7750 SR OS OAM and Diagnostics Guide

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Preface

About This Guide

This guide describes service mirroring and Operations, Administration and Management (OAM) and diagnostic tools provided by the 7750 SR OS 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.

Audience

This manual is intended for network administrators who are responsible for configuring the 7750 SR routers. It is assumed that the network administrators have an understanding of networking principles and configurations. Protocols, standards, and services described in this manual include the following:

- CLI concepts
- Subscriber services
- Service mirroring
- Operation, Administration and Maintenance (OAM) operations

List of Technical Publications

The 7750 SR documentation set is composed of the following books:

- 7750 SR OS Basic System Configuration Guide

  This guide describes basic system configurations and operations.
- 7750 SR OS System Management Guide

  This guide describes system security and access configurations as well as event logging and accounting logs.

- 7750 SR OS Interface Configuration Guide

  This guide describes card, Media Dependent Adapter (MDA), and port provisioning.

- 7750 SR OS Router Configuration Guide

  This guide describes logical IP routing interfaces and associated attributes such as an IP address, port, link aggregation group (LAG) as well as IP and MAC-based filtering, VRRP, and Cflowd.

- 7750 SR OS Routing Protocols Guide

  This guide provides an overview of routing concepts and provides configuration examples for RIP, OSPF, IS-IS, Multicast, BGP, and route policies.

- 7750 SR OS MPLS Guide

  This guide describes how to configure Multiprotocol Label Switching (MPLS) and Label Distribution Protocol (LDP).

- 7750 SR OS Services Guide

  This guide describes how to configure service parameters such as service distribution points (SDPs), customer information, and user services.

- 7750 SR OS OAM and Diagnostic Guide

  This guide describes how to configure features such as service mirroring and Operations, Administration and Management (OAM) tools.

- 7750 SR OS Triple Play Guide

  This guide describes Triple Play services and support provided by the 7750 SR and presents examples to configure and implement various protocols and services.

- 7750 SR Quality of Service Guide

  This guide describes how to configure Quality of Service (QoS) policy management.

- 7750 SR-Series OS Integrated Services Adapter Guide
  This guide describes Triple Play and subscriber management services and how these are linked to Application Assurance.
  Note that this guide explains details and discusses Application Assurance functionality. The Triple Play Guide contains only information on how subscribers are associated with Application Assurance.

Technical Support

If you purchased a service agreement for your 7750 SR 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 an Alcatel-Lucent service agreement, contact your welcome center.

Web: http://www1.alcatel-lucent.com/comps/pages/carrier_support.jhtml

Getting Started

In This Chapter

This book provides process flow information to configure service mirroring and Operations, Administration and Management (OAM) tools.

Alcatel-Lucent 7750 SR-Series Services Configuration Process

Table 1 lists the tasks necessary to configure mirroring, lawful intercept, and perform tools monitoring functions.
This guide is presented in an overall logical configuration flow. Each section describes a software area and provides CLI syntax and command usage to configure parameters for a functional area.

Table 1: Configuration Process

Area	Task	Chapter
Diagnostics/ Service verification	Mirroring	Mirror Services on page 13
	Lawful Intercept	Lawful Intercept on page 26
	OAM	OAM and SAA on page 107
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support on page 267

Mirror Services

In This Chapter

This chapter provides information to configure mirroring.

Topics in this chapter include:

Service Mirroring

When troubleshooting complex operational problems, customer packets can 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 and/or routers. These, at best, are only able to mirror from one port to another on the same device.

Alcatel-Lucent's Service Mirroring extends and integrates these capabilities into the network and provides significant operational benefits. Each 7750 SR can mirror packets from a specific service to any destination point in the network, regardless of interface type or speed.

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

Alcatel-Lucent's 7750 SR routers support service-based mirroring. While some Layer 3 switches and routers can mirror on a per-port basis within the device, Alcatel-Lucent 7750 SR routers can mirror on an n-to-1 unidirectional service basis and re-encapsulate the mirrored data for transport through the core network to another location, using either IP or MPLS tunneling as required (Figure 1).

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

The mirrored frame size that is to be transmitted to the mirror destination can be explicitly configured by using slicing features. This enables mirroring only the parts needed for analysis. 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.

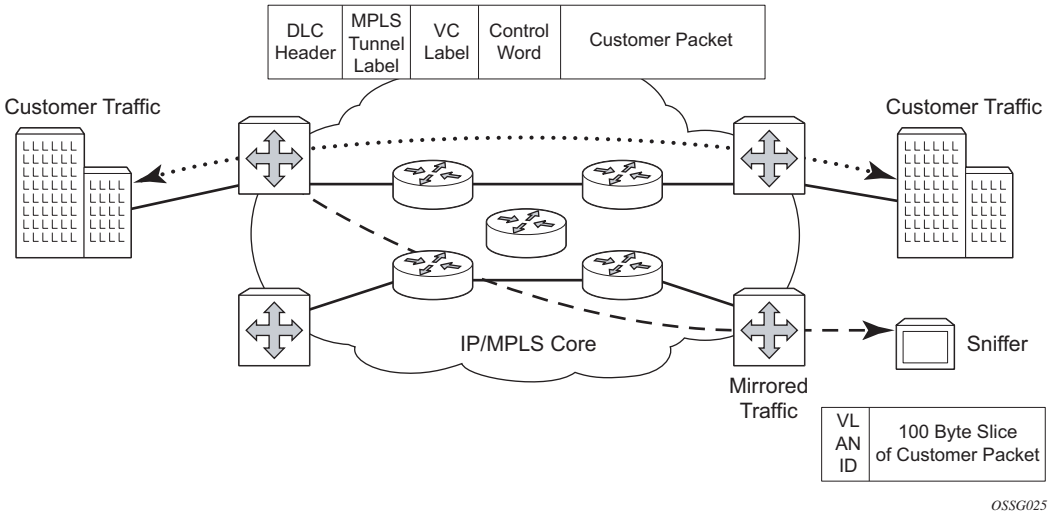


Figure 1: Service Mirroring

Mirror Implementation

Mirroring can be implemented on ingress or egress service access points (SAPs) or ingress and egress network interfaces. The Flexible Fast Path processing complexes preserve the ingress packet throughout the forwarding and mirroring process, making incremental packet changes on a separate copy.

Alcatel-Lucent's implementation of packet mirroring is based on two 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 Flexible Fast Path network processor array (NPA) 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 NPA performs normal packet handling on the egress packet, encapsulating it for the destination interface. A copy of the forwarded packet (as seen on the wire) is forwarded to the mirror destination.
- Mirroring must support 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.

Mirror Source and Destinations

Mirror sources and destinations have the following characteristics:

- They can be on the same 7750 SR 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 decode 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 another or the same port (the ports can be on separate nodes).
- A total of 255 mirror destinations are supported (local and/or remote), per chassis.

Local and Remote Mirroring

Mirrored frames can be copied and sent to a specific local destination or service on the 7750 SR router (local mirroring) or copies can be encapsulated and sent to a different 7750 SR router (remote mirroring). This functionality allows network operators to centralize not only network analyzer (sniffer) resources, but also the technical staff who operate them.

The 7750 SR allows multiple concurrent mirroring sessions so traffic from more than one ingress mirror source can be mirrored to the same or different egress mirror destinations.

Remote mirroring uses a service distribution path (SDP) which acts as a logical way of directing traffic from one 7750 SR-Series router to another through a uni-directional (one-way) service tunnel. The SDP terminates at the far-end 7750 SR which directs packets to the correct destination on that device.

The SDP configuration from the mirrored device to a far-end 7750 SR requires a return path SDP from the far-end 7750 SR 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.

Slicing

A further service mirroring refinement is “slicing” which copies a specified packet size of each frame. This is useful to monitor network usage without having to copy the actual data. Slicing enables mirroring larger frames than the destination packet decode equipment can handle. It also allows conservation of mirroring resources by limiting the size of the stream of packet through the 7750 SR 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, most likely, will grow larger as encapsulations are added when packets are transmitted through the network core or out the mirror destination SAP to the packet/protocol decode equipment. Note that slice-size is not supported by CEM encap-types or IP-mirroring.

The transmission of a sliced or non-sliced frame is also dependent on 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.

Mirroring Performance

Replication of mirrored packets can, typically, affect performance and should be used carefully. Alcatel-Lucent 7750 SR routers minimize the impact of mirroring on performance by taking advantage of its distributed Flexible Fast Path technology. Flexible Fast Path 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. The mirroring architecture also supports mirror rate limiting both at the ingress and egress Flexible Fast Path NPA. This rate limiting is accomplished though a shaping queue and is set according to the maximum amount of mirroring desired.

Mirroring can be performed based on the following criteria:

- Port
- SAP
- MAC filter
- IP filter
- Ingress label
- Subscriber

Mirroring Configuration

Configuring mirroring is similar to creating a uni-direction service. Mirroring requires the configuration of:

- Mirror source — The traffic on a specific point(s) to mirror.
- Mirror destination — The location to send the mirrored traffic, where the sniffer will be located.

Figure 2 depicts a local mirror service configured on ALA-A.

- Port 2/1/2 is specified as the source. Mirrored traffic ingressing and egressing this port will be sent to port 2/1/3.
- SAP 2/1/3 is specified as the destination. The sniffer is physically connected to this port. Mirrored traffic ingressing and egressing port 2/1/2 is sent here. SAP, encapsulation requirements, packet slicing, and mirror classification parameters are configured. SDPs are not used in local mirroring.

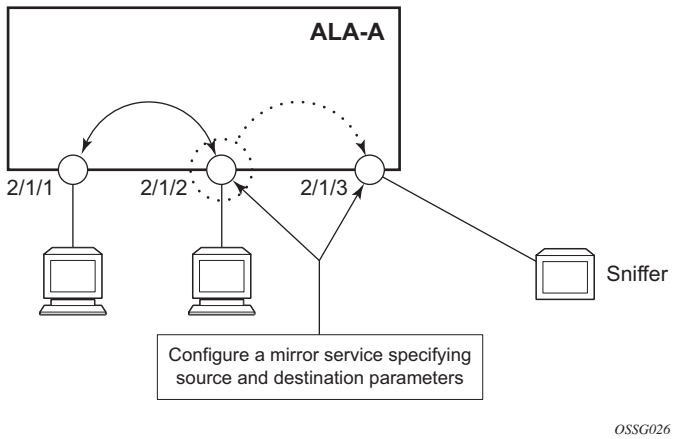


Figure 2: Local Mirroring Example

Figure 3 depicts a remote mirror service configured as ALA B as the mirror source and ALA A as the mirror destination. Mirrored traffic ingressing and egressing port 5/2/1 (the source) on ALA B is handled the following ways:

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

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

  ALA A decodes the service ID and sends the traffic out of port 3/1/3.
  The sniffer is physically connected to this port (3/1/3). SAP, encapsulation requirements, packet slicing, and mirror classification parameters are configured in the destination parameters.

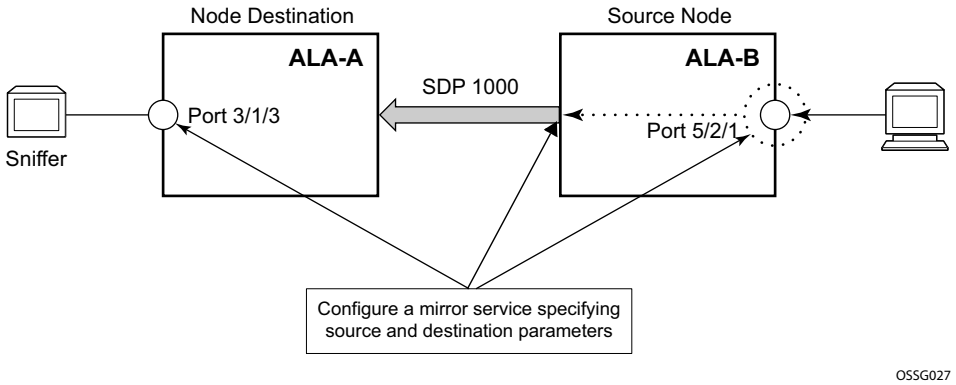


Figure 3: Remote Mirroring Example

ATM Mirroring

ATM mirror functionality allows 7750 SR users to mirror AAL5 packets from a source ATM SAP to a destination ATM SAP connected locally or remotely. This functionality can be used to monitor the ATM traffic on a particular ATM SAP. In both the local and remote scenarios the source and destination SAPs must be of ATM SAP type.

All ingress and egress AAL5 traffic at the source ATM SAP is duplicated and sent toward the destination ATM SAP. Mirroring the ingress traffic only, egress traffic only, or both, can be configured. ATM OAM traffic is not mirrored toward the destination ATM SAP.

IP filters used as a mirror source are supported on ATM SAPs based on the IP filter applicability for different services.

ATM mirroring is applicable to the following services using an ATM SAP:

- Layer 3: IES and VPRN
- Layer 2: Apipe (sdu-type only), Ipipe, EPipe, VPLS

ATM mirroring on an ATM SAP extends the service mirroring feature to include mirror sources with SAP type of ATM. Mirroring is supported on the following services:

- IES
- VPRN
- VPLS
- Epipe
- Ipipe
- Apipe VLL service with the AAL5 SDU mode (atm-sdu spoke-sdp type)

Characteristics include:

- Supported only ATM MDAs and on the Any Service Any Port (ASAP) MDA.
- Mirror destinations for ATM mirroring must be ATM SAPs and cannot be part of an APS group, an IMA bundle, or an IMA Bundle Protection Group (BPGRP).
- A mirror source can be an ATM SAP component of an IMA bundle but cannot be part of an IMA BPGRP.
- ATM SAPs of an Apipe service with N:1 cell mode (atm-vcc, atm-vpc, and atm-cell spoke-sdp types) cannot be ATM mirror sources.

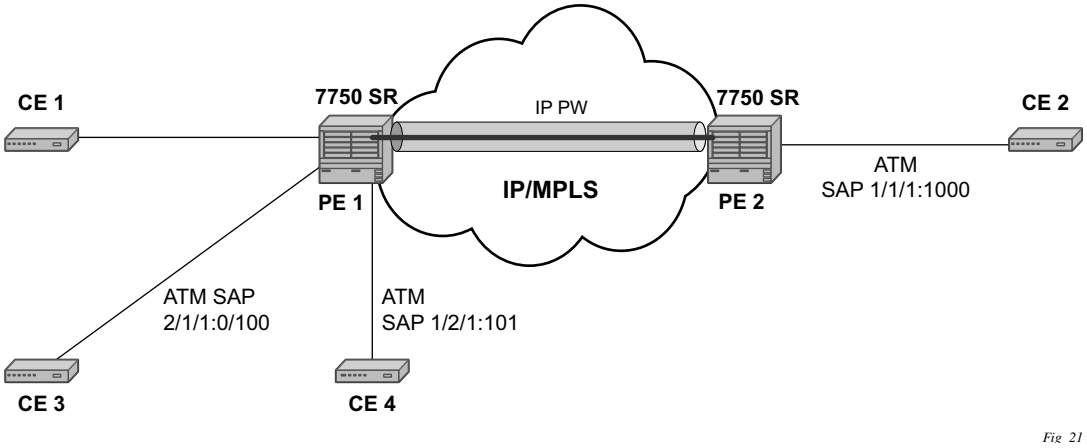


Figure 4: Example of an ATM Mirror Service

In Figure 4, CE 3 is connected to PE1 on ATM SAP 2/1/1/:0/100 as part of an IES service. The traffic on ATM SAP 2/1/1/:0/100 is mirrored locally to CE4 device through ATM SAP 1/2/1:1/101. In this scenario, all AAL5 packets arriving at SAP 2/1/1/:0/100 are duplicated and send towards ATM SAP 1/2/1:1/101.

In the case where the destination ATM SAP is on a remote node PE2, then the AAL5 traffic arriving at ATM SAP 2/1/1/:0/100 is duplicated and sent across the IP/MPLS network to PE2. At PE2 the traffic is forwarded to ATM SAP 1/1/1:0/1000 towards the ATM traffic monitoring device.

IP Mirroring

The IP mirroring capability allows a mirror to be created with a parameter that specifies that only the IP packet is mirrored without the original ATM/FR/POS/Ethernet DLC header. This results in the mirrored IP packet becoming media agnostic on the mirror service egress.

This option is configurable on SAP mirrors for IES, VPRN and VPLS services, Ipipe services, and subscriber mirrors. It is not supported on VLL services such as Apipe, Epipe, Fpipe, and on ports.

