     | Segment ID                                      |
| SIR     | sustained information rate                      |
| SL      | short length                                    |
| SLA     | service-level agreement                         |
| SLARP   | serial line address resolution protocol         |
| SLID    | subscriber location identifier of a GPON module |
| SLM     | synthetic loss measurement                      |
| SNMP    | Simple Network Management Protocol              |
| SNPA    | subnetwork point of attachment                  |
| SNR     | signal to noise ratio                           |
| SNTP    | simple network time protocol                    |
| SONET   | synchronous optical networking                  |
| S-PE    | switching provider edge router                  |
| SPF     | shortest path first                             |
| SPI     | security parameter index                        |
| S-PMSI  | selective PMSI                                  |
| SPT     | shortest path tree                              |
| SR      | Service Router (7750 SR)<br>segment routing     |
| SRGB    | segment routing global block                    |
| SRLG    | shared risk link group                          |
| SRP     | stateful request parameter                      |
| SRRP    | subscriber routed redundancy protocol           |

| Acronym | Expansion                                                     |
|---------|---------------------------------------------------------------|
| SR-ISIS | segment routing IS-IS                                         |
| SR-MPLS | segment routing with MPLS data plane                          |
| SR-OSPF | segment routing OSPF                                          |
| SR-TE   | segment routing traffic engineering                           |
| SSH     | secure shell                                                  |
| SSM     | source-specific multicast<br>synchronization status messaging |
| SSU     | system synchronization unit                                   |
| S-tag   | service VLAN tag                                              |
| STM     | synchronous transport module                                  |
| STM1    | synchronous transport module, level 1                         |
| STP     | spanning tree protocol                                        |
| STS     | synchronous transport signal                                  |
| SVC     | switched virtual circuit                                      |
| SVEC    | synchronization vector                                        |
| SYN     | synchronize                                                   |
| TACACS+ | Terminal Access Controller Access-Control System Plus         |
| TC      | traffic class (formerly known as <a href="#">EXP bits</a> )   |
| TCI     | tag control information                                       |
| TCP     | transmission control protocol                                 |
| TCP-AO  | TCP Authentication Option                                     |
| TDA     | transmit diversity antenna                                    |
| TDEV    | time deviation                                                |
| TDM     | time division multiplexing                                    |
| TE      | traffic engineering                                           |
| TEDB    | traffic engineering database                                  |
| TEID    | tunnel endpoint identifier                                    |
| TEP     | tunnel endpoint                                               |

| Acronym | Expansion                                       |
|---------|-------------------------------------------------|
| TFTP    | trivial file transfer protocol                  |
| T-LDP   | targeted LDP                                    |
| TLS     | transport layer security                        |
| TLV     | type length value                               |
| TM      | traffic management                              |
| ToD     | time of day                                     |
| ToS     | type of service                                 |
| T-PE    | terminating provider edge router                |
| TPID    | tag protocol identifier                         |
| TPIF    | IEEE C37.94 teleprotection interface            |
| TPMR    | two-port MAC relay                              |
| TPS     | transmission protection switching               |
| TSoP    | transparent SDH/SONET over packet               |
| TTL     | time to live                                    |
| TTLS    | tunneled transport layer security               |
| TTM     | tunnel table manager                            |
| TU      | tributary unit                                  |
| TUG     | tributary unit group                            |
| TWAMP   | two-way active measurement protocol             |
| U-APS   | unidirectional automatic protection switching   |
| UAS     | unavailable seconds                             |
| UBR     | unspecified bit rate                            |
| UDP     | user datagram protocol                          |
| UFD     | unidirectional forwarding detection             |
| UMH     | upstream multicast hop                          |
| UMTS    | Universal Mobile Telecommunications System (3G) |
| UNI     | user-to-network interface                       |