Remote IP Mirroring

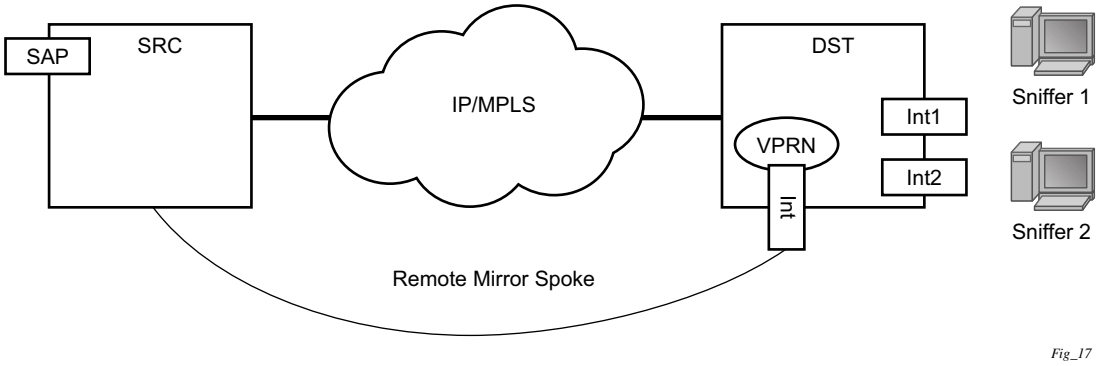


Figure 5: Remote IP Mirroring

With remote IP mirroring, the mirror destination configuration can allow IP packets to be mirrored from a source router (Figure 5). The packets will be delivered to the destination in a spoke-terminated interface created in a VPRN service. IES interfaces are not supported. The interface can be configured with policy-based routing filters to allow sniffer selection based on incoming mirrored destination IP addresses. The interface cannot send traffic out as it is a destination only feature. Packets arriving at the interface will be routed based on the routing information within the VPRN. Policy-based routing should always be used unless only a sniffer is connected to the VPRN.

Local IP Mirroring

Local mirroring is similar to remote mirroring but the source and destination of the mirror exist in the same Local IP mirroring node. The configuration must include the source address and destination MAC addresses for the packets going to the sniffer. The destination SAP must be Ethernet.

Port-ID Enabled PPP Mirroring

Operators that use mirroring for statistics collection make use of VLANs or DLCIs for customer separation. Since PPP offers no such separation, the maximum number of PPP circuits may be identified (one per destination). This feature provides a proprietary mechanism to allow a single mirror to be used.

Port-ID enabled PPP mirroring includes the system's port ID in the mirrored packet. An operator using this flag in a PPP mirror will be able to identify the end customer circuit by finding the system's port ID (which is optionally made persistent) and correlating it to the port-id in the mirrored packet.

This mirroring does not change the priority of the mirror order (port/sap/sub/filter). Lawful intercept mirrors can use the flag and their priority is also maintained.

Since the inclusion of the port ID flag is placed on the mirror destination, all mirrored packets of all sources will include the port ID. For remote mirroring, the mirror destination service at the source node must be configured with this flag.

Note the following restrictions:

- This flag can only be used with a PPP mirror destination.
- This flag is mutually exclusive with a remote-source.
- This flag cannot be enabled on a an IP mirror type.

Subscriber Mirroring

This section describes mirroring based on a subscriber match. Enhanced subscriber management provides the mechanism to associate subscriber hosts with queuing and filtering resources in a shared SAP environment. Mirroring used in subscriber aggregation networks for lawful intercept and debugging is required. With this feature, the mirroring capability allows the match criteria to include a subscriber-id.

Subscriber mirroring provides the ability to create a mirror source with subscriber information as match criteria. Specific subscriber packets can be mirrored mirror when using ESM with a shared SAP without prior knowledge of their IP or MAC addresses and without concern that they may change. The subscriber mirroring decision is more specific than a SAP. If a SAP (or port) is placed in a mirror and a subscriber host of which a mirror was configured is mirrored on that SAP packets matching the subscriber host will be mirrored to the subscriber mirror destination.

The mirroring configuration can be limited to specific forwarding classes used by the subscriber. When a forwarding class (FC) map is placed on the mirror only packets that match the specified FCs are mirrored. A subscriber can be referenced in maximum 2 different mirror-destinations: 1 for ingress and 1 for egress.

Lawful Intercept

Lawful Intercept (LI) describes a process to intercept telecommunications by which law enforcement authorities can un-obtrusively monitor voice and data communications to combat crime and terrorism with higher security standards of lawful intercept capabilities in accordance with local law and after following due process and receiving proper authorization from competent authorities. The interception capabilities are sought by various telecommunications providers.

As lawful interception is subject to national regulation, requirements vary from one country to another. Alcatel-Lucent's implementation satisfies most national standard's requirements. LI capability is configurable for all Alcatel-Lucent service types.

LI mirroring is configured by an operator that has LI permission. LI mirroring is hidden from anyone who does not have the right permission.

Configuration Process Overview

Figure 6 displays the process to provision basic mirroring parameters.

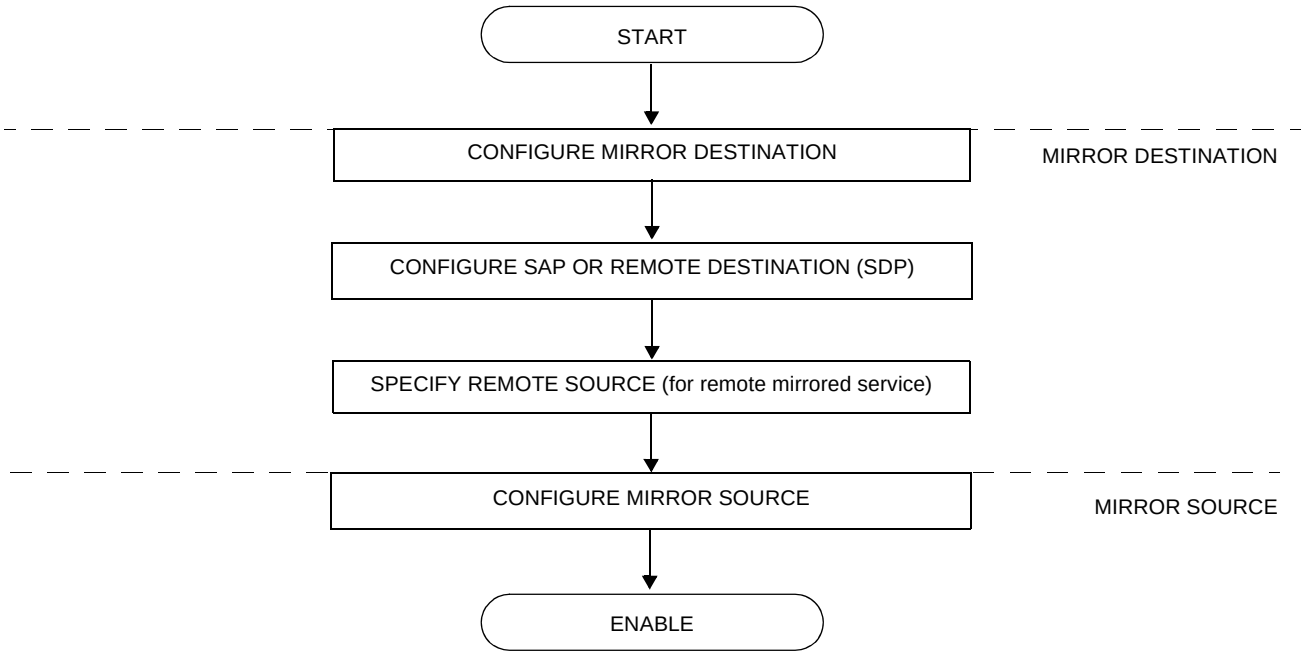


Figure 6: Mirror Configuration and Implementation Flow

Figure 7 displays the process to provision lawful intercept parameters.

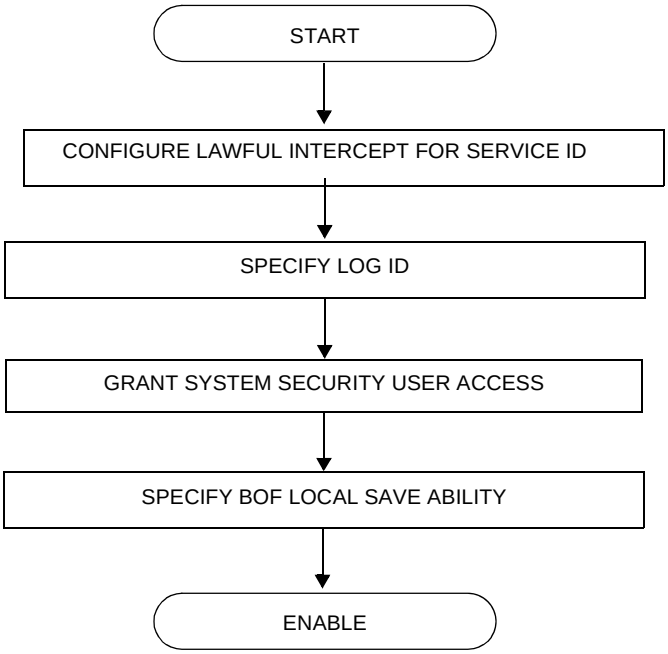


Figure 7: Lawful Intercept Configuration and Implementation Flow

Configuration Notes

This section describes mirroring configuration caveats.

- Up to 255 mirroring service IDs 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 (re)boots and are included in the configuration saves.

  The source packet mirroring enabling criteria defined in debug mirror mirror-source commands are not preserved in configuration saves.
- Physical layer problems such as collisions, jabbers, etc., are not mirrored. Typically, only complete packets are mirrored. Complete stats are available on the interface for these physical layer problems.
- Starting and shutting down mirroring:

  Mirror destinations:

  → The default state for a mirror destination service ID is `shutdown`. You must issue a `no shutdown` command to enable the feature.

  → When a mirror destination service ID is shutdown, mirrored packets associated with the service ID are not accepted from its mirror source or remote source 7750 SR router. 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.

  Mirror sources:

  → The default state for a mirror source for a given mirror-dest 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 shutdown to remove them from the system. When a mirror source is shutdown, mirroring is terminated for all sources defined locally for the mirror destination service ID.

The following are lawful intercept configuration caveats.

Network management — Operators without LI permission cannot view or manage the LI data on the node nor can they view or manage the data on the Network Management platform.

LI mirroring does not allow the configuration of ports and ingress labels as a source parameter.

Configuring Service Mirroring with CLI

This section provides information about service mirroring

Topics in this section include:

Mirror Configuration Overview

7750 SR mirroring can be organized in the following logical entities:

- The *mirror source* is defined as the location where ingress or egress traffic specific to a port, SAP, MAC or IP filter, ingress label or a subscriber 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 where the mirrored packets are sent.
- The subscriber contains hosts which are added to a mirroring service.

Defining Mirrored Traffic

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

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

- Source IP address/mask
- Destination IP address/mask
- IP Protocol value
- Source port value/range (for example, UDP or TCP port)
- Destination port value/range (for example, UDP or TCP port)
- DiffServ Code Point (DSCP) value
- IP fragments
- IP option value/mask
- Single or multiple IP option fields present
- IP option fields present
- TCP ACK set/reset
- TCP SYN set/reset
- ICMP code
- ICMP type

- SAP ingress/egress labels

The MAC criteria can be combinations of:

- IEEE 802.1p value/mask
- Source MAC address/mask
- Destination MAC address/mask
- Ethernet Type II Ethernet type value
- Ethernet 802.2 LLC DSAP value/mask
- Ethernet 802.2 LLC SSAP value/mask
- IEEE 802.3 LLC SNAP Ethernet Frame OUI zero/non-zero value
- IEEE 802.3 LLC SNAP Ethernet Frame PID value
- SAP ingress/egress labels

Lawful Intercept Configuration Overview

Lawful Intercept allows the user to access and execute commands at various command levels based on profiles assigned to the user by the administrator. LI must be configured in the **config>system>security>user>access** and **config>system>security>profile** contexts. The options include FTP, SNMP, console, and LI access.

LI parameters configured in the BOF context (**li-local-save** and **li-separate**) include the ability to access LI separately than the normal administrator. As with all BOF entities, changing the BOF file during normal system operation only results in the parameter being set for the next reboot. These BOF commands are initialized to the default values, **no li-separate** and **no-li-local-save**. A system boot is necessary for any change to the **li-separate** and **li-local-save** to become effective.

Changes to the li-separate and li-local-save configurations should be made in both primary and backup CM BOF files.

At regular intervals, a LI status event is generated by the system to indicate the mode of the LI administration, time of the last reboot, and whether local save is enabled.

Saving LI Data

Depending on location and law enforcement preferences, the node can be configured to save all LI data on local media. If the operator saves this data then when starting/restarting the system the configuration file will be processed first then the LI configuration will be restarted.

When permitted to save the data, the data is encrypted and the encryption key is unique per system and is not visible to any administrator.

To save LI data locally, the option must be configured in the **bof>li-local-save** context. Enabling this option will only be applied after a system reboot.

If an LI save is permitted, then only a local save is permitted and, by default, it will be saved to Compact Flash 3 with the filename of "*li.cfg*". An explicit save command under the **config>li** context must be executed to save the LI. An LI administrator with privileges to configure LI, can execute the *li.cfg* file.

Regulating LI Access

Depending on local regulations pertaining to Lawful Intercept (LI) a node can be configured to separate normal system administration tasks from tasks of a Lawful Intercept operator.

If the separation of access is not required and any administrator can manage lawful intercept or plain mirroring, then it is not necessary to configured the **li-separate** parameter in the BOF configuration. However, to ensure logical separation, the following must occur:

- An **administrator** must create a user and configure the user as LI capable (**config>system> security>user>access** context). Furthermore, the **administrator** must assure that both CLI and SNMP access permission is granted for the LI operator.
- Finally, before turning the system into two separate administration domains, the CLI user must be granted a profile that limits the LI operator to those tasks relevant to the job (**config>system> security>profile>li** context).

It is important to remember that the LI operator is the only entity who can grant LI permission to any other user once in **li-separate** mode.

Provided the above procedure is followed, the LI administrator must decide whether to allow the LI (source) configuration to be saved onto local media. This is also subject to local regulations.

At this point, the BOF file can be configured with the **li-separate** and **li-local-save** parameters. If the local save is not configured then the LI information must be reconfigured after a system reboot.

Assuming **li-separate** is configured, the node should be rebooted to activate the **separate** mode. At this point the system administrators without LI permission cannot modify, create or view any LI- specific configurations. In order for this to occur, the BOF file must be reconfigured and the system rebooted. This, combined with other features prohibits an unauthorized operator from modifying the administrative separation without notifying the LI administrator.

The following displays an SNMP example showing views, access groups, and attempts parameters.

```
A:ALA-23>config>system>security>snmp# info detail
----------------------------------------------
                view iso subtree 1
                    mask ff type included
                exit
                view no-security subtree 1
                    mask ff type included
                exit
                view no-security subtree 1.3.6.1.6.3
                    mask ff type excluded
                exit
                view no-security subtree 1.3.6.1.6.3.10.2.1
                    mask ff type included
                exit
                view no-security subtree 1.3.6.1.6.3.11.2.1
```

```
                    mask ff type included
                exit
                view no-security subtree 1.3.6.1.6.3.15.1.1
                    mask ff type included
                exit
...
              access group "snmp-li-ro" security-model usm security-level <security level>
context "li" read "li-view" notify "iso"
              access group "snmp-li-rw" security-model usm security-level <security level>
context "li" read "li-view" write "li-view" notify "iso"
                attempts 20 time 5 lockout 10
...
-----------------------------------------------
A:ALA-23>config>system>security>snmp#
```

The following displays a user account configuration example.

```
A:ALA-23>config>system>security# info
-----------------------------------------------
...
    user "liuser"
        access console snmp li
        console
            no member "default"
            member "liprofile"
        exit
        snmp
            authentication md5 <auth-key> privacy des <priv-key>
            group "snmp-li-rw"
        exit
   exit
...
-----------------------------------------------
A:ALA-23>config>system>security#
```

LI User Access

By default, LI user access is limited to those commands that are required to manage LI functionality. If a user is granted permission to access other configuration and operational data, then this must be explicitly configured in the user profile of the LI operator in the **config>system>security>profile>entry>match** *command-string* context. Figure 8 depicts a flow as to set an LI operator.

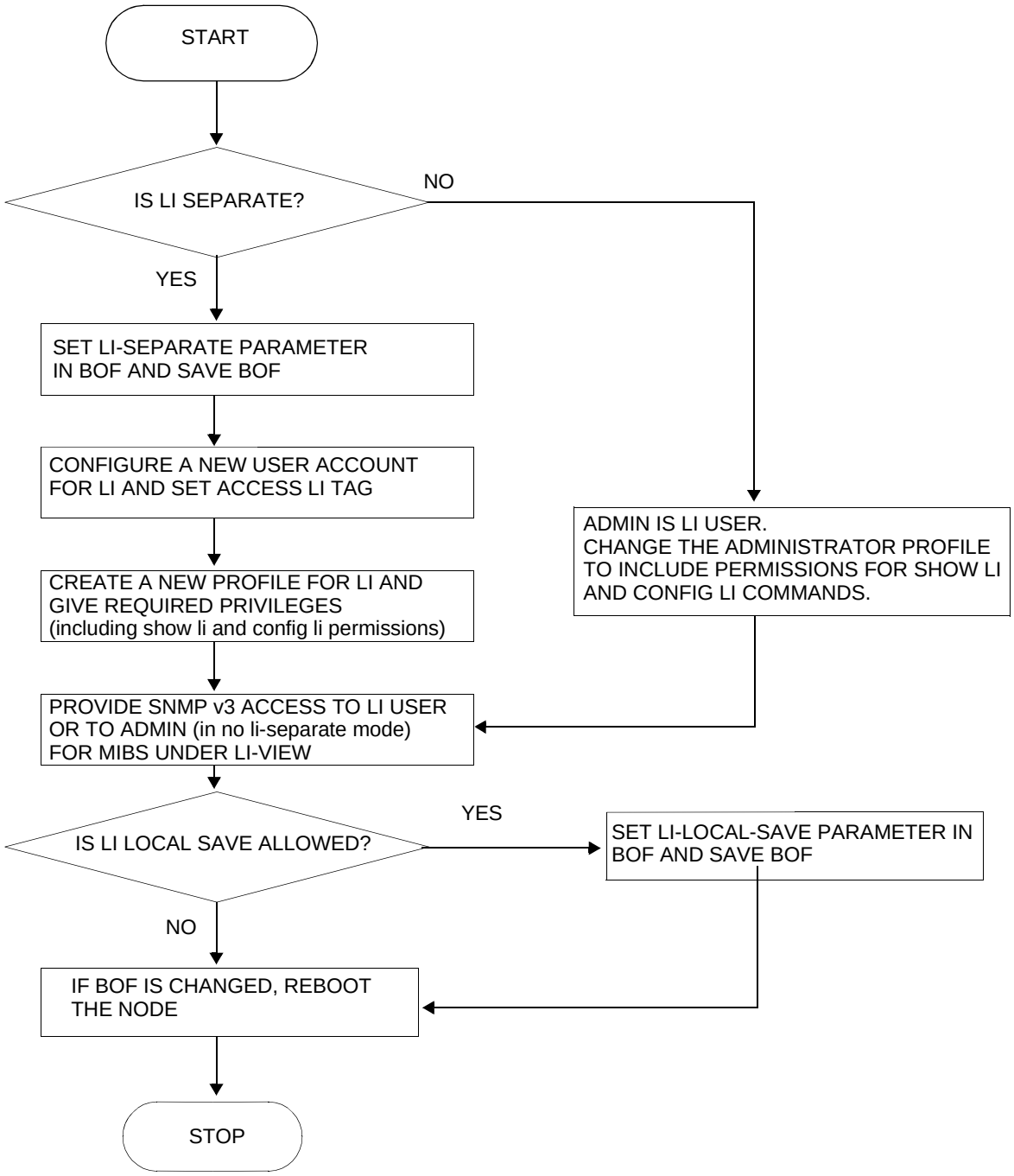


Figure 8: Creating an LI Operator Account

LI Source Configuration

Filter configuration is accessible to both the LI operator and regular system administrators. If the content of a filter list that is subject to an LI operation and if a filter (included in the filter list) is used by an LI operator, its contents cannot be modified. If an attempt is made, then an LI event is generated. Only one mirror source can be attached to one mirror destination service. LI takes priority over debug mirror sources, So if a debug mirror source (for example, 10) exists and an LI mirror source is created with same ID 10, then the debug mirror source is silently discarded.

In the configuration, when an LI operator specifies that a given entry must be used as an LI entry then this fact is hidden from all non-LI operators. Modification of a filter entry is not allowed if it is used by LI. However, an event is generated, directed to the LI operator, indicating that the filter has been compromised.

Standard mirroring (non-LI) has a lower priority than LI instantiated mirroring. If a mirror source parameter (for example, SAP 1/1/1) exists and the same parameter is created in an LI source, the parameter is silently deleted from the debug mirror source.
The following order applies for both ingress and egress traffic:

- Port mirroring (debug only)
- SAP mirroring (debug or LI)
- Subscriber mirroring (debug or LI)
- Filter mirroring (debug or LI)

For frames from network ports:

- Port mirroring (debug only)
- Label mirroring (debug only, ingress only)
- Filter mirroring (debug or LI)

Filters can be created by all users that have access to the relevant CLI branches.

Once an LI mirror source using a given service ID is created and is in the **no shutdown** state, the corresponding mirror destination on the node cannot be modified (including **shutdown**/**no shutdown** commands) or deleted.

In the **separate** mode, the anonymity of the source is protected. Once source criterion is attached to the LI source, the following applies:

- In SAP configurations, only modifications that stop the flow of LI data while the customer receives data is blocked.
- In filter configurations, if a filter entry is attached to the LI source, modification and deletion of both the filter and the filter entry are blocked.

LI Logging

A logging collector is supported in addition to existing main, security, change, and debug log collectors. LI log features include the following:

- Only visible to LI operators (such as show command output)
- Encrypted when transmitted (SNMPv3)
- Logging ability can only be created, modified, or deleted by an LI operator
- The LI user profile must include the ability to manage the LI functions

Basic Mirroring Configuration

Destination mirroring parameters must include at least:

- A mirror destination ID (same as the mirror source service ID).
- A mirror destination SAP *or* SDP.

Mirror source parameters must include at least:

- A mirror service ID (same as the mirror destination service ID).
- At least one source type (port, SAP, ingress label, IP filter or MAC filter) specified.

The following example displays a sample configuration of a local mirrored service where the source and destinations are on the same device (ALA-A).

```
*A:ALA-A>config>mirror# info
----------------------------------------------
        mirror-dest 103 create
            sap 2/1/25:0 create
                egress
                    qos 1
                exit
            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-A>config>mirror#
```

The following displays the mirror source configuration:

```
*A:ALA-A>debug>mirror-source# show debug mirror
debug
    mirror-source 103
        port 2/1/24 egress ingress
        no shutdown
    exit
exit
*A:ALA-A>debug>mirror-source# exit
```

The following example displays a sample configuration of a remote mirrored service where the source is a port on ALA-A and the destination a SAP is on ALA-B.

```
*A:ALA-A>config>mirror# info
----------------------------------------------
        mirror-dest 1000 create
            sdp 2 egr-svc-label 7000
            no shutdown
        exit
----------------------------------------------
*A:ALA-A>config>mirror# exit all
*A:ALA-A# show debug
debug
    mirror-source 1000
        port 2/1/2 egress ingress
        no shutdown
    exit
exit
*A:ALA-A#
```

```
*A:ALA-B>config>mirror# info
----------------------------------------------
        mirror-dest 1000 create
            remote-source
                far-end 10.10.10.104 ing-svc-label 7000
            exit
            sap 3/1/2:0 create
                egress
                    qos 1
                exit
            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-B>config>mirror#
```

Mirror Classification Rules

Alcatel-Lucent's implementation of mirroring can be performed by configuring parameters to select network traffic according to any combination of the following entities:

- Port
- SAP
- MAC filter
- IP filter
- Ingress label
- Subscriber

Port

The `port` command associates a port to a mirror source. The port is identified by the `port-id`. The following displays the port-id syntax:

port-id: slot/mda/port[.channel]
aps-*id* **aps**-*group-id*[.*channel*]
aps keyword
group-id 1 — 64

bundle-*type-slot/mda.bundle-num*
bundle keyword
type ima
bundle-num 1 — 128

ccag-*id* - **ccag**-*id.path-id*[*cc-type*]:*cc-id*
ccag keyword
id 1 — 8
path-id a, b
cc-type .sap-net, .net-sap
cc-id 0 — 4094
lag-id 1 — 64
egress keyword
ingress keyword

The defined port can be Ethernet or Frame Relay port, a SONET/SDH path, a multilink bundle, a TDM channel, a Cross Connect Aggregation Group (CCAG), or a Link Aggregation Group (LAG) ID. If the port is a SONET/SDH or TDM channel, the channel ID must be specified to identify which channel is being mirrored. When a LAG ID is given as the port ID, mirroring is enabled on all ports making up the LAG. Ports that are ATM, circuit-emulation (CEM), and PPP bundle groups cannot be used in a mirror source.

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

Table 2: Mirror Source Port Requirements

Port Type	Port Mode	Port Encap Type
faste/gige/xgige	access	dot1q, null, qinq
faste/gige/xgige	network	dot1q, null
SONET (clear/deep channel)	access	bcp-null, bcp-dot1q, ipcp
TDM (clear/deep channel)	access	bcp-null, bcp-dot1q, ipcp

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

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

SAP

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

CLI Syntax: `debug>mirror-source# sap `*`sap-id`*` {[egress] [ingress]}`

Example: `*A:ALA-A>debug>mirror-source# sap 2/1/4:100 ingress egress`

or `debug>mirror-source# port 2/2/1.sts12 ingress`

MAC filter

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

CLI Syntax: `debug>mirror-source# mac-filter` *`mac-filter-id`* `entry` *`entry-id`* `[`*`entry-id`* `…]`

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

IP filter

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

Ingress mirrored packets are mirrored to the mirror destination prior to any ingress packet modifications. Egress mirrored packets are mirrored to the mirror destination after all egress packet modifications.

CLI Syntax: `debug>mirror-source# ip-filter` *`ip-filter-id`* `entry` *`entry-id`* `[`*`entry-id`* `…]`

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

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

Ingress label

The `ingress-label` command is used to mirror ingressing MPLS frames with the specified MPLS labels. The ingress label must be at the top of the label stack and can only be mirrored to a single mirror destination. If the same label is defined with multiple mirror destinations, an error is generated and the original mirror destination does not change. `Ingress-label` allows packets matching the ingress label to be duplicated (mirrored) and forwarded to the mirror destination. The ingress label has to be active before it can be used as mirror source criteria. If the ingress label is not used in the router, the mirror source will remove the ingress label automatically.

CLI Syntax: `debug>mirror-source# ingress-label` *`label`* `[`*`label`*`...]`

Example: `*A:ALA-A>debug>mirror-source# ingress-label 103000 1048575`

Subscriber

The subscriber command is used to add hosts of a subscriber to a mirroring service.

CLI Syntax: `debug>mirror-source# subscriber` *`sub-ident-string`* `[sap...]`

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. Note that local and remote *mirror source* and *mirror destination* components must be configured under the same service ID context.

Each local mirrored service (Figure 9) (within the same router) requires the following configurations:

1. Specify *mirror destination* (SAP).
2. Specify *mirror source* (port, SAP, IP filter, MAC filter, ingress label, subscriber).

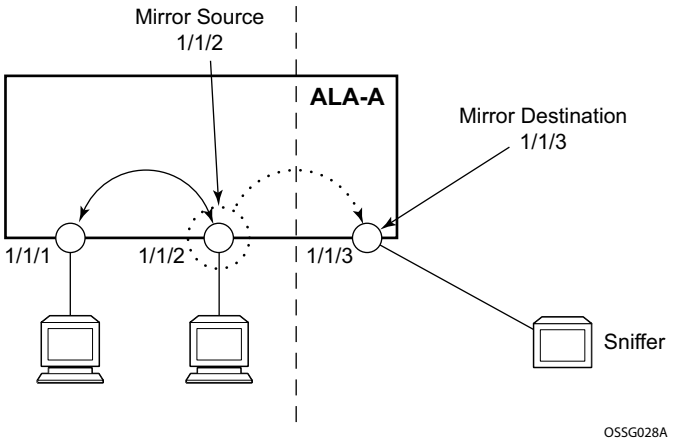


Figure 9: Local Mirrored Service Tasks

Each remote mirrored service (Figure 10) (across the network core) requires the following configurations:

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 mirror source (port, SAP, IP filter, MAC filter, ingress label, subscriber)

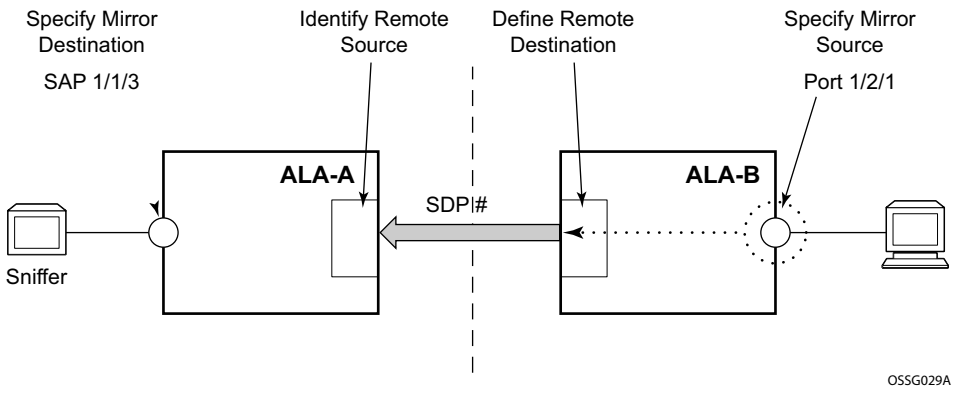


Figure 10: Remote Mirrored Service Configuration Example

Configuring a Local Mirror Service

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

The **mirror-source** commands are used as traffic selection criteria to identify traffic to be mirrored at the source. Each of these criteria are independent. For example, use the **debug>mirror-source>port** {*port-id* | **lag** *lag-id*} {[**egress**] [**ingress**]} command and **debug>mirror-source ip-filter** *ip-filter-id* **entry** *entry-id* [*entry-id*…] command to capture (mirror) traffic that matches a specific IP filter entry and traffic ingressing and egressing a specific port. A filter must be applied to the SAP or interface if only specific packets are to be mirrored. Note that slice-size is not supported by CEM encap-types or IP-mirroring.

Use the CLI syntax to configure one or more mirror source parameters:

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

CLI Syntax:
```
config>mirror
 mirror-dest service-id [type {ether|frame-relay|ppp|ip-on-
 ly|atm-sdu|satop-e1|satop-t1|cesopsn|cesopsn-cas}]
    description string
    fc fc-name
    sap sap-id
    slice-size bytes
    no shutdown
```

CLI Syntax:
```
debug# mirror-source service-id
 ip-filter ip-filter-id entry entry-id [entry-id …]
 ingress-label label [label …]
 mac-filter mac-filter-id entry entry-id [entry-id …]
 port {port-id|lag lag-id} {[egress][ingress]}
 sap sap-id {[egress][ingress]}
 subscriber sub-ident-string [sap sap-id [ip ip-address] [mac
 ieee-address]|sla-profile sla-profile-name] [fc {[be] [l2]
 [af] [l1] [h2] [ef] [h1] [nc]}] {[ingress] [egress]}
 no shutdown
```

CLI Syntax:
```
config>li
 li-source service-id
    ip-filter ip-filter-id entry entry-id [entry-id …]
    mac-filter mac-filter-id entry entry-id [entry-id …]
    sap sap-id {[ingress] [egress]}
    subscriber sub-ident-string [sap sap-id [ip ip-address]
          [mac ieee-address]|sla-profile sla-profile-name]
```

```
                    [fc {[be] [l2] [af] [l1] [h2] [ef] [h1] [nc]}] {[in-
                    gress] [egress]}
                no shutdown
```

The following output displays an example of a local mirrored service. On ALA-A, mirror service 103 is mirroring traffic matching IP filter 2, entry 1 as well as egress and ingress traffic on port 2/1/24 and sending the mirrored packets to SAP 2/1/25.

```
*A:ALA-A>config>mirror# info
----------------------------------------------
        mirror-dest 103 create
            sap 2/1/25:0 create
                egress
                    qos 1
                exit
            exit
            no shutdown
        exit
----------------------------------------------
*A:ALA-A>config>mirror#
```

The following displays the debug mirroring information:

```
*A:ALA-A>debug>mirror-source# show debug mirror
debug
    mirror-source 103
        no shutdown
        port 2/1/24 egress ingress
        ip-filter 2 entry 1
    exit
exit
*A:ALA-A>debug>mirror-source# exit
```

Configuring SDPs

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, refer to the *Subscriber Services* chapter.

Consider the following SDP characteristics:

- Configure either GRE or MPLS SDPs.
- Each distributed service must have an SDP defined for every remote SR 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 to 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.
- The SDP IP address must be a 7750 SR system IP address.
- In order 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.
1. Select an encapsulation type.
2. Select the far-end node.

To configure the return path SDP, perform the same steps on the far-end 7750 SR router.

1. Select an originating node.
2. Create an SDP ID.
3. Select an encapsulation type.
4. Select the far-end node.

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. When you configure a distributed Epipe SAP, you must identify an SDP ID. 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 [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 displays SDP configurations on both the mirror-source and mirror-destination routers.

```
*A:ALA-A>config>service# info
----------------------------------------
        sdp 1 create
            description "to-10.10.10.104"
            far-end 10.10.10.104
            no shutdown
        exit
----------------------------------------
*A:ALA-A>config>service#

*A:ALA-B>config>service# info
----------------------------------------------
        sdp 4 create
            description "to-10.10.10.103"
            far-end 10.10.10.103
            no shutdown
        exit
----------------------------------------
*A:ALA-B>config>service#
```

Configuring a Remote Mirror Service

For remote mirroring, the source and destination are configured on the different routers. Note that mirror source and mirror destination parameters 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. For example, use the `port` *port-id*`[.`*channel-id*`] {[egress] [ingress]}` and `mac-filter` *mac-filter-id* `entry` *entry-id* `[`*entry-id* `…]` commands.