| Acronym | Expansion                                 |
|---------|-------------------------------------------|
| uRPF    | unicast reverse path forwarding           |
| V.11    | ITU-T V-series Recommendation 11          |
| V.24    | ITU-T V-series Recommendation 24          |
| V.35    | ITU-T V-series Recommendation 35          |
| VC      | virtual circuit                           |
| VCB     | voice conference bridge                   |
| VCC     | virtual channel connection                |
| VCCV    | virtual circuit connectivity verification |
| VCI     | virtual circuit identifier                |
| VID     | VLAN ID                                   |
| VLAN    | virtual LAN                               |
| VLL     | virtual leased line                       |
| VM      | virtual machine                           |
| VoIP    | voice over IP                             |
| Vp      | peak voltage                              |
| VP      | virtual path                              |
| VPC     | virtual path connection                   |
| VPI     | virtual path identifier                   |
| VPLS    | virtual private LAN service               |
| VPN     | virtual private network                   |
| VPRN    | virtual private routed network            |
| VPWS    | virtual private wire service              |
| VRF     | virtual routing and forwarding table      |
| VRRP    | virtual router redundancy protocol        |
| V-SAP   | virtual service access point              |
| VSE     | vendor-specific extension                 |
| VSI     | virtual switch instance                   |

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| Acronym | Expansion                                                                            |
|---------|--------------------------------------------------------------------------------------|
| VSO     | vendor-specific option                                                               |
| VT      | virtual trunk<br>virtual tributary                                                   |
| VTG     | virtual tributary group                                                              |
| Wavence | formerly 9500 MPR (Microwave Packet Radio)                                           |
| WCDMA   | wideband code division multiple access (transmission protocol used in UMTS networks) |
| WRED    | weighted random early discard                                                        |
| WTR     | wait to restore                                                                      |
| X.21    | ITU-T X-series Recommendation 21                                                     |
| XOR     | exclusive-OR                                                                         |
| XRO     | exclude route object                                                                 |



## 7 Supported standards and protocols

This chapter lists the 7705 SAR compliance with security and telecom standards, the protocols supported, and proprietary MIBs.

### 7.1 Security standards

FIPS 140-3—Federal Information Processing Standard publication 140-3, Security Requirements for Cryptographic Modules

### 7.2 Telecom standards

ANSI/TIA/EIA-232-C—Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

IEEE 802.1AB-2016—IEEE Standard for Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery

IEEE 802.1ad—IEEE Standard for Local and Metropolitan Area Networks—Virtual Bridged Local Area Networks

IEEE Std 802.1AE-2006 Media Access Control (MAC) Security

IEEE Std 802.1AEbw-2013—Media Access Control (MAC) Security Amendment 2: Extended Packet Numbering

IEEE 802.1ag—Service Layer OAM

IEEE 802.1p/q—VLAN Tagging

IEEE 802.1x-2010—IEEE Standard for Local and Metropolitan Area Networks—Port-based Network Access Control

IEEE 802.3—10BaseT

IEEE 802.3ab—1000BaseT

IEEE 802.3ah—Ethernet OAM

IEEE 802.3u—100BaseTX

IEEE 802.3x —Flow Control

IEEE 802.3z—1000BaseSX/LX

IEEE 802.3-2008—Revised base standard

IEEE 802.1AX-2008—Link Aggregation Task Force (transferred from IEEE 802.3ad)

IEEE C37.94-2017—N Times 64 Kilobit Per Second Optical Fiber Interfaces Between Teleprotection and Multiplexer Equipment

ITU-T G.704—Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels

ITU-T G.707—Network node interface for the Synchronous Digital Hierarchy (SDH)

ITU-T G.826—End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections

ITU-T G.8032 — Ethernet Ring Protection Switching

ITU-T G.984.1—Gigabit-capable passive optical networks (GPON): general characteristics

ITU-T Y.1564—Ethernet service activation test methodology

ITU-T Y.1731—OAM functions and mechanisms for Ethernet-based networks

## 7.3 Protocol support

### 7.3.1 ATM

AF-PHY-0086.001—Inverse Multiplexing for ATM (IMA)

af-tm-0121.000—Traffic Management Specification Version 4.1, March 1999

GR-1113-CORE—Bellcore, Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements, Issue 1, July 1994