Use the CLI syntax to configure one or more *mirror source* parameters:

CLI Syntax:
```
debug> mirror-source service-id
 ip-filter ip-filter-id entry entry-id [entry-id …]
 ingress-label label [label …]
 mac-filter mac-filter-id entry entry-id [entry-id …]
 port {port-id|lag lag-id} {[egress][ingress]}
 sap sap-id {[egress][ingress]}
 sdp sap-id:[vc-id] {[egress] [ingress]}
 subscriber sub-ident-string [sap sap-id [ip ip-address] [mac
 ieee-address]|sla-profile sla-profile-name] [fc {[be] [l2]
 [af] [l1] [h2] [ef] [h1] [nc]}] {[ingress] [egress]}
 no shutdown
```

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

CLI Syntax:
```
config>mirror#
 mirror-dest service-id [type {ether|frame-relay|ppp|ip-on-
 ly|atm-sdu|satop-e1|satop-t1|cesopsn|cesopsn-cas}]
    description string
    fc fc-name
    remote-source
       far-end ip-addr ing-svc-label ing-svc-label
    sap sap-id
    sdp sdp-id[:vc-id][egr-svc-label [label|tldp]
    no shutdown
    slice-size bytes
```

CLI Syntax:
```
config>li
 li-source service-id
    ip-filter ip-filter-id entry entry-id [entry-id …]
    mac-filter mac-filter-id entry entry-id [entry-id …]
    port {port-id|lag lag-id} {[egress][ingress]}
```

```
subscriber sub-ident-string [sap sap-id [ip ip-address]
      [mac ieee-address]|sla-profile sla-profile-name]
      [fc {[be] [l2] [af] [l1] [h2] [ef] [h1] [nc]}] {[in-
      gress] [egress]}
no shutdown
```

The following displays the *mirror destination*, which is on ALA-A, configuration for mirror service 1216. This configuration specifies that the mirrored traffic coming from the *mirror source* (10.10.0.91) is to be directed to SAP 4/1/58 and states that the service only accepts traffic from far end 10.10.0.92 (ALA-B) with an ingress service label of 5678. When a forwarding class is specified, then all mirrored packets transmitted to the destination SAP or SDP override the default (be) forwarding class. The slice size limits the size of the stream of packet through the 7750 SR and the core network.

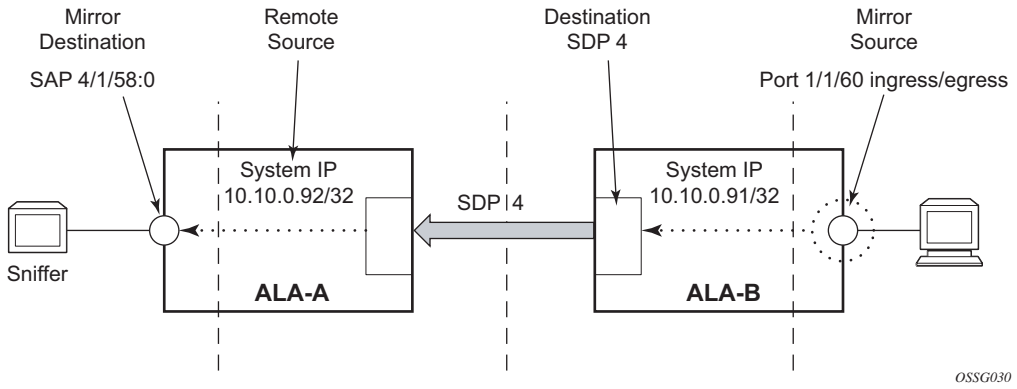


Figure 11: Remote Mirrored Service Tasks

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

The following displays the mirror destination configuration for mirror service 1216 on ALA-A.

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

The following displays the remote mirror destination configured on ALA-B:

```
*A:ALA-B>config>mirror# info
----------------------------------------------
        mirror-dest 1216 create
            description "Sending mirrored traffic to .92"
            fc h1
            sdp 4 egr-svc-label 5678
            slice-size 128
            no shutdown
        exit
----------------------------------------------
*A:ALA-B>config>mirror#
```

The following displays the mirror source configuration for ALA-B:

```
*A:ALA-B# show debug mirror
debug
    mirror-source 1216
        port 1/1/60 egress ingress
        no shutdown
    exit
exit
*A:ALA-B#
```

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

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


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

Configuring an ATM Mirror Service

Configure a local ATM mirror service at PE1:

Example:
```
config>mirror# mirror-dest 1 type atm-sdu create
    config>mirror>mirror-dest# sap 1/2/1:1/101 create
    config>mirror>mirror-dest>sap# no shutdown
    config>mirror>mirror-dest>sap# exit all
    # debug
    debug# mirror-source 1
    debug>mirror-source# sap 2/1/1/:0/100 ingress
```

Configure a remote ATM mirror service at PE1:

Example:
```
config>mirror# mirror-dest 1 type atm-sdu create
    config>mirror>mirror-dest# sdp 1:20
    config>mirror>mirror-dest# exit all
    # debug

    debug# mirror-source 1
    debug>mirror-source# sap 2/1/1/:0/100 ingress
```

Configure a remote ATM mirror service at PE2:

Example:
```
config>mirror# mirror-dest 1 type atm-sdu create
    config>mirror>mirror-dest# remote-source
    config>mirror>mirror-dest>remote-source# far-end 10.10.10.10
    config>mirror>mirror-dest>remote-source# exit
    config>mirror>mirror-dest# sap 1/2/1:1/101 create
```

Configuring Lawful Intercept Parameters

The following display LI source configuration and LI log configuration examples.

```
A:ALA-48>config# info
#------------------------------------------------
...
(LI  Source Config)
        li-source 1
            sap 1/5/5:1001 egress ingress
            no shutdown
        exit
        li-source 2
            subscriber "test" sla-profile "test" fc l2 ingress egress
            no shutdown
        exit
        li-source 3
            mac-filter 10 entry 1
            no shutdown
        exit
        li-source 4
            ip-filter 11 entry 1
            no shutdown
        exit
...
(LI Log Config)
        log-id 1
                filter 1
                from li
                to session
            exit
            log-id 11
                from li
                to memory
            exit
            log-id 12
                from li
                to snmp
            exit
...
#------------------------------------------------
A:ALA-48>config#
```

Service Management Tasks

This section discusses the following service management tasks:

Use the following command syntax to modify an existing mirrored service:

CLI Syntax:
```
config>mirror#
 mirror-dest service-id [type {ether|frame-relay|ppp|ip-on-
 ly|atm-sdu|satop-e1|satop-t1|cesopsn|cesopsn-cas}]
    description description-string
    no description
    fc fc-name
    no fc
    remote-source
       far-end ip-address [ing-svc-label ing-svc-label|tldp]
       no far-end ip-address
    sap sap-id
    no sap
    sdp sdp-name [egr-svc-label egr-svc-label|tldp]
    no sdp
    [no] shutdown
```

CLI Syntax:
```
debug
[no] mirror-source service-id
    ip-filter ip-filter-id entry entry-id [entry-id]
    no ip-filter ip-filter-id
    no ip-filter v entry entry-id [entry-id]
    ingress-label label [label]
    no ingress-label
    no ingress-label label [label]
    mac-filter mac-filter-id entry entry-id [entry-id]
    no mac-filter mac-filter-id
    no mac-filter mac-filter-id entry entry-id [entry-id]
    [no] port {port-id|lag lag-id} {[egress][ingress]}
    [no] sap sap-id {[egress] [ingress]}
    [no] shutdown
```

CLI Syntax:
```
config>li
 li-source service-id
    ip-filter ip-filter-id entry entry-id [entry-id …]
    mac-filter mac-filter-id entry entry-id [entry-id …]
    sap sap-id {[ingress] [egress]}
```

```
subscriber sub-ident-string [sap sap-id [ip ip-address]
      [mac ieee-address]|sla-profile sla-profile-name]
      [fc {[be] [l2] [af] [l1] [h2] [ef] [h1] [nc]}] {[in-
      gress] [egress]}
no shutdown
```

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 displays 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 3/1/5:0 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

      debug# mirror-dest 103
      debug>mirror-source# no port 2/1/24 ingress egress
      debug>mirror-source# port 3/1/7 ingress egress
```

The following displays the local mirrored service modifications:

```
*A:ALA-A>config>mirror# info
----------------------------------------------
mirror-dest 103 create
            no shutdown
            fc be
            remote-source
            exit
            sap 3/1/5:0 create
                egress
                    qos 1
                exit
            exit
            slice-size 128
        exit

*A:ALA-A>debug>mirror-source# show debug mirror
debug
    mirror-source 103
        no shutdown
        port 3/1/7 egress ingress
    exit
*A:ALA-A>debug>mirror-source#
```

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 displays commands to delete a local mirrored service.

Example:ALA-A>
```
config>mirror# mirror-dest 103
      config>mirror>mirror-dest# shutdown
      config>mirror>mirror-dest# exit
      config>mirror# no mirror-dest 7
      config>mirror# exit
```

Modifying a Remote Mirrored Service

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

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

The following example displays commands to modify parameters for a remote mirrored service.

Example:

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

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

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

       SR3>#  debug
       debug# mirror-source 104
       debug>mirror-source# port 5/1/2 ingress egress
       debug>mirror-source# no shutdown

*A:ALA-A>config>mirror# info
----------------------------------------------
       mirror-dest 104 create
            remote-source
                far-end 10.10.10.3 ing-svc-label 3500
            exit
            sap 2/1/15:0 create
                egress
                    qos 1
                exit
            exit
            no shutdown
       exit

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

```
        exit
-----------------------------------------------
SR3>config>mirror#

SR3# show debug mirror
debug
    mirror-source 104
        no shutdown
        port 5/1/2 egress ingress
    exit
exit
SR3#
```

Deleting a Remote Mirrored Service

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

Mirror destinations must be shut down first before they can be deleted.

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

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

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

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

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


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

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

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

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

Mirror Service Command Reference

Command Hierarchies

Mirror Configuration Commands

```
config
    — mirror
        — mirror-dest service-id [type encap-type]
        — no mirror-dest service-id
            — description string
            — no description
            — [no] enable-port-id
            — fc fc-name
            — no fc
            — [no] remote-source
                — far-end ip-address [ing-svc-label ing-vc-label | tldp]
                — no far-end ip-address
            — sap sap-id
            — no sap
                — cem
                    — packet jitter-buffer milliseconds [payload-size bytes ]
                    — packet payload-size bytes
                    — no packet
                    — [no] rtp-header
                — egress
                    — ip-mirror
                        — sa-mac ieee-address da-mac ieee-address
                        — no sa-mac
                    — qos policy-id
                    — no qos
            — sdp sdp-id[:vc-id] [egr-svc-label label | tldp]
            — no sdp
            — slice-size bytes
            — no slice-size
            — [no] shutdown
```

Debug Commands

debug

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

— **ingress-label** *label* [*label* …up to 8 max]

— **no ingress-label** [*label* [*label* …up to 8 max]]

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

— **no ip-filter** *ip-filter-id* [**entry** *entry-id*] [*entry-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* {[**egress**] [**ingress**]}

— **no sap** *sap-id* [**egress**] [**ingress**]

— **subscriber** *sub-ident-string* [**sap** *sap-id* [**ip** *ip-address*] [**mac** *ieee-address*] |**sla-profile** *sla-profile-name*] [**fc** {[**be**] [**l2**] [**af**] [**l1**] [**h2**] [**ef**] [**h1**] [**nc**]}] {[**ingress**] [**egress**]}

— **no subscriber** *sub-ident-string*

— [**no**] **shutdown**

Lawful Intercept Commands

```
config
    — li
        — li-source service-id
            — ip-filter ip-filter-id entry entry-id [entry-id...]
            — no ip-filter ip-filter-id [entry entry-id...]
            — mac-filter mac-filter-id entry entry-id [entry-id...]
            — no mac-filter mac-filter-id [entry entry-id...]
            — sap sap-id {[ingress] [egress]}
            — no sap sap-id [ingress] [egress]
            — [no] shutdown
            — subscriber sub-ident-string [sap sap-id [ip ip-address] [mac ieee-address] |sla-profile sla-profile-name] [fc {[be] [l2] [af] [l1] [h2] [ef] [h1] [nc]}] {[ingress] [egress]}
            — no subscriber sub-ident-string
        — log
            — [no] log-id log-id
                — description description-string
                — no description
                — filter filter-id
                — no filter
                — from {[li]}
                — no from
                — [no] shutdown
                — time-format {local | utc}
                — to memory [size]
                — to session
                — to snmp [size]
        — save
```

The following commands are also described in the 7750 SR OS Basic System Configuration Guide.

```
config
    — bof
        — [no] li-local-save
        — [no] li-separate
```

The following commands are also described in the 7750 SR OS System Management Configuration Guide.