GR-1248-CORE—Generic Requirements for Operations of ATM Network Elements (NEs). Issue 3 June 1996

ITU-T Recommendation I.432.1—B-ISDN user-network interface - Physical layer specification: General characteristics

ITU-T Recommendation I.610—B-ISDN Operation and Maintenance Principles and Functions version 11/95

RFC 2514—Definitions of Textual Conventions and OBJECT\_IDENTITIES for ATM Management, February 1999

RFC 2515—Definition of Managed Objects for ATM Management, February 1999

RFC 2684—Multiprotocol Encapsulation over ATM Adaptation Layer 5

### 7.3.2 BFD

RFC 7130—Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces

RFC 7881—Seamless Bidirectional Forwarding Detection (S-BFD) for IPv4, IPv6, and MPLS

draft-ietf-bfd-mib-00.txt—Bidirectional Forwarding Detection Management Information Base

draft-ietf-bfd-base-o5.txt—Bidirectional Forwarding Detection

draft-ietf-bfd-v4v6-1hop-06.txt—BFD IPv4 and IPv6 (Single Hop)

draft-ietf-bfd-multihop-06.txt—BFD for Multi-hop Paths

### 7.3.3 BGP

RFC 1397—BGP Default Route Advertisement  
RFC 1997—BGP Communities Attribute  
RFC 2385—Protection of BGP Sessions via the TCP MD5 Signature Option  
RFC 2439—BGP Route Flap Dampening  
RFC 2545—Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing  
RFC 2918—Route Refresh Capability for BGP-4  
RFC 3107—Carrying Label Information in BGP-4  
RFC 3392—Capabilities Advertisement with BGP-4  
RFC 4271—BGP-4 (previously RFC 1771)  
RFC 4360—BGP Extended Communities Attribute  
RFC 4364—BGP/MPLS IP Virtual Private Networks (VPNs) (previously RFC 2574bis BGP/MPLS VPNs)  
RFC 4456—BGP Route Reflection: Alternative to Full-mesh IBGP (previously RFC 1966 and RFC 2796)  
RFC 4486—Subcodes for BGP Cease Notification Message  
RFC 4684—Constrained Route Distribution for Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs)  
RFC 4724—Graceful Restart Mechanism for BGP - GR Helper  
RFC 4760—Multi-protocol Extensions for BGP (previously RFC 2858)  
RFC 4893—BGP Support for Four-octet AS Number Space  
RFC 4798—Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE)  
RFC 5549—Advertising IPv4 Network Layer Reachability Information with an IPv6 Next Hop  
RFC 5925—The TCP Authentication Option  
RFC 5926—Cryptographic Algorithms for the TCP Authentication Option (TCP-AO)  
RFC 6513—Multicast in MPLS/BGP IP VPNs  
RFC 6514—BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs  
RFC 7311—The Accumulated IGP Metric Attribute for BGP  
RFC 7606—Revised Error Handling for BGP UPDATE Messages  
draft-ietf-idr-add-paths-04.txt—Advertisement of Multiple Paths in BGP  
draft-ietf-idr-add-paths-guidelines-00.txt—Best Practices for Advertisement of Multiple Paths in BGP  
draft-weis-esp-group-counter-cipher-00.txt—Using Counter Modes with Encapsulating Security Payload (ESP) and Authentication Header (AH) to Protect Group Traffic

### 7.3.4 DHCP/DHCPv6

RFC 1534—Interoperation between DHCP and BOOTP  
RFC 2131—Dynamic Host Configuration Protocol (REV)

RFC 2132—DHCP Options and BOOTP Vendor Extensions  
RFC 3046—DHCP Relay Agent Information Option (Option 82)  
RFC 3315—Dynamic Host Configuration Protocol for IPv6  
RFC 3736—Stateless Dynamic Host Configuration Protocol (DHCP) Service for IPv6