```
config
    — system
        — security
            — user
                — [no] access [ftp] [snmp] [console] [li]
            — [no] profile user-profile-name
```

Show Commands

show
- **debug** [*application*]
- **mirror mirror-dest** [*service-id*]
- **li**
  - **li-source** [*service-id*]
  - **log**
    - **log-id** [*log-id*] [**severity** *severity-level*] [**application** *application*] [**sequence** *from-seq* [*to-seq*]] [**count** *count*] [**router** *router-instance* [**expression**]] [**subject** *subject* [**regexp**]] [**ascending** | **descending**]
  - **status**
- **service**
  - **active-subscribers summary**
  - **active-subscribers** [**subscriber** *sub-ident-string* [**sap** *sap-id* **sla-profile** *sla-profile-name*]] [**detail**|**mirror**]
  - **active-subscribers hierarchy** [**subscriber** *sub-ident-string*]
  - **service-using mirror**

Configuration Commands

Generic Commands

description

Syntax **description** *string*
no description

Context config>mirror>mirror-dest
config>li>log>log-id

Description This command creates a text description stored in the configuration file for a configuration context.

The **description** command is a text string to help you identify the content of the file.

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

Default There is no default description associated with the configuration context.

Parameters *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 (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

enable-port-id

Syntax [**no**] **enable-port-id**

Context configure>mirror>mirror-dest

Description This command includes the mirrored packet system's port-id. The system port ID can be used to identify which port the packet was received or sent on.

Default no enable-port-id

shutdown

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

Context config>mirror>mirror-dest
debug>mirror-source
config>li>li-source
config>li>log>log-id

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

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. Many objects must be shut down before they may be deleted.

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

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

Default See Special Cases below.

Special Cases **Mirror Destination —** When a mirror destination service ID is shutdown, mirrored packets associated with the service ID are not accepted from the mirror source or remote source 7750 SR 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 shutdown 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.

Mirror Destination Configuration Commands

far-end

Syntax **far-end** *ip-address* [**ing-svc-label** *ing-vc-label* | **tldp**]
no far-end *ip-addr*

Context config>mirror>mirror-dest>remote-source

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

The **far-end** command is used within the context of the **remote-source** node. It allows the definition of accepted remote sources for mirrored packets to this *mirror-dest-service-id*. Up to 50 **far-end** sources can be specified. If a far end 7750 SR router has not been specified, packets sent to the router are discarded.

The **far-end** command is used to define a remote source 7750 SR that may send mirrored packets to this 7750 SR for handling by this **mirror-dest** *service-id*.

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

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

Default No far end service ingress addresses are defined.

Parameters *ip-address* — The service IP address (system IP address) of the remote 7750 SR device sending mirrored traffic to this mirror destination service. If 0.0.0.0 is specified, any remote 7750 SR is allowed to send to this service.

Values 1.0.0.1 — 223.255.255.254

The ingress service label must be manually defined using the **ing-svc-label** keyword. On the far end 7750 SR, the associated SDP **egr-svc-label** must be manually set and equal to the label defined in **ing-svc-label**.

ing-svc-label *ing-vc-label* **—** Specifies the ingress service label for mirrored service traffic on the **far end** device for manually configured mirror service labels.

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

The specified *ing-svc-label* must not have been used for any other service ID and must match the far end expected specific *egr-svc-label* for this 7750 SR. It must be within the range specified for manually configured service labels defined on this 7750 SR. It may be reused for other far end addresses on this *mirror-dest-service-id*.

Values 2048 — 18431

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

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

Default The best effort (be) forwarding class is associated with the **mirror-dest** service ID.

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 *fc-name* will override the default forwarding class.

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

mirror-dest

Syntax **mirror-dest** *service-id* [**type** *encap-type*]
no mirror-dest

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 7750 SR router) or remotely, over the core of the network and have a far end 7750 SR decode the mirror encapsulation.

The **mirror-dest** service is comprised 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 far end 7750 SR devices 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 mirror-source command that references the same *service-id*. Up to 255 **mirror-dest** service IDs can be created within a single system.

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

LI source configuration is saved using the **li>save** command.

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

Default No packet mirroring services are defined.

Parameters *service-id* — The service identification 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 7750 SR router that this particular service is defined on.

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

For example:

If an Epipe service-ID **11** exists, then a mirror destination service-ID **11** cannot be created. If a VPLS service-ID **12** exists, then a mirror destination service-ID **12** cannot be created.
If an IES service-ID **13** exists, then a mirror destination service-ID **13** cannot be created.

Values 1 — 2147483647

type *encap-type* **—** The type describes the encapsulation supported by the mirror service.

Values ether, frame-relay, ppp, ip-only, atm-sdu, satop-e1, satop-t1, cesopsn, cesopsn-cas

enable-port-id

Syntax [**no**] **enable-port-id**

Context config>mirror>mirror-dest

Description This command includes the port-id of the system in the packet.

remote-source

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

Context config>mirror>mirror-dest

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

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

Specific far-end 7750 SR devices can be specified with the **far-end** command allowing them to use this router as the destination for the same *mirror-dest-service-id*.

The **remote-source** node allows the source of mirrored packets to be on remote 7750 SR devices. The local 7750 SR will configure its network ports to forward packets associated with the *service-id* to the destination SAP. When **remote-source far-end** addresses are configured, an SDP is not allowed as a destination.

By default, the **remote-source** context contains no **far-end** addresses. When no **far-end** addresses have been specified, network remote 7750 SR devices will not be allowed to mirror packets to the local 7750 SR as a mirror destination. Packets received from unspecified **far-end** addresses will be discarded at network ingress.

The **no** form of the command restores the *service-id* to the default condition to not allow a remote 7750 SR access to the mirror destination. The **far-end** addresses are removed without warning.

Default No remote source devices defined

sap

Syntax **sap** *sap-id*
no sap

Context config>mirror>mirror-dest

Description This command creates a service access point (SAP) within a mirror destination service. It also associates a predefined SAP within another service ID to a mirror source.

The SAP is defined with port and encapsulation parameters to uniquely identify the (mirror) SAP on the interface and within the box. The specified SAP may be defined on a FastE, GigE, or XGigE access port with a dot1q, null, or q-in-q encapsulation type.

The SAP is owned by the mirror destination service ID. If the interface is administratively down, all SAPs on that interface are also operationally down. A SAP can only be defined on a port configured as an access port with the **mode** command at the interface level.

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, LAG, APS group or IMA bundle.

If the defined SAP exists in the context of the service ID of the **mirror-dest** service, the CLI context is changed to the predefined SAP.

If the defined SAP exists in the context of another service ID, **mirror-dest** or any other type, an error is generated and the CLI context is not changed from the current context.

Mirror destination SAPs can be created on Ethernet interfaces that have been defined as an access interface. If the interface is defined as network, the SAP creation returns an error and the current CLI context is not changed.

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 No default SAP for the mirror destination service defined.

Parameters *sap-id* — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for command syntax.

cem

Syntax **cem**

Context config>mirror>mirror-dest>sap

Description This command enables the context to specify circuit emulation (CEM) mirroring properties.

Ingress and egress options cannot be supported at the same time on a CEM encap-type SAP. The options must be configured in either the ingress **or** egress contexts.

packet

Syntax **packet jitter-buffer** *milliseconds* [**payload-size** *bytes*]
packet payload-size *bytes*
no packet *bytes*

Context config>mirror>mirror-dest>sap>cem

Description This command specifies the jitter buffer size, in milliseconds, and payload size, in bytes.

Default The default value depends on the CEM SAP endpoint type, and if applicable, the number of timeslots:

Endpoint Type	Timeslots	Default Jitter Buffer (in ms)
unstructuredE1	n/a	5
unstructuredT1	n/a	5
unstructuredE3	n/a	5
unstructuredT3	n/a	5

Endpoint Type	Timeslots	Default Jitter Buffer (in ms)
nxDS0 (E1/T1)	N = 1	32
	N = 2..4	16
	N = 5..15	8
	N >= 16	5
nxDS0WithCas (E1)	N	8
nxDS0WithCas (T1)	N	12

Parameters *milliseconds* — specifies the jitter buffer size in milliseconds (ms).

Configuring the payload size and jitter buffer to values that result in less than 2 packet buffers or greater than 32 packet buffers is not allowed.

Setting the jitter butter value to 0 sets it back to the default value.

Values 1 — 250

payload-size *bytes* **—** Specifies the payload size (in bytes) of packets transitted to the packet service network (PSN) by the CEM SAP. This determines the size of the data that will be transmitted over the service. If the size of the data received is not consistent with the payload size then the packet is considered malformed.

Default The default value depends on the CEM SAP endpoint type, and if applicable, the number of timeslots:

Endpoint Type	Timeslots	Default Payload Size (in bytes)
unstructuredE1	n/a	256
unstructuredT1	n/a	192
unstructuredE3	n/a	1024
unstructuredT3	n/a	1024
nxDS0 (E1/T1)	N = 1	64
	N = 2..4	N x 32
	N = 5..15	N x 16
	N >= 16	N x 8
nxDS0WithCas (E1)	N	N x 16
nxDS0WithCas (T1)	N	N x 24

For all endpoint types except for nxDS0WithCas, the valid payload size range is from the default to 2048 bytes.

For nxDS0WithCas, the payload size divide by the number of timeslots must be an integer factor of the number of frames per trunk multiframe (for example, 16 for E1 trunk and 24 for T1 trunk).

For 1xDS0, the payload size must be a multiple of 2.

For NxDS0, where N > 1, the payload size must be a multiple of the number of timeslots.

For unstructuredE1, unstructuredT1, unstructuredE3 and unstructuredT3, the payload size must be a multiple of 32 bytes.

Configuring the payload size and jitter buffer to values that result in less than 2 packet buffers or greater than 32 packet buffer is not allowed.

Setting the payload size to 0 sets it back to the default value.

Values 0, 16 — 2048

rtp-header

Syntax [**no**] **rtp-header**

Context config>mirror>mirror-dest>sap>cem

Description This command specifies whether an RTP header is used when packets are transmitted to the packet service network (PSN) by the CEM SAP.

Default no rtp-header

egress

Syntax **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.

ip-mirror

Syntax **ip-mirror**

Context config>mirror>mirror-dest>sap>egress

Description This command configures IP mirror information.

sa-mac

Syntax **sa-mac** *ieee-address* **da-mac** *ieee-address*
no sa-mac

Context config>mirror>mirror-dest>sap>egress>ip-mirror

Description This command configures the source and destination MAC addresses for IP mirroring.

Parameters **sa-mac** *ieee-address* **—** Specifies the source MAC address. Multicast, Broadcast and zeros are not allowed.

da-mac *ieee-address* **—** Specifies the destination MAC address. Zeroes are not allowed.

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* — The QoS policy ID to associate with SAP for the mirrored service. The policy ID must already exist.

Values 1 — 65535

sdp

Syntax **sdp** *sdp-id*[:*vc-id*] [**egr-svc-label** *label* **| tlpd**]
no sdp

Context config>mirror>mirror-dest

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

The operational state of the SDP dictates the operational state of the SDP binding to the mirror destination. If the SDP is shutdown or operationally down, then SDP binding is down. Once the binding is defined and the service and SDP are operational, the far-end 7750 SR defined in the **config service sdp** *sdp-id* **far-end** parameter is considered part of the service ID.

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

An SDP is a logical mechanism that ties a far end 7750 SR to a specific service without having to define the far-end SAP. Each SDP represents a method to reach a 7750 SR.

One method is the IP Generic Router Encapsulation (GRE) encapsulation, which has no state in the core of the network. GRE does not specify a specific path to a 7750 SR router. A GRE-based SDP uses the underlying IGP routing table to find the best next hop to the far end router.

The other method is Multi-Protocol Label Switching (MPLS) encapsulation. 7750 SR routers support both signaled and non-signaled LSPs (Label Switched Path) though the network. Non-signaled paths are defined at each hop through the network. Signaled paths are protocol communicated from end to end using RSVP. Paths may be manually defined or a constraint based routing protocol (i.e., OSPF-TE or CSPF) can be used to determine the best path with specific constraints.

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

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

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

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 to another 7750 SR over the core network.

Parameters *sdp-id*[:*vc-id*] — A 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. So, to avoid this, the mirror service SDP bindings now accepts *vc-ids*.

Values 1 — 17407

egr-svc-label *label* — The **egr-svc-label** keyword is used to define the *egr-svc-label* used to identify this **mirror-dest** over this *sdp-id*. The *egr-svc-label* must be explicitly configured.

The specified *egr-svc-label* must be locally unique within this 7750 SR and match the far end expected specific *ing-svc-label* for this 7750 SR. It must be within the range specified for manually configured service labels defined on this 7750 SR.

Default None — Must be explicitly configured.

Values 16 — 1048575

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

slice-size

Syntax **slice-size** *bytes*
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 decode 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 decode equipment.

The actual capability of the 7750 SR 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.

Notes:

- When configuring IP mirroring, packet slice will be rejected as an incorrect option as it will cause IP packets to be rejected by the next hop with an IP header verification error.
- Slice-size is not supported by CEM encap-types or IP-mirroring.

The **no** form of the command disables mirrored packet truncation.

Default **no slice-size** — Mirrored packet truncation is disabled.

Parameters *bytes* — The number of bytes to which mirrored frames will be truncated, expressed as a decimal integer.

Values 128 — 9216

Mirror Source Configuration Commands

ingress-label

Syntax [**no**] **ingress-label** *label* [*label …*up to 8 max]
no ingress-label *label* [*label …*up to 8 max]

Context debug>mirror-source

Description This command enables ingress MPLS frame mirroring based on the top-of-stack MPLS label. Multiple labels can be defined simultaneously.

The **ingress-label** command is used to mirror ingressing MPLS frames with specific MPLS labels to a specific mirror destination. The ingress label must be at the top of the label stack and can only be mirrored to a single mirror destination. If the same label is defined with multiple mirror destinations, an error is generated and the original mirror destination remains.

The **ingress-label** mirror source overrides all other mirror source definitions. The MPLS frame is mirrored to the mirror destination as it is received on the ingress network port. The 7750 SR MPLS label space is global for the system. A specific label is mirrored to the mirror destination regardless of the ingress interface.

By default, no ingress MPLS frames are mirrored. The **ingress-label** command must be executed to start mirroring on a specific MPLS label.

The **no ingress-label** command removes all label mirroring for the mirror source. To stop mirroring on specific labels, use the **no ingress-label** *label* form of the command. Multiple labels may be given in a single **no ingress-label** command.

Default No ingress MPLS labels for mirroring are defined.

Parameters *label* — The top-of-stack label received on ingress to be mirrored. A label can only be mirrored to a single mirror destination.

If the label does not exist on any ingress network ports, no packets are mirrored for that label. An error will not occur. Once the label exists on a network port, ingress mirroring commences for that label.

Values 0 — 1048575. The local MPLS stack may not support portions of this range.

ip-filter

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

Context debug>mirror-source

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

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

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

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

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

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

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

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

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

Default IP filter mirroring is not defined.

Parameters *ip-filter-id* — The IP filter ID whose entries are mirrored. If the *ip-filter-id* does not exist, an error will occur and the command will not execute. Mirroring of packets will commence once the *ip-filter-id* is defined on a SAP or IP interface.

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

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

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

mac-filter

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

Context debug>mirror-source

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

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

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

If the MAC filter is defined as ingress, only ingress packets are mirrored. Ingress mirrored packets are mirrored to the mirror destination 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* within 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.

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

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

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

Default No MAC filter mirroring defined.

Parameters *mac-filter-id* — The MAC filter ID whose entries are mirrored. If the *mac-filter-id* does not exist, an error will occur and the command will not execute. Mirroring of packets will commence once the *mac-filter-id* is defined on a SAP.

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

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

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

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-dest-service-id*. The mirror destination service must already exist within the system.

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

1. Filter entry
2. Subscriber mirror priority
3. Service access port (SAP)
4. Physical port

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

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

By default, all **mirror-dest** service IDs have a **mirror-source** associated with them. The **mirror-source** is not technically created with this command. Instead the service ID provides a contextual node for storing the current mirroring sources for the associated **mirror-dest** service ID. The **mirror-source** is created for the mirror service when the operator enters the **debug>mirror-source** *svcId* for the first time. If the operator enters **li>li-source** *svcId* for the first time, an LI source is created for the mirror service. 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 No mirror source match criteria is defined for the mirror destination service.

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 1 — 2147483647. The service ID must already exist as a **mirror-dest**.

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 a port (Ethernet port, SONET/SDH channel, TDM channel, or Link Aggregation Group (LAG)).

The **port** command associates a port or LAG to a mirror source. The port is identified by the *port-id*. The defined port may be Ethernet, SONET/SDH, access or network, or TDM channel, access. A network port may be a single 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. If the port is a SONET/SDH interface, the *channel-id* must be specified to identify which channel is being mirrored. Either a LAG port member *or* the LAG port can be mirrored.

The port is only referenced in the mirror source for mirroring purposes. The mirror source association does not need to be removed before deleting the card to which the the port belongs. If the port is removed from the system, the mirroring association will be removed from the mirror source.

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

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

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

The encapsulation type on an access port or channel cannot be changed to Frame Relay if it is being 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 No ports are defined.

Parameters *port-id* — Specifies the port ID.

Syntax: port-id *slot/mda/port*[.*channel*]
aps-id aps-*group-id*[.*channel*]
aps keyword
group-id 1 — 64
bundle-id: bundle-*type*-*slot/mda*.*bundle-num*
bundle keyword
type ima, ppp
bundle-num 1 — 128
ccag-id ccag-*id*.*path-id*[*cc-type*]:*cc-id*
ccag keyword
id 1 — 8
path-id a, b
cc-type .sap-net, .net-sap
cc-id 0 — 4094

lag-id — The LAG identifier, expressed as a decimal integer.

Values 1 — 200

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.

sap

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

Context debug>mirror-source

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

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

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

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

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

Note that the ingress and egress options cannot be supported at the same time on a CEM encap-type SAP. The options must be configured in either the ingress **or** egress contexts.

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

Default No SAPs are defined by default.

Parameters *sap-id* — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for command syntax.

channel-id — The SONET/SDH or TDM channel on the port of the SAP. A period separates the physical port from the *channel-id*. The port must be configured as an access port.

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

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

Lawful Intercept Commands

li

Syntax **li**

Context config

Description This command configures the context to configure lawful intercept (LI) parameters.

li-source

Syntax [**no**] **li-source** *service-id*

Context config>li

Description This command configures a lawful intercept (LI) mirror source.

Parameters *service-id* — The service identification 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.

Values 1 — 2147483647

ip-filter

Syntax **ip-filter** *ip-filter-id* **entry** *entry-id* [*entry-id*...]
no ip-filter *ip-filter-id* [**entry** *entry-id*...]

Context config>li>li-source

Description This command enables lawful interception (LI) of packets that match specific entries in an existing IP filter.

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

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

If the IP filter is defined as ingress, only ingress packets are intercepted. Ingress packets are sent to the destination prior to any ingress packet modifications.

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

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

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

When the **no** command is executed with the **entry** keyword and one or more *entry-id*'s, interception of that list of *entry-id*'s is terminated within the *ip-filter-id*. If an *entry-id* is listed that does not exist, an error will occur and the command will not execute. If an *entry-id* is listed that is not currently being intercepted, no error will occur for that *entry-id* and the command will execute normally.

Parameters *ip-filter-id* — The IP filter ID whose entries are to be intercepted. If the *ip-filter-id* does not exist, an error will occur and the command will not execute. Intercepting packets will commence when the *ip-filter-id* is defined on a SAP or IP interface.

entry *entry-id* [*entry-id* …] **—** The IP filter entries to use as match criteria for lawful intercept (LI). The **entry** keyword begins a list of *entry-id*'s for interception. Multiple *entry-id* entries can be specified with a single command. Each *entry-id* must be separated by a space. Up to <N><n> 8 entry IDs may be specified in a single command.

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

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

mac-filter

Syntax **mac-filter** *mac-filter-id* **entry** *entry-id* [*entry-id*...]
no mac-filter *mac-filter-id* [**entry** *entry-id*...]

Context config>li>li-source

Description This command enables lawful interception (LI) of packets that match specific entries in an existing MAC filter. Multiple entries can be created using unique entry-id numbers within the filter. The 7750 SR OS implementation exits the filter on the first match found and executes the actions in accordance with the accompanying action command. For this reason, entries must be sequenced correctly from most to least explicit.

An entry may not have any match criteria defined (in which case, everything matches) but must have at least the keyword **action** for it to be considered complete. Entries without the **action** keyword will be considered incomplete and hence will be rendered inactive.

The **no** form of the command removes the specified entry from the IP or MAC filter. Entries removed from the IP or MAC filter are immediately removed from all services or network ports where that filter is applied.

Parameters *mac-filter-id* — Specifies the MAC filter ID. If the *mac-filter-id* does not exist, an error will occur and the command will not execute.

entry *entry-id* [*entry-id* …] **—** The MAC filter entries to use as match criteria.

sap

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

Context config>li>li-source

Description This command creates a service access point (SAP) within an LI configuration. The specified SAP must define a FastE, GigE, or XGigE access port with a dot1q, null, or q-in-q encapsulation type.

When the **no** form of this command is used on a SAP, the SAP with the specified port and encapsulation parameters is deleted.

Default none

Parameters *sap-id* — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for command syntax.

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

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

subscriber

Syntax **subscriber** *sub-ident-string* [**sap** *sap-id* [**ip** *ip-address*] [**mac** *ieee-address*]|**sla-profile** *sla-profile-name*] [**fc** {[**be**] [**l2**] [**af**] [**l1**] [**h2**] [**ef**] [**h1**] [**nc**]}] {[**ingress**] [**egress**]}
no subscriber *sub-ident-string*

Context config>li>li-source

Description This command adds hosts of a subscriber to mirroring service.

Parameters *sub-ident-string* — Specifies the name of the subscriber identification policy.

sap-id — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for command syntax.

ip-address — The service IP address (system IP address) of the remote 7750 SR device sending LI traffic. If 0.0.0.0 is specified, any remote 7750 SR is allowed to send to this service.

Values 1.0.0.1 — 223.255.255.254

mac *mac-address* — Specify this optional parameter when defining a static host. The MAC address must be specified for **anti-spoof ip-mac** and **arp-populate**. Multiple static hosts may be configured with the same MAC address given that each definition is distinguished by a unique IP address.

sla-profile-name — Specifies the SLA profile name.

Values 32 characters maximum.

fc — The name of the forwarding class with which to associate LI 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 *fc-name* will override the default forwarding class.

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

ingress — Specifies information for the ingress policy.

egress — Specifies information for the egress policy.

log

Syntax **log**

Context config>li

Description This command enables the context to configure an event log for Lawful Intercept.

log-id

Syntax [**no**] **log-id** *log-id*

Context config>li>log

Description This command configures an LI event log destination. The *log-id* is used to direct events, alarms/traps, and debug information to respective destinations.

Parameters *log-id* — The log ID number, expressed as a decimal integer.

Values 1 — 100

filter

Syntax **filter** *filter-id*
no filter

Context config>li>log>log-id

Description This command adds an event filter policy with the log destination.

The **filter** command is optional. If no event filter is configured, all events, alarms and traps generated by the source stream will be forwarded to the destination.

An event filter policy defines (limits) the events that are forwarded to the destination configured in the log-id. The event filter policy can also be used to select the alarms and traps to be forwarded to a destination **snmp-trap-group**.

The application of filters for debug messages is limited to application and subject only.

Accounting records cannot be filtered using the **filter** command.

Only one filter-id can be configured per log destination.

The **no** form of the command removes the specified event filter from the *log-id*.

Default **no filter — No event filter policy is specified for a** *log-id*.

Parameters *filter-id.* The event filter policy ID is used to associate the filter with the *log-id* configuration. The event filter policy ID must already be defined in **config>log>filter** *filter-id*.

Values 1 — 1000

from

Syntax **from** {[**li**]}
no from

Context config>li>log>log-id

Description This command configures a bit mask that specifies the log event source stream(s) to be forwarded to the destination specified in the log destination (memory, session, SNMP). Events from more than one source can be forwarded to the log destination.

Parameters **li —** Specifies the **li** event streamthat contains all events configured for Lawful Intercept activities. If the requestor does not have access to the **li** context, the event stream will fail.

time-format

Syntax **time-format** {**local**|**utc**}

Context config>li>log>log-id

Description This command specifies whether the time should be displayed in local or Coordinated Universal Time (UTC) format.

Default **utc**

Parameters **local —** Specifies that timestamps are written in the system's local time.

utc — Specifies that timestamps are written using the UTC value. This was formerly called Greenwich Mean Time (GMT) and Zulu time.

to

Syntax **to memory** [*size*]
to session
to snmp [*size*]

Context config>li>log>log-id

Description This command enables the context to configure the destination type for the event log.

The source of the data stream must be specified in the **from** command prior to configuring the destination with the **to** command.

The **to** command cannot be modified or re-entered. If the destination or maximum size of an SNMP or memory log needs to be modified, the log ID must be removed and then re-created.

Parameters *[size]* — The size parameter indicates the number of events that can be stored into memory.

Default 100

Values 50 — 1024

save

Syntax **save**

Context config>li

Description This command is required to save LI configuration parameters.

Other LI Configuration Commands

The following commands are also described in the 7750 SR OS Basic System Configuration Guide.

li-local-save

Syntax [**no**] **li-local-save**

Context bof

Description This command specifies whether or not lawful intercept (LI) configuration is allowed to be save to a local file. Modifying this command will not take affect until the system is rebooted.

Default li-local-save

li-separate

Syntax [**no**] **li-separate**

Context bof

Description This command specifies whether or not a non-LI user has access to lawful intercept (LI) information. When this command is enabled, a user who does not have LI access will not be allowed to access CLI or SNMP objects in the li context. Modifying this command will not take affect until the system is rebooted.

When the **no li-separate** command is set (the default mode), those who are allowed access to the **config>system>security>profile** context and user command nodes are allowed to modify the configuration of the LI parameters. In this mode, a user that has a profile allowing access to the **config>li** and/or **show>li** command contexts can enter and use the commands under those nodes.

When the **li-separate** command is configured, only users that have the LI access capabilities set in the **config>system>security>user>access li** context are allowed to access the **config>li** and/or **show>li** command contexts. A user who does not have LI access is not allowed to enter the **config>li** and **show>li** contexts even though they have a profile that allows access to these nodes. When in the **li-separate** mode, only users with **config>system>security>user>access li** set in their user account have the ability modify the setting LI parameters in either their own or others profiles and user configurations.

Default no li-separate

The following commands are also described in the 7750 SR OS System Management Configuration Guide.

access

Syntax [**no**] **access** [**ftp**] [**snmp**] [**console**] [**li**]

Context config>>system>security>user

Description This command grants a user permission for FTP, SNMP, console or lawful intercept (LI) access.

If a user requires access to more than one application, then multiple applications can be specified in a single command. Multiple commands are treated additively.

The **no** form of command removes access for a specific application.
no access denies permission for all management access methods. To deny a single access method, enter the **no** form of the command followed by the method to be denied, for example, **no access FTP** denies FTP access.

Default No access is granted to the user by default.

Parameters **ftp —** Specifies FTP permission.

snmp — Specifies SNMP permission. This keyword is only configurable in the **config>system>security>user** context.

console — Specifies console access (serial port or Telnet) permission.

li — Allows user to access CLI commands in the lawful intercept (LI) context.

Show Commands

debug

Syntax **debug** [*application*]

Context **show**

Description This command displays set debug points.

Parameters *application* — Display which debug points have been set.

Values: service, ip, ospf, ospf3, bgp, mtrace, rip, isis, mpls, rsvp, ldp, mirror, vrrp, system, filter, subscriber-mgmt, radius, lag, oam, frame-relay, local-dhcp-server, igmp, mld, pim

Output

```
*A:EsrC# show debug
debug
    mirror-source 100
        subscriber "user1" ingress
        subscriber "user2" fc be h2 h1 nc egress
        subscriber "user3" ingress egress
        subscriber "user4" sap 1/1/2:1 fc af ef nc ingress
        subscriber "user5" sap 1/1/2:1 egress
        subscriber "user6" sap 1/1/2:1 fc be l2 af h2 ef nc ingress egress
        subscriber "user7" sap 1/1/2:1 ip 1.1.0.7 fc l1 h2 ingress
        subscriber "user8" sap 1/1/2:1 ip 1.1.0.8 fc af l1 h2 ef nc egress
        subscriber "user9" sap 1/1/2:1 ip 1.1.0.9 ingress egress
        subscriber "user10" sap 1/1/2:1 mac 00:00:01:00:00:01 fc be l2 l1 h1 nc
ingress
       subscriber "user11" sap 1/1/2:1 mac 00:00:01:00:00:02 fc be l1 h2 ef h1 egress
        subscriber "user12" sap 1/1/2:1 mac 00:00:01:00:00:03 fc be ef ingress egress
       subscriber "user13" sap 1/1/2:1 ip 1.1.0.13 mac 00:00:01:00:00:01 fc be ef h1
ingress
        subscriber "user14" sap 1/1/2:1 ip 1.1.0.14 mac 00:00:01:00:00:02 egress
       subscriber "user15" sap 1/1/2:1 ip 1.1.0.15 mac 00:00:01:00:00:03 fc af l1 ef
nc ingress egress
        subscriber "user16" sla-profile "sla1" ingress
        subscriber "user17" sla-profile "sla2" egress
        subscriber "user18" sla-profile "sla3" fc be af h2 ingress egress
        no shutdown
    exit
exit
*A:EsrC#
```

active-subscribers

Syntax **active-subscribers summary**
active-subscribers [**subscriber** *sub-ident-string* [**sap** *sap-id* **sla-profile** *sla-profile-name*]] [**detail|mirror**]
active-subscribers hierarchy [**subscriber** *sub-ident-string*]

Context show>service

Description This command displays active subscriber information.

Parameters *sub-ident-string* — Specifies an existing subscriber identification string.

sap *sap-id* — Specifies the physical port identifier portion of the SAP definition. See “Common CLI Command Descriptions” on page 261 for command syntax.

sla-profile-name — Displays an existing SLA profile name.

hierarchy — Displays the subscriber hierarchy.

summary — Displays subscriber summary.

Sample Output

```
*A:EsrC# show service active-subscribers mirror
===============================================================================
Active Subscribers
===============================================================================
Subscriber user1 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-----------------------------------------------
1.1.0.1         00:00:01:00:00:01 Static
                    Ingress mirror:      100   l2 af l1 nc
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:11 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-----------------------------------------------
11.1.0.1        00:00:01:00:00:01 Static
                    Ingress mirror:      100   l2 af l1 nc
-----------------------------------------------
Subscriber user10 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-----------------------------------------------
1.1.0.10        00:00:01:00:00:01 Static
                    Ingress mirror:      100   af ef h1 nc
-----------------------------------------------
Subscriber user11 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-----------------------------------------------
1.1.0.11        00:00:01:00:00:02 Static
                    Egress  mirror:      100   l2 ef h1
-----------------------------------------------
Subscriber user12 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-----------------------------------------------
1.1.0.12        00:00:01:00:00:03 Static
                    Ingress mirror:      100   be l2 af l1 h2 ef h1 nc
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
-----------------------------------------------
Subscriber user13 (sub1)
```

```
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.13        00:00:01:00:00:01 Static
                    Ingress mirror:      100   l1 ef h1
-------------------------------------------
Subscriber user14 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.14        00:00:01:00:00:02 Static
                    Egress  mirror:      100   l2 h2 ef h1
-------------------------------------------
Subscriber user15 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.15        00:00:01:00:00:03 Static
                    Ingress mirror:      100   l1 nc
                    Egress  mirror:      100   l1 nc
-------------------------------------------
Subscriber user16 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.16        00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af nc
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:11 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
11.1.0.16       00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af nc
-------------------------------------------
Subscriber user17 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla2
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.17        00:00:01:00:00:01 Static
                    Egress  mirror:      100   af l1 h1
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:11 - sla:sla2
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
11.1.0.17       00:00:01:00:00:01 Static
                    Egress  mirror:      100   af l1 h1
-------------------------------------------
Subscriber user18 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla3
-------------------------------------------------------------------------------
```

```
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.18        00:00:01:00:00:01 Static
                    Ingress mirror:      100   h2
                    Egress  mirror:      100   h2
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:11 - sla:sla3
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
11.1.0.18       00:00:01:00:00:01 Static
                    Ingress mirror:      100   h2
                    Egress  mirror:      100   h2
-------------------------------------------
Subscriber user2 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.2         00:00:01:00:00:01 Static
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:11 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
11.1.0.2        00:00:01:00:00:01 Static
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------
Subscriber user3 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.3         00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af l1 h2 ef h1 nc
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:11 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
11.1.0.3        00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af l1 h2 ef h1 nc
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------
Subscriber user4 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.4         00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------
Subscriber user5 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
```

```
1.1.0.5         00:00:01:00:00:01 Static
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------
Subscriber user6 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.6         00:00:01:00:00:01 Static
                    Ingress mirror:      100   be af l1 h2
                    Egress  mirror:      100   be af l1 h2
-------------------------------------------
Subscriber user7 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.7         00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af l1 h2 ef h1 nc
-------------------------------------------
Subscriber user8 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.8         00:00:01:00:00:01 Static
                    Egress  mirror:      100   be af l1 h1 nc
-------------------------------------------
Subscriber user9 (sub1)
-------------------------------------------------------------------------------
SLA Profile Instance sap:lag-8:1 - sla:sla1
-------------------------------------------------------------------------------
IP Address      MAC Address       Origin
-------------------------------------------
1.1.0.9         00:00:01:00:00:01 Static
                    Ingress mirror:      100   be l2 af l1 h2 ef h1 nc
                    Egress  mirror:      100   be l2 af l1 h2 ef h1 nc
===============================================================================
*A:EsrC#
```

service-using

Syntax **service-using** [**mirror**]

Context show>service

Description Displays mirror services.

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

Parameters **mirror** — Displays mirror services.

Output **Show Service-Using Mirror —** The following table describes service-using mirror output fields:

Label	Description
Service Id	The service identifier.
Type	Specifies the service type configured for the service ID.
Adm	The desired state of the service.
Opr	The operating state of the service.
CustomerID	The ID of the customer who owns this service.
Last Mgmt Change	The date and time of the most recent management-initiated change to this service.

Sample Output

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

li-source

Syntax **li-source** [*service-id*]

Context show>li

Description Displays Lawful Intercept mirror configuration and operation information.

Parameters *service-id* — Specifies the service ID.

Values 1 — 2147483647

Sample Output

```
*A:sim138# show li li-source 2
===============================================================================
Mirror Service
===============================================================================
Service Id       : 2                    Type          : Ether
Admin State      : Up                   Oper State    : Up
Forwarding Class : be                   Remote Sources: No
Slice            : 0
Destination SDP  : 1000 (100.1.1.2)     Egress Label  : 4000
Signaling:       : None
```

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

 - IP Filter       1          Entry 1
===============================================================================
*A:sim138#
```

log

Syntax **log**

Context show>li

Description Displays Lawful Intercept event log information.

log-id

Syntax **log-id** [*log-id*] [**severity** *severity-level*] [**application** *application*] [**sequence** *from-seq* [*to-seq*]] [**count** *count*] [**router** *router-instance* [**expression**]] [**subject** *subject* [**regexp**]] [**ascending | descending**]

Context show>li>log

Description Displays information for specified log.

Parameters *log-id* — Specifies the log ID.

Values 1 — 100

severity-level — Specifies the severity level.

Values cleared, indeterminate, critical, major, minor, warning

application — Specifies the application name.

Values application_assurance, aps, atm, bgp, cflowd, chassis, debug, dhcp, dhcps, dot1ag, efm_oam, filter, gsmp, igmp, igmp_snooping, ip, isis, lag, ldp, li, logger, mc_redundancy, mirror, mld, mld_snooping, mpls, msdp, ntp, oam, ospf, pim, pim_snooping, port, ppp, pppoe, rip, route_policy, rsvp, security, snmp, stp, svcmgr, system, user, vrrp, vrtr

from-seq [*to-seq*] — Specifies the sequence value.

Values 1 — 4294967295

count — Specifies the count.

Values 1 — 4294967295

subject — Specifies a subject string to match.

reexp — Specifies to use a regular expression match.

ascending|*descending* — Specifies the sort direction

router-instance — Specifies the router instance.

status

Syntax **status**

Context show>li

Description Displays Lawful Intercept status information.

Sample Output

```
*A:sim138# show li status
===============================================================================
Lawful Intercept Status Information
===============================================================================
LI Booted Config Status      : fail
LI Local Save Allowed        : yes
Separate LI administration   : no
Last LI Config Save Time     : N/A
Last Config Save Result      : none
Changes Since Last Save      : yes
Last LI Config Modified Time : 2008/01/11 10:24:30
===============================================================================
*A:sim138#
```

li

Syntax **li**

Context show

Description Displays Lawful Intercept (LI) information.

mirror mirror-dest

Syntax **mirror mirror-dest** *service-id*

Context show

Description Displays mirror configuration and operation information.

Parameters *service-id* — Specify the mirror service ID.

Output **Mirroring Output —** The following table describes the mirroring output fields:

Table 3: Mirroring Output Fields

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

Table 3: Mirroring Output Fields (Continued)

Label	Description (Continued)
Admin State	Up — The mirror destination is administratively enabled.
	Down — The mirror destination is administratively disabled.
Oper State	Up — The mirror destination is operationally enabled.
	Down — The mirror destination is operationally disabled.
Forwarding Class	The forwarding class for all packets transmitted to the mirror destination.
Remote Sources	Yes — A remote source is configured.
	No — A remote source is not configured.
Enable Port Id	Yes — PPP Port ID Mirroring is enabled.
	No — PPP Port ID Mirroring is disabled.
Slice	The value of the slice-size, the maximum portion of the mirrored frame that will be transmitted to the mirror destination. Any frame larger than the slice-size will be truncated to this value before transmission to the mirror destination. A value of 0 indicates that mirrored packet truncation based on slice size is disabled.
Destination SAP	The ID of the access port where the Service Access Point (SAP) associated with this mirror destination service is defined.
Egr QoS Policy	This value indicates the egress QoS policy ID. A value of 0 indicates that no QoS policy is specified.