### 7.3.5 Differentiated services

RFC 2474—Definition of the DS Field in the IPv4 and IPv6 Headers  
RFC 2597—Assured Forwarding PHB Group  
RFC 2598—An Expedited Forwarding PHB  
RFC 3140—Per-Hop Behavior Identification Codes

### 7.3.6 Digital data network management

V.35  
RS-232 (also known as EIA/TIA-232)  
X.21

### 7.3.7 ECMP

RFC 2992—Analysis of an Equal-Cost Multi-Path Algorithm

### 7.3.8 Ethernet VPN (EVPN)

RFC 7432—BGP MPLS-Based Ethernet VPN  
draft-ietf-bess-evpn-vpws—Virtual Private Wire Service support in Ethernet VPN  
draft-ietf-rabadan-bess-evpn-pref-pdf—Preference-based EVPN DF Election

### 7.3.9 Frame relay

ANSI T1.617 Annex D—Signalling Specification For Frame Relay Bearer Service  
ITU-T Q.922 Annex A—Digital Subscriber Signalling System No. 1 (DSS1) data link layer - ISDN data link layer specification for frame mode bearer services  
FRF.1.2—PVC User-to-Network Interface (UNI) Implementation Agreement  
RFC 2427—Multiprotocol Interconnect over Frame Relay

### 7.3.10 GRE

RFC 2784—Generic Routing Encapsulation (GRE)

### 7.3.11 Internet protocol (IP) – version 4

RFC 768—User Datagram Protocol  
RFC 791—Internet Protocol  
RFC 792—Internet Control Message Protocol  
RFC 793—Transmission Control Protocol  
RFC 826—Ethernet Address Resolution Protocol  
RFC 854—Telnet Protocol Specification  
RFC 1350—The TFTP Protocol (Rev. 2)  
RFC 1812—Requirements for IPv4 Routers  
RFC 3021—Using 31-Bit Prefixes on IPv4 Point-to-Point Links

### 7.3.12 Internet protocol (IP) – version 6

RFC 2460—Internet Protocol, Version 6 (IPv6) Specification  
RFC 2462—IPv6 Stateless Address Autoconfiguration  
RFC 2464—Transmission of IPv6 Packets over Ethernet Networks  
RFC 3587—IPv6 Global Unicast Address Format  
RFC 3595—Textual Conventions for IPv6 Flow Label  
RFC 4007—IPv6 Scoped Address Architecture  
RFC 4193—Unique Local IPv6 Unicast Addresses  
RFC 4291—IPv6 Addressing Architecture  
RFC 4443—Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 Specification  
RFC 4649—DHCPv6 Relay Agent Remote-ID Option  
RFC 4861—Neighbor Discovery for IP version 6 (IPv6)  
RFC 5095—Deprecation of Type 0 Routing Headers in IPv6  
RFC 5952—A Recommendation for IPv6 Address Text Representation

### 7.3.13 IPSec

ITU-T X.690 (2002)—ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)  
PKCS #12 Personal Information Exchange Syntax Standard  
RFC 2315—PKCS #7: Cryptographic Message Syntax  
RFC 2409—The Internet Key Exchange (IKE)  
RFC 2986—PKCS #10: Certification Request Syntax Specification  
RFC 3706—A Traffic-Based Method of Detecting Dead Internet Key Exchange (IKE) Peers

RFC 3947—Negotiation of NAT-Traversal in the IKE  
RFC 3948—UDP Encapsulation of IPsec ESP Packets  
RFC 4301—Security Architecture for the Internet Protocol  
RFC 4303—IP Encapsulating Security Payload (ESP)  
RFC 4210—Internet X.509 Public Key Infrastructure Certificate Management Protocol (CMP)  
RFC 4211—Internet X.509 Public Key Infrastructure Certificate Request Message Format (CRMF)  
RFC 4945—The Internet IP Security PKI Profile of IKEv1/ISAKMP, IKEv2, and PKIX  
RFC 5280—Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile  
RFC 5996—Internet Key Exchange Protocol Version 2 (IKEv2)  
RFC 7383—Internet Key Exchange Protocol Version 2 (IKEv2) Message Fragmentation

### 7.3.14 IS-IS

RFC 1142—OSI IS-IS Intra-domain Routing Protocol (ISO 10589)  
RFC 1195—Use of OSI IS-IS for routing in TCP/IP & dual environments  
RFC 2763—Dynamic Hostname Exchange for IS-IS  
RFC 2966—Domain-wide Prefix Distribution with Two-Level IS-IS  
RFC 2973—IS-IS Mesh Groups  
RFC 3373—Three-Way Handshake for Intermediate System to Intermediate System (IS-IS) Point-to-Point Adjacencies  
RFC 3567—Intermediate System to Intermediate System (IS-IS) Cryptographic Authentication  
RFC 3719—Recommendations for Interoperable Networks using IS-IS  
RFC 3784—Intermediate System to Intermediate System (IS-IS) Extensions for Traffic Engineering (TE)  
RFC 3787—Recommendations for Interoperable IP Networks  
RFC 4205 for Shared Risk Link Group (SRLG) TLV  
RFC 4971—Intermediate System to Intermediate System (IS-IS) Extensions for Advertising Router Information  
RFC 5120—M-ISIS: Multi Topology (MT) Routing in Intermediate System to Intermediate Systems (IS-ISs)  
RFC 5304—IS-IS Cryptographic Authentication  
RFC 5305—IS-IS Extensions for Traffic Engineering  
RFC 5307—IS-IS Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)  
RFC 5308—Routing IPv6 with IS-IS  
RFC 5309—Point-to-Point Operation over LAN in Link State Routing Protocols  
RFC 5310—IS-IS Generic Cryptographic Authentication  
RFC 6232—Purge Originator Identification TLV for IS-IS  
RFC 8570—IS-IS Traffic Engineering (TE) Metric Extensions

### 7.3.15 LDP

RFC 5036—LDP Specification

RFC 5283—LDP Extension for Inter-Area Label Switched Paths

RFC 5350—IANA Considerations for the IPv4 and IPv6 Router Alert Options

RFC 5443—LDP IGP Synchronization

RFC 5561—LDP Capabilities

RFC 5926—Cryptographic Algorithms for the TCP Authentication Option (TCP-AO)

RFC 6388—Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths

RFC 6512—Using Multipoint LDP When the Backbone Has No Route to the Root

RFC 6829—Label Switched Path (LSP) Ping for Pseudowire Forwarding Equivalence Classes (FECs) Advertised over IPv6

RFC 7552—Updates to LDP for IPv6

draft-ietf-mpls-ldp-ip-pw-capability—Controlling State Advertisements Of Non-negotiated LDP Applications

draft-ietf-mpls-oam-ipv6-rao—IPv6 Router Alert Option for MPLS OAM

draft-pdutta-mpls-ldp-adj-capability-00—LDP Adjacency Capabilities

draft-pdutta-mpls-ldp-v2-00—LDP Version 2

draft-pdutta-mpls-mldp-up-redundancy-00.txt—Upstream LSR Redundancy for Multi-point LDP Tunnels

draft-weis-esp-group-counter-cipher-00—Using Counter Modes with Encapsulating Security Payload (ESP) and Authentication Header (AH) to Protect Group Traffic

### 7.3.16 LDP and IP FRR

RFC 5286—Basic Specification for IP Fast Reroute: Loop-Free Alternates

RFC 7490—Remote Loop-Free Alternate (LFA) Fast Reroute (FRR)

### 7.3.17 MPLS

RFC 3031—MPLS Architecture

RFC 3032—MPLS Label Stack Encoding

RFC 3815—Definitions of Managed Objects for the Multiprotocol Label Switching (MPLS), Label Distribution Protocol (LDP)

RFC 5440—Path Computation Element (PCE) Communication Protocol (PCEP)

RFC 6790—The Use of Entropy Labels in MPLS Forwarding

RFC 8253—PCEPS: Usage of TLS to Provide a Secure Transport for the Path Computation Element Communication Protocol (PCEP)