Sample Output

```
A:SR7# show mirror mirror-dest 1000
===============================================================================
Mirror Service
===============================================================================
Service Id       : 1000                Type          : Ether
Admin State      : Up                  Oper State    : Down
Forwarding Class : be                  Remote Sources: No
Slice            : 0
Destination SAP  : 1/1/1               Egr QoS Policy: 1
-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up
 - Port            1/1/2                          Egress Ingress
===============================================================================
A:SR7#
```

```
A:ALA-123>config>mirror# show mirror mirror-dest 500
===============================================================================
Mirror Service
===============================================================================
Service Id       : 500                  Type          : Ether
Admin State      : Up                   Oper State    : Up
Forwarding Class : be                   Remote Sources: Yes
Destination SAP  : 1/1/2                Egr QoS Policy: 1
-------------------------------------------------------------------------------
Remote Sources
-------------------------------------------------------------------------------
Far End          : 10.20.1.45           Ingress Label : 131070
-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up
No Mirror Sources configured
===============================================================================
A:ALA-123>config>mirror#


A:ALA-456# show mirror mirror-dest 500
===============================================================================
Mirror Service
===============================================================================
Service Id       : 500                  Type          : Ether
Admin State      : Up                   Oper State    : Up
Forwarding Class : be                   Remote Sources: No
Destination SDP  : 144 (10.20.1.44)     Egress Label  : 131070
Signaling:       : TLDP
-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up
No Mirror Sources configured
===============================================================================
A:ALA-456#


A:NS042650115# show mirror mirror-dest 100
===============================================================================
Mirror Service
===============================================================================
Service Id       : 100                  Type          : PPP
Admin State      : Up                   Oper State    : Up
Forwarding Class : be                   Remote Sources: No
Slice            : 0                 Enable Port Id: Yes
Destination SDP  : 100 (2.2.2.2)     Egress Label  : 131070
Signaling:       : TLDP
-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up
No Mirror Sources configured
===============================================================================
A:NS042650115#


*A:EsrC# show mirror mirror-dest 100
===============================================================================
Mirror Service
===============================================================================
Service Id       : 100                  Type          : Ether
```

```
Description      : Added by createMirrorDestination 100
Admin State      : Up                    Oper State    : Up
Forwarding Class : be                    Remote Sources: No
Slice            : 0
Destination SAP  : 1/1/5:100             Egr QoS Policy: 1
-------------------------------------------------------------------------------
Local Sources
-------------------------------------------------------------------------------
Admin State      : Up
-Subs  user1                                                                Ing
-Subs  user2                                                          Egr
                                                 FC  be h2 h1 nc
-Subs  user3                                                          Egr Ing
-Subs  user4                             1/1/2:1                          Ing
                                                 FC  af ef nc
-Subs  user5                             1/1/2:1                      Egr
-Subs  user6                             1/1/2:1                      Egr Ing
                                                 FC  be l2 af h2 ef nc
-Subs  user7                             1/1/2:1                          Ing
          IP 1.1.0.7                             FC  l1 h2
-Subs  user8                             1/1/2:1                      Egr
          IP 1.1.0.8                             FC  af l1 h2 ef nc
-Subs  user9                             1/1/2:1                      Egr Ing
          IP 1.1.0.9
-Subs  user10                            1/1/2:1                          Ing
                              MAC 00:00:01:00:00:01 FC  be l2 l1 h1 nc
-Subs  user11                            1/1/2:1                      Egr
                              MAC 00:00:01:00:00:02 FC  be l1 h2 ef h1
-Subs  user12                            1/1/2:1                      Egr Ing
                              MAC 00:00:01:00:00:03 FC  be ef
-Subs  user13                            1/1/2:1                          Ing
          IP 1.1.0.13         MAC 00:00:01:00:00:01 FC  be ef h1
-Subs  user14                            1/1/2:1                      Egr
          IP 1.1.0.14         MAC 00:00:01:00:00:02
-Subs  user15                            1/1/2:1                      Egr Ing
          IP 1.1.0.15         MAC 00:00:01:00:00:03 FC  af l1 ef nc
-Subs  user16                            SLA sla1                         Ing
-Subs  user17                            SLA sla2                     Egr
-Subs  user18                            SLA sla3                     Egr Ing
                                                 FC  be af h2
===============================================================================
A:EsrC#
```

Debug Commands

subscriber

Syntax **subscriber** *sub-ident-string* [**sap** *sap-id* [**ip** *ip-address*] [**mac** *ieee-address*]|**sla-profile** *sla-profile-name*] [**fc** {[**be**] [**l2**] [**af**] [**l1**] [**h2**] [**ef**] [**h1**] [**nc**]}] {[**ingress**] [**egress**]}
no subscriber *sub-ident-string*

Context debug>mirroring-source

Description This command adds hosts of a subscriber to mirroring service.

Parameters *sub-ident-string* — Specifies the name of the subscriber identification policy.

sap-id — Specifies the physical port identifier portion of the SAP definition. See "Common CLI Command Descriptions" on page 261 for command syntax.

ip *ip-address* — The service IP address (system IP address) of the remote 7750 SR device sending LI traffic.

Values 1.0.0.1 — 223.255.255.254

mac *mac-address* — Specify this optional parameter when defining a static host. The MAC address must be specified for **anti-spoof ip-mac** and **arp-populate**. Multiple static hosts may be configured with the same MAC address given that each definition is distinguished by a unique IP address.

sla-profile *sla-profile-name* — Specifies the SLA profile name.

Values 32 characters maximum.

fc — The name of the forwarding class with which to associate LI traffic.

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

ingress — Specifies information for the ingress policy.

egress — Specifies information for the egress policy.

OAM and SAA

In This Chapter

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

Topics in this chapter include:

OAM Overview

Delivery of services requires 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 Operation, Administration, and Maintenance (OAM) tools is required, with the ability to test each of the individual packet operations.

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

The suite of OAM diagnostics supplement the basic IP ping and traceroute operations with diagnostics specialized for the different levels in the service delivery model. There are diagnostics for MPLS LSPs, SDPs, Services and VPLS MACs within a service.

LSP Diagnostics

The 7750 SR OS LSP diagnostics are implementations of LSP ping and LSP traceroute based on RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*. In an LDP ECMP network, a unique-path trace can be accomplished by specifying a unique 127/8 IP address for the **path-destination** *ip-address* parameter. Note that the 7750 SR can send multipath type 0 or 8, and up to a maximum of 36 bytes for multipath length (refer to RFC 4379 for more details). The 7750 SR supports unique-path trace on an LER of an LDP ECMP path. LSP ping, as described in the draft, provides a mechanism to detect dataplane failures in MPLS LSPs. 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.

For a given FEC, LSP ping verifies whether the packet reaches the egress label edge router (LER), while in LSP traceroute mode, the packet is sent to the control plane of each transit label switched router (LSR) which performs various checks to see if it is actually a transit LSR for the path.

SDP Diagnostics

The 7750 SR OS SDP diagnostics are SDP ping and SDP MTU path discovery.

SDP Ping

SDP ping performs in-band uni-directional 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 uni-directional test, SDP ping tests:

- Egress SDP ID encapsulation
- Ability to reach the far-end IP address of the SDP ID within the SDP encapsulation
- Path MTU to the far-end IP address over the SDP ID
- Forwarding class mapping between the near-end SDP ID encapsulation and the far-end tunnel termination

For a round-trip test, SDP ping uses a local egress SDP ID and an expected remote SDP ID. Since SDPs are uni-directional tunnels, the remote SDP ID must be specified and must exist as a configured SDP ID on the far-end 7750 SR. SDP round trip testing is an extension of SDP connectivity testing with the additional ability to test:

- Remote SDP ID encapsulation
- Potential service round trip time
- Round trip path MTU
- Round trip forwarding class mapping

SDP MTU Path Discovery

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

The Path MTU Discovery tool provides a powerful tool that enables service provider to get the exact MTU supported between the service ingress and service termination points (accurate to one byte).

Service Diagnostics

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

Service ping is initiated from a 7750 SR router to verify round-trip connectivity and delay to the far-end of the service. Alcatel-Lucent's implementation functions for both GRE 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

VPLS MAC Diagnostics

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

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

The VPLS OAM tools are:

- MAC Ping — Provides the ability to trace end-to-end switching of specified MAC addresses. MAC ping provides an end-to-end test to identify the egress customer-facing port where a customer MAC was learned. MAC ping can also be used with a broadcast MAC address to identify all egress points of a service for the specified broadcast MAC.
- MAC Trace — Provides the ability to trace a specified MAC address hop-by-hop until the last node in the service domain.
- CPE Ping — Provides the ability to check network connectivity to the specified client device within the VPLS. CPE ping will return the MAC address of the client, as well as the SAP and PE at which it was learned.

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

MAC Ping

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

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

In the data plane, a MAC ping is sent with a VC label TTL of 255. This packet traverses each hop using forwarding plane information for next hop, VC label, etc. 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.

MAC Trace

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

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

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

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

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

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

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

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

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

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

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.

CPE Ping

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

The **cpe-ping** command extends this capability to detecting end-station IP addresses inside a VPLS. A CPE ping for a specific destination IP address within a VPLS will be translated to a MAC-ping towards 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 7750 SR.

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 an OAM induced learning with some other binding), to prevent new dynamic learning to over-write the existing OAM MAC entry, to allow customer packets with this MAC to either ingress or egress the network, while still using the OAM MAC entry.

Finally, an option to flood the MAC Populate request causes each upstream node to learn the MAC (i.e., 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.

MAC Purge

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

MAC Purge follows the same flooding mechanism as the MAC Populate.

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

VLL Diagnostics

VCCV Ping

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

VCCV-Ping Application

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

1. Use of a Router Alert Label immediately above the VC label. This method has the drawback that if ECMP is applied to the outer LSP label (for example, transport label), the VCCV message will not follow the same path as the user packets. This effectively means it will not troubleshoot the appropriate path. This method is supported by the 7750 SR.
2. Use of the OAM control word as illustrated in Figure 12.

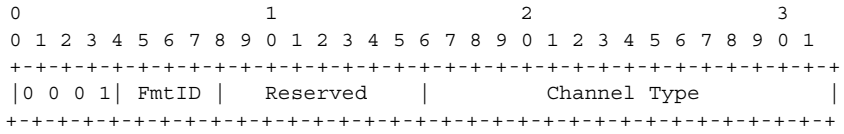


Figure 12: OAM Control Word Format

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

The use of the OAM control word assumes that the draft-martini control word is also used on the user packets. This means that if the control word is optional for a VLL and is not configured, the 7750 SR PE node will only advertise the router alert label as the CC capability in the Label Mapping message. This method is supported by the 7750 SR.

3. Set the TTL in the VC label to 1 to force PE2 control plane to process the VCCV message. This method is not guaranteed to work under all circumstances. For instance, the draft mentions some implementations of penultimate hop popping overwrite the TTL field. . This method is not supported by the 7750 SR.

When sending the label mapping message for the VLL, PE1 and PE2 must indicate which of the above OAM packet encapsulation methods (for example, which control channel type) they support. This is accomplished by including an optional VCCV TLV in the pseudowire FEC Interface Parameter field. The format of the VCCV TLV is shown in Figure 13.

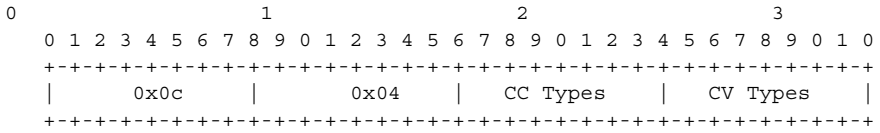


Figure 13: VCCV TLV

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

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

- 0x00 None of the following VCCV control channel types are supported
- 0x01 PWE3 OAM control word (see Figure 12)
- 0x02 MPLS Router Alert Label
- 0x04 MPLS inner label TTL = 1

If both PE nodes support more than one of the CC types, then a 7750 SR PE will make use of the one with the lowest type value. For instance, OAM control word will be used in preference to the MPLS router alert label.

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

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

0x01 ICMP Ping. Not applicable to a VLL over a MPLS or GRE SDP and as such is not supported by the 7750 SR.

0x02 LSP Ping. This is used in VCCV-Ping application and applies to a VLL over an MPLS or a GRE SDP. This is supported by the 7750 SR.

A VCCV-Ping is an LSP Echo Request message as defined in RFC 4379. It contains an L2 FEC stack TLV which must include within the sub-TLV type 10 “"FEC 128" Pseudowire”. It also

contains a field which indicates to the destination PE which reply mode to use. There are four reply modes defined in RFC 4379:

Reply Mode: Meaning:

1. Do not reply. This mode is supported by the 7750 SR.
2. Reply via an IPv4/IPv6 UDP packet. This mode is supported by the 7750 SR.
3. Reply via an IPv4/IPv6 UDP packet with Router Alert. This mode sets the router alert bit in the IP header and is not be confused with the CC type which makes use of the router alert label. This mode is not supported by the 7750 SR.
4. Reply via application level control channel. This mode sends the reply message inband over the pseudowire from PE2 to PE1. PE2 will encapsulate the Echo Reply message using the CC type negotiated with PE1. This mode is supported by the 7750 SR.

The reply is an LSP Echo Reply message as defined in RFC 4379. The message is sent as per the Reply Mode requested by PE1. The return codes supported are the same as those supported in the 7750 SR LSP Ping capability.

The VCCV ping feature is in addition to the service ping OAM feature which can be used to test a service between 7750 SR nodes. The VCCV ping feature can test connectivity of a VLL with any third party node which is compliant to RFC 5085.

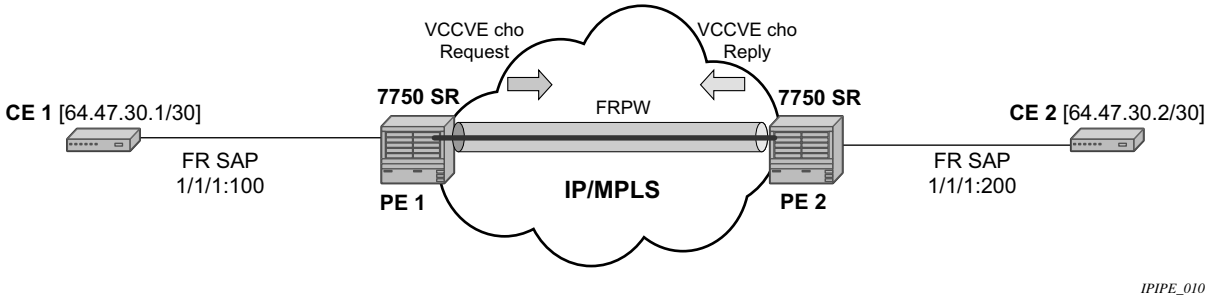


Figure 14: VCCV-Ping Application

VCCV-Ping in a Multi-Segment Pseudowire

Figure 15 displays and example of an application of VCCV ping over a multi-segment pseudowire.

Pseudowire switching is a method for scaling a large network of VLL or VPLS services by removing the need for a full mesh of T-LDP sessions between the 7750 SR PE nodes as the number of these nodes grow over time. Pseudowire switching is also used whenever there is a need to deploy a VLL service across two separate routing domains.

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

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

1. VCCV-Ping to a destination PE. A VLL FEC Ping is a message sent by T-PE1 to test the FEC at T-PE2. The operation at T-PE1 and T-PE2 is the same as in the case of a single-segment pseudowire. The 7x50 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 7750 SR S-PE1 node does not process the VCCV OAM Control Word unless the VC label TTL expires. In that case, the message is sent to the CPM for further validation and processing. This is the method described in draft-hart-pwe3-segmented-pw-vccv.

Note that 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.

VCCV-Trace to 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 by which T-PE1 sends successive VCCV-Ping messages while incrementing the TTL value, starting from TTL=1. The procedure for each iteration is the same as above and 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 from T-PE2 or when a timeout occurs.