RFC 8697—Path Computation Element Communication Protocol (PCEP) Extensions for Establishing Relationships between Sets of Label Switched Paths (LSPs)

RFC 8745—Path Computation Element Communication Protocol (PCEP) Extensions for Associating Working and Protection Label Switched Paths (LSPs) with Stateful PCE  
RFC 8800—Path Computation Element Communication Protocol (PCEP) Extension for Label Switched Path (LSP) Diversity Constraint Signaling  
draft-dhody-pce-pceps-tls13-02—Updates for PCEPS  
draft-ietf-pce-stateful-pce—PCEP Extensions for Stateful PCE  
draft-ietf-pce-segment-routing—PCEP Extensions for Segment Routing  
draft-alvarez-pce-path-profiles—PCE Path Profiles

### 7.3.18 MPLS – OAM

RFC 6424— Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels  
RFC 8029—Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures

### 7.3.19 Multicast

RFC 3956—Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address  
RFC 3973—Protocol Independent Multicast - Dense Mode (PIM-DM): Protocol Specification (Revised)  
RFC 4610—Anycast-RP Using Protocol Independent Multicast (PIM), which is similar to RFC 3446—Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)  
RFC 6514—BGP Encodings and Procedures for Multicast in MPLS/IP VPNs  
RFC 6826—Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths  
cisco-ipmulticast/pim-autorp-spec—Auto-RP: Automatic discovery of Group-to-RP mappings for IP multicast, which is similar to RFC 5059—Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM)  
draft-ietf-l2vpn-vpls-pim-snooping-07—Protocol Independent Multicast (PIM) over Virtual Private LAN Service (VPLS)  
draft-ietf-mboned-msdp-deploy-nn.txt—Multicast Source Discovery Protocol (MSDP) Deployment Scenarios

### 7.3.20 Network management

IANA-IFType-MIB  
ITU-T X.721—Information technology- OSI-Structure of Management Information  
ITU-T X.734—Information technology- OSI-Systems Management: Event Report Management Function  
M.3100/3120—Equipment and Connection Models  
RFC 1157—SNMPv1  
RFC 1850—OSPF-MIB



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RFC 1907—SNMPv2-MIB  
RFC 2011—IP-MIB  
RFC 2012—TCP-MIB  
RFC 2013—UDP-MIB  
RFC 2030—Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI  
RFC 2096—IP-FORWARD-MIB  
RFC 2138—RADIUS  
RFC 2206—RSVP-MIB  
RFC 2571—SNMP-FRAMEWORKMIB  
RFC 2572—SNMP-MPD-MIB  
RFC 2573—SNMP-TARGET-&-NOTIFICATION-MIB  
RFC 2574—SNMP-USER-BASED-SMMIB  
RFC 2575—SNMP-VIEW-BASED ACM-MIB  
RFC 2576—SNMP-COMMUNITY-MIB  
RFC 2588—SONET-MIB  
RFC 2665—EtherLike-MIB  
RFC 2819—RMON-MIB  
RFC 2863—IF-MIB  
RFC 2864—INVERTED-STACK-MIB  
RFC 3014—NOTIFICATION-LOG MIB  
RFC 3164—The BSD Syslog Protocol  
RFC 3273—HCRMON-MIB  
RFC 3411—An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks  
RFC 3412—Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)  
RFC 3413—Simple Network Management Protocol (SNMP) Applications  
RFC 3414—User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)  
RFC 3418—SNMP MIB  
RFC 3954—Cisco Systems NetFlow Services Export Version 9  
RFC 5101—Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information  
RFC 5102—Information Model for IP Flow Information Export  
draft-ietf-disman-alarm-mib-04.txt  
draft-ietf-mpls-ldp-mib-07.txt  
draft-ietf-ospf-mib-update-04.txt  
draft-ietf-mpls-lsr-mib-06.txt

draft-ietf-mpls-te-mib-04.txt

TMF 509/613—Network Connectivity Model

### 7.3.21 OSPF

RFC 1765—OSPF Database Overflow

RFC 2328—OSPF Version 2

RFC 2370—Opaque LSA Support

RFC 2740—OSPF for IPv6

RFC 3101—OSPF NSSA Option

RFC 3137—OSPF Stub Router Advertisement

RFC 3509—Alternative Implementations of OSPF Area Border Routers

RFC 3623—Graceful OSPF Restart (support for Helper mode)

RFC 3630—Traffic Engineering (TE) Extensions to OSPF

RFC 4203 for Shared Risk Link Group (SRLG) sub-TLV

RFC 4577—OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs) (support for basic OSPF at PE-CE links)

RFC 4915—Multi-Topology (MT) Routing in OSPF

RFC 4970—Extensions to OSPF for Advertising Optional Router Capabilities

RFC 5185—OSPF Multi-Area Adjacency

### 7.3.22 OSPFv3

RFC 4552—Authentication/Confidentiality for OSPFv3

### 7.3.23 PPP

RFC 1332—PPP Internet Protocol Control Protocol (IPCP)

RFC 1570—PPP LCP Extensions

RFC 1619—PPP over SONET/SDH

RFC 1661—The Point-to-Point Protocol (PPP)

RFC 1662—PPP in HDLC-like Framing

RFC 1989—PPP Link Quality Monitoring

RFC 1990—The PPP Multilink Protocol (MP)

RFC 2686—The Multi-Class Extension to Multi-Link PPP

### 7.3.24 Pseudowires

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RFC 3550—RTP: A Transport Protocol for Real-Time Applications

RFC 3985—Pseudo Wire Emulation Edge-to-Edge (PWE3) Architecture

RFC 4385—Pseudowire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN

RFC 4446—IANA Allocation for PWE3

RFC 4447—Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP)

RFC 4448—Encapsulation Methods for Transport of Ethernet over MPLS Networks

RFC 4553—Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP)

RFC 4717—Encapsulation Methods for Transport of Asynchronous Transfer Mode (ATM) over MPLS Networks

RFC 4618—Encapsulation Methods for Transport of PPP/High-Level Data Link Control (HDLC) over MPLS Networks

RFC 4619—Encapsulation Methods for Transport of Frame Relay over Multiprotocol Label Switching (MPLS) Networks

RFC 4816—Pseudowire Emulation Edge-to-Edge (PWE3) Asynchronous Transfer Mode (ATM) Transparent Cell Transport Service

RFC 5085—Pseudowire Virtual Circuit Connectivity Verification (VCCV): A Control Channel for Pseudowires

RFC 5086—Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)

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### 7.3.25 RIP

RFC 1058—Routing Information Protocol

RFC 2453—RIP Version 2

### 7.3.26 RADIUS

RFC 2865—Remote Authentication Dial In User Service

RFC 2866—RADIUS Accounting

RFC 6613—RADIUS over TCP

RFC 6614—Transport Layer Security (TLS) Encryption for RADIUS

### 7.3.27 RSVP-TE and FRR

RFC 2430—A Provider Architecture for DiffServ & TE

RFC 2702—Requirements for Traffic Engineering over MPLS  
RFC 2747—RSVP Cryptographic Authentication  
RFC 2961—RSVP Refresh Overhead Reduction Extensions  
RFC 3097—RSVP Cryptographic Authentication - Updated Message Type Value  
RFC 3209—Extensions to RSVP for LSP Tunnels  
RFC 3210—Applicability Statement for Extensions to RSVP for LSP Tunnels  
RFC 3477—Signalling Unnumbered Links in Resource ReSerVation Protocol - Traffic Engineering (RSVP-TE)  
RFC 4090—Fast Reroute Extensions to RSVP-TE for LSP Tunnels

### 7.3.28 Segment routing (SR)

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draft-gredler-idr-bgp-ls-segment-routing-ext-03—BGP Link-State extensions for Segment Routing  
draft-ietf-isis-segment-routing-extensions-04—IS-IS Extensions for Segment Routing  
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draft-ietf-ospf-segment-routing-extensions-04—OSPF Extensions for Segment Routing  
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ITU-T Recommendation G.841—Telecommunication Standardization Section of ITU, Types and Characteristics of SDH Networks Protection Architecture, issued in October 1998 and as augmented by Corrigendum1 issued in July 2002

### 7.3.30 SSH

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draft-ietf-secsh-architecture.txt—SSH Protocol Architecture  
draft-ietf-secsh-userauth.txt—SSH Authentication Protocol  
draft-ietf-secsh-connection.txt—SSH Connection Protocol  
draft-ietf-secsh-newmodes.txt—SSH Transport Layer Encryption Modes  
draft-ietf-secsh-filexfer-13.txt—SSH File Transfer Protocol

### 7.3.31 Synchronization

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G.813—Timing characteristics of SDH equipment slave clocks (SEC)

G.823—The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy, 2003/03/16

G.824—The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy, 2003/03/16

G.8261—Timing and synchronization aspects in packet networks

G.8262—Timing characteristics of synchronous Ethernet equipment slave clock

GR 1244 CORE—Clocks for the Synchronized Network: Common Generic Criteria

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IEEE Std 1588-2008—IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems

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ITU-T G.8275.1—Telecommunication Standardization Section of ITU, Precision time protocol telecom profile for phase/time synchronization with full timing support from the network, issued 07/2014

ITU-T G.8275.2—Telecommunication Standardization Section of ITU, Precision time protocol telecom profile for time/phase synchronization with partial timing support from the network, issued 06/2016

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RFC 8573—Message Authentication Code for the Network Time Protocol

### 7.3.32 TACACS+

IETF draft-grant-tacacs-02.txt—The TACACS+ Protocol

### 7.3.33 TLS

RFC 5246—The Transport Layer Security (TLS) Protocol Version 1.2

RFC 5425—Transport Layer Security (TLS) Transport Mapping for Syslog

RFC 5922—Domain Certificates in the Session Initiation Protocol (SIP)

RFC 6460—Suite B Profile for Transport Layer Security (TLS)

RFC 8446—The Transport Layer Security (TLS) Protocol Version 1.3

### 7.3.34 TWAMP

RFC 5357—A Two-Way Active Measurement Protocol (TWAMP)

RFC 8762—Simple Two-Way Active Measurement Protocol

RFC 8972—Simple Two-Way Active Measurement Protocol Optional Extensions

### 7.3.35 VPLS

RFC 4762—Virtual Private LAN Services Using LDP

### 7.3.36 VRRP

RFC 2787—Definitions of Managed Objects for the Virtual Router Redundancy Protocol

RFC 3768 Virtual Router Redundancy Protocol

RFC 5798 Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6

## 7.4 Proprietary MIBs

TIMETRA-ATM-MIB.mib

TIMETRA-CAPABILITY-7705-V1.mib

TIMETRA-CHASSIS-MIB.mib

TIMETRA-CLEAR-MIB.mib

TIMETRA-FILTER-MIB.mib

TIMETRA-GLOBAL-MIB.mib

TIMETRA-LAG-MIB.mib

TIMETRA-LDP-MIB.mib

TIMETRA-LOG-MIB.mib

TIMETRA-MPLS-MIB.mib

TIMETRA-OAM-TEST-MIB.mib

TIMETRA-PORT-MIB.mib

TIMETRA-PPP-MIB.mib

TIMETRA-QOS-MIB.mib

TIMETRA-ROUTE-POLICY-MIB.mib

TIMETRA-RSVP-MIB.mib

TIMETRA-SAP-MIB.mib

TIMETRA-SDP-MIB.mib

TIMETRA-SECURITY-MIB.mib

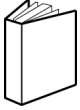
TIMETRA-SERV-MIB.mib

TIMETRA-SYSTEM-MIB.mib

TIMETRA-TC-MIB.mib

TIMETRA-VRRP-MIB.mib

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