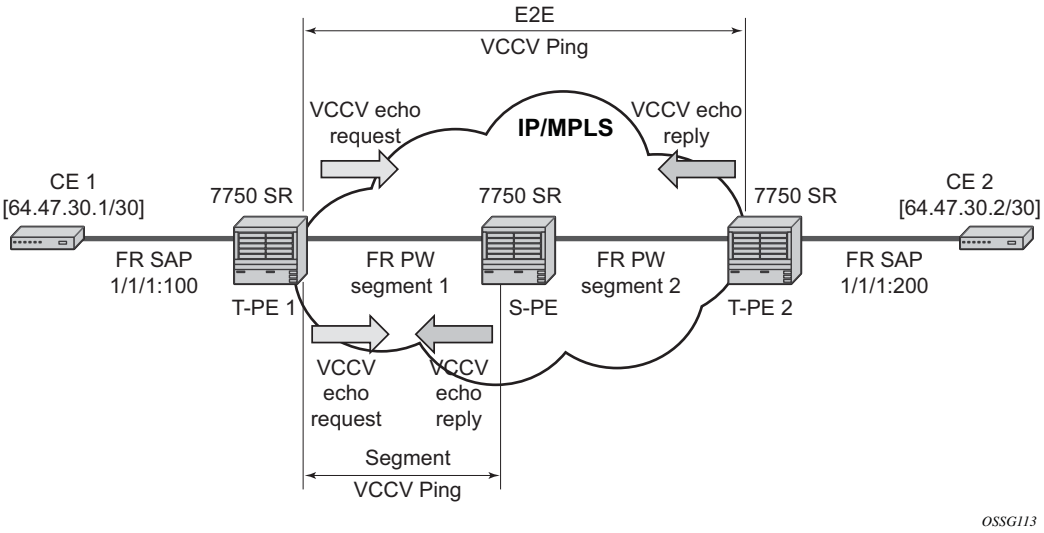


Figure 15: VCCV-Ping over a Multi-Segment Pseudowire

Automated VCCV-Trace Capability for MS-Pseudowire

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

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

The method is described in draft-hart-pwe3-segmented-pw-vccv, *VCCV Extensions for Segmented Pseudo-Wire*, and is pending acceptance by the PWE3 working group. In each iteration, the source T-PE or S-PE builds the MPLS echo request message in a way similar to VCCV Ping on page 114. The first message with TTL=1 will have the next-hop S-PE T-LDP session source address in the Remote PE Address field in the pseudowire FEC TLV. Each S-PE which terminates and processes the message will include in the MPLS echo reply message the FEC 128 TLV corresponding the pseudowire segment to its downstream node. The inclusion of the FEC TLV in the echo reply message is allowed in RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*. The source T-PE or S-PE can then build the next echo reply message with TTL=2 to test the next-next hop for the MS-pseudowire. It will copy the FEC TLV it received in the echo reply message into the new echo request message. The process is terminated when the reply is from the egress T-PE or when a timeout occurs. If specified, the max-ttl parameter in the vccv-trace command will stop on SPE before reaching T-PE.

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

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

VCCV for Static Pseudowire Segments

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

Detailed VCCV-Trace Operation

In Figure 15 on page 118,a trace can be performed on the MS-pseudowire originating from T-PE1 by a single operational command. The following process occurs:

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

Control Plane Processing of a VCCV Echo Message in a MS-pseudowire

Sending a VCCV Echo Request

When in the ping mode of operation, the sender of the echo request message requires the FEC of the last segment to the target S-PE/T-PE node. This information can either be configured manually or be obtained by inspecting the corresponding sub-TLV's of the pseudowire switching point TLV. However, the pseudowire switching point TLV is optional and there is no guarantee that all S-PE nodes will populate it with their system address and the pseudowire-id of the last pseudowire segment traversed by the label mapping message. Thus the 7x50 implementation will always make use of the user configuration for these parameters.

When in the trace mode operation, the T-PE will automatically learn the target FEC by probing one by one the hops of the MS-pseudowire path. Each S-PE node includes the FEC to the downstream node in the echo reply message in a similar way that LSP trace will have the probed node return the downstream interface and label stack in the echo reply message.

Receiving an VCCV Echo Request

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

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

Receiving an VCCV Echo Reply

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

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

However, in trace mode, the node builds and sends the subsequent VCCV echo request with a incrementing TTL and the information (such as the downstream FEC 128) it received in the echo request to the next downstream pseudowire segment.

IGMP Snooping Diagnostics

MFIB Ping

The multicast forwarding information base (MFIB) ping OAM tool allows to easily verify inside a VPLS which SAPs would normally egress a certain multicast stream. The multicast stream is identified by a source unicast and destination multicast IP address, which are mandatory when issuing an MFIB ping command.

An MFIB ping packet will be sent through the data plane and goes out with the data plane format containing a configurable VC label TTL. This packet traverses each hop using forwarding plane information for next hop, VC label, etc. 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 (SAP), it is identified by the OAM label below the VC label and passed to the management plane.

ATM Diagnostics

The ATM OAM ping allows operators to test VC-integrity and endpoint connectivity for existing PVCCs using OAM loopback capabilities.

If portId:vpi/vci PVCC does not exist, a PVCC is administratively disabled, or there is already a ping executing on this PVCC, then this command returns an error.

Because oam atm-ping is a dynamic operation, the configuration is not preserved. The number of oam atm-ping operations that can be performed simultaneously on a 7750 is configurable as part of the general OAM MIB configuration.

An operator can specify the following options when performing an oam atm-ping:

end-to-end – this option allows sending oam atm-ping towards the connection endpoint in the line direction by using OAM end-to-end loopback cells

segment – this option allows sending oam atm-ping towards the segment termination point in the line direction by using OAM segment loopback cells.

The result of ATM ping will show if the ping to a given location was successful. It also shows the round-trip time the ping took to complete (from the time the ping was injected in the ATM SAR device until the time the ping response was given to S/W by the ATM SAR device) and the average ping time for successful attempts up to the given ping response.

An oam atm ping in progress will time-out if a PVCC goes to the operational status down as result of a network failure, an administrative action, or if a PVCC gets deleted. Any subsequent ping attempts will fail until the VC's operational state changes to up.

To stop a ping in progress, an operator can enter "CTRL – C". This will stop any outstanding ping requests and will return ping result up to the point of interruption (a ping in progress during the above stop request will fail).

End-to-End Testing of Paths in an LDP ECMP Network

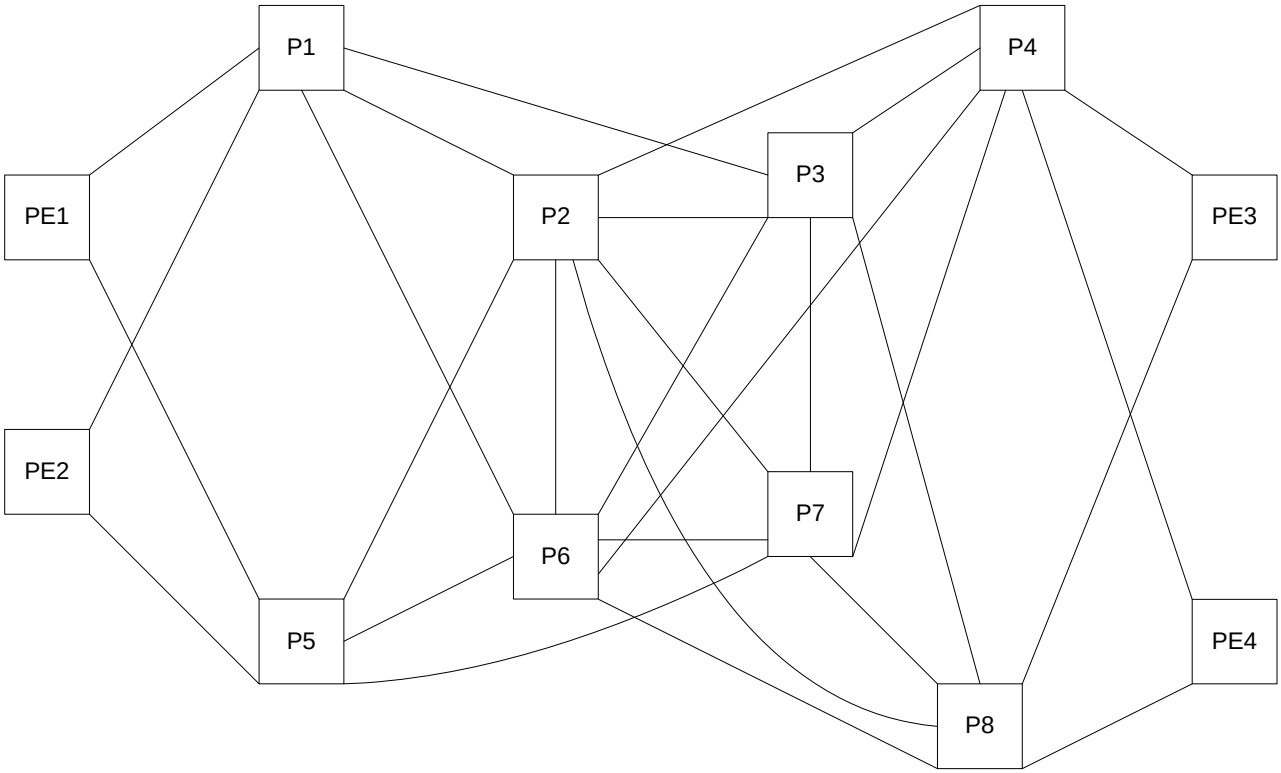


Figure 16: Network Resilience Using LDP ECMP

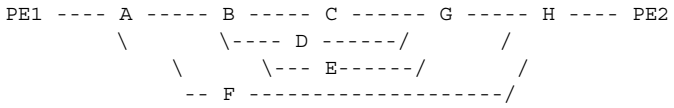
Figure 16 depicts an IP/MPLS network which uses LDP ECMP for network resilience. Faults that are detected through IGP and/or LDP are corrected as soon as IGP and LDP re-converge. The impacted traffic will be forwarded on the next available ECMP path as determined by the hash routine at the node that had a link failure.

However, there are faults which the IGP/LDP control planes may not detect. These faults may be due to a corruption of the control plane state or of the data plane state in a node. Although these faults are very rare and mostly due to misconfiguration, the LDP ECMP OAM is intended to detect these “silent” data plane and control plane faults. For example, it is possible that the forwarding plane of a node has a corrupt Next Hop Label Forwarding Entry (NHLFE) and keeps forwarding packets over an ECMP path only to have the downstream node discard them. This data plane fault can only be detected by an OAM tool that can test all possible end-to-end paths between the ingress LER and the egress LER. A corruption of the NLHFE entry can also result from a corruption in the control plane at that node.

LDP ECMP Tree Building

The 7750 SR ingress LER builds the ECM tree for a given FEC (egress LER) by sending LSP trace messages and including the LDP IPv4 Prefix FEC TLV as well as the downstream mapping TLV.In order to build the ECMP tree, the 7750 SR LER inserts an IP address range drawn from the 127/8 space. When received by the downstream LSR, it will use this range to determine which ECMP path is exercised by any IP address or a sub-range of addresses within that range based on its internal hash routine. When the MPLS echo reply is received by the 7750 SR LER, it will record this information and proceed with the next echo request message targeted for a node downstream of the first LSR node along one of the ECMP paths. The sub-range of IP addresses indicated in the initial reply will be used since the objective is to have the LSR downstream of the 7750 SR LER pass this message to its downstream node along the first ECMP path.

The following figure illustrates the behavior through the following example adapted from RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*:



LSR A has two downstream LSRs, B and F, for PE2 FEC. PE1 receives an echo reply from A with the Multipath Type set to 4, with low/high IP addresses of 127.1.1.1->127.1.1.255 for downstream LSR B and 127.2.1.1->127.2.1.255 for downstream LSR F. PE1 reflects this information to LSR B. B, which has three downstream LSRs, C, D, and E, computes that 127.1.1.1->127.1.1.127 would go to C and 127.1.1.128-> 127.1.1.255 would go to D. B would then respond with 3 Downstream Mappings: to C, with Multipath Type 4 (127.1.1.1->127.1.1.127); to D, with Multipath Type 4 (127.1.1.127->127.1.1.255); and to E, with Multipath Type 0.

The 7750 SR supports multipath type 0 and 8, and up to a maximum of 36 bytes for the multipath length and supports the LER part of the LDP ECMP tree building feature.

A user configurable parameter sets the frequency of running the tree trace capability. The minimum and default value is 60 minutes and the increment is 1 hour.

The 7750 SR LER gets the list of FECs from the LDP FEC database. New FECs will be added to the discovery list at the next tree trace and not when they are learned and added into the FEC database. The maximum number of FECs to be discovered with the tree building feature is limited to 500. The user can configure FECs to exclude the use of a policy profile.

Periodic Path Exercising

The periodic path exercising runs in the background to test the LDP ECMP paths discovered by the tree building capability. The probe used is an LSP ping message with an IP address drawn from the sub-range of 127/8 addresses indicated by the output of the tree trace for this FEC.

The periodic LSP ping messages continuously probes an ECMP path at a user configurable rate of at least 1 message per minute. This is the minimum and default value. The increment is 1 minute. If an interface is down on a 7750 SR LER, then LSP ping probes that normally go out this interface will not be sent.

The LSP ping routine updates the content of the MPLS echo request message, specifically the IP address, as soon as the LDP ECMP tree trace has output the results of a new computation for the path in question.

Ethernet Connectivity Fault Management (CFM)

Ethernet Connectivity Fault Management (CFM) is defined in IEEE 802.1ag. It specifies protocols, procedures, and managed objects to support transport fault management, including discovery and verification of the path, detection and isolation of a connectivity fault for each Ethernet service instance. IEEE 802.1ag-based CFM functionalities are supported on SR and ESS platforms.

IEEE 802.1ag can detect:

- Loss of connectivity
- Unidirectional loss
- Loops
- Merging of services

CFM uses Ethernet frames and can be distinguished by its ether-type and special Ethernet multicast addresses. CFM frames are only processed by IEEE MAC bridges.

With CFM, interoperability can be achieved between different vendor equipment in the service provider network up to and including customer premises bridges. The following table lists CFM-related acronyms used in this section.

Acronym	Callout
CCM	Continuity check message
CFM	Connectivity fault management
LBM	Loopback message
LBR	Loopback reply
LTM	Linktrace message
LTR	Linktrace reply
ME	Maintenance entity
MA	Maintenance association
MA-ID	Maintenance association identifier
MD	Maintenance domain
MEP	Maintenance association end point
MEP-ID	Maintenance association end point identifier
MHF	MIP half function
MIP	Maintenance domain intermediate point

MA, MEP, MIP and MD Levels

Maintenance Domain (MD) levels are used to define CFM maintenance domains, maintenance association End Points (MEPs) and Maintenance association Intermediate Point (MIP) only communicate within the same level. It is carried in the CFM PDU to inform management entities where maintenance association (MA) the CFM PDU belongs. There are 8 levels defined. 0 is the lowest level, 7 is the highest level. The levels are nested, not overlapping. Overlapping is not allowed.

In IEEE 802.1ag, the MD is the part of the network where services are monitored (the administrative boundaries).

In the 7750, the first step to configure a maintenance domain:

CLI Syntax:
```
config>dot1ag
 domain md-index [format {dns|mac|string}] name md-name level
 level
 domain md-index
    association ma-index [format {integer|string|vid|vpn-id}]
    name ma-name
    association ma-index
```

CFM levels include:

- MEP is an actively managed functional component, which implements CFM functionalities. Together, MEPs form the maintenance association.
- MIP is the intermediate point between MEPs.
- MEP and MIP perform different CFM functionalities.

Maintenance association (MA) includes a set of MEPs, each configured with the same MA-ID and MD level, verify the integrity of a single service instance.

Figure 17 depicts a high-level view of MEPs and MIPs in a CFM-enabled network. Two MAs are displayed.

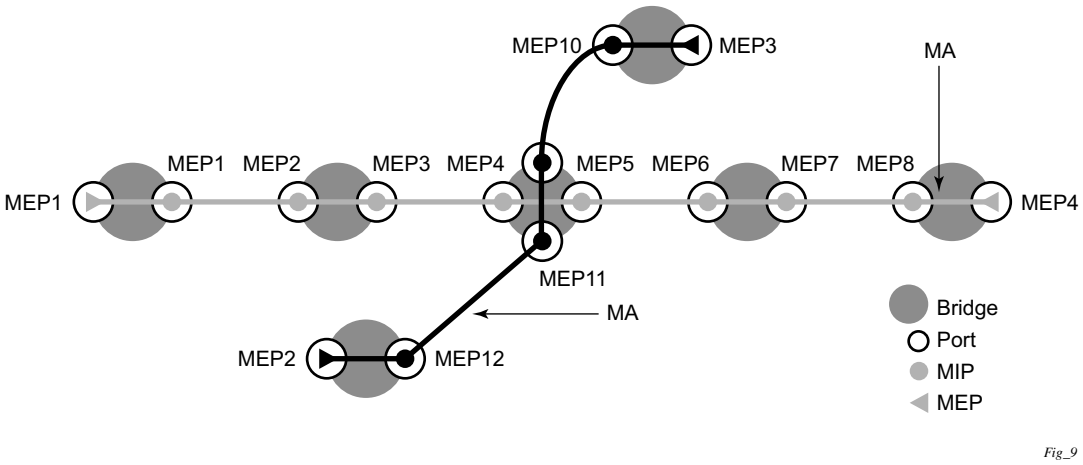


Figure 17: MEP and MIP

Figure 18 shows a more detailed view of MEP, MIP and MD levels.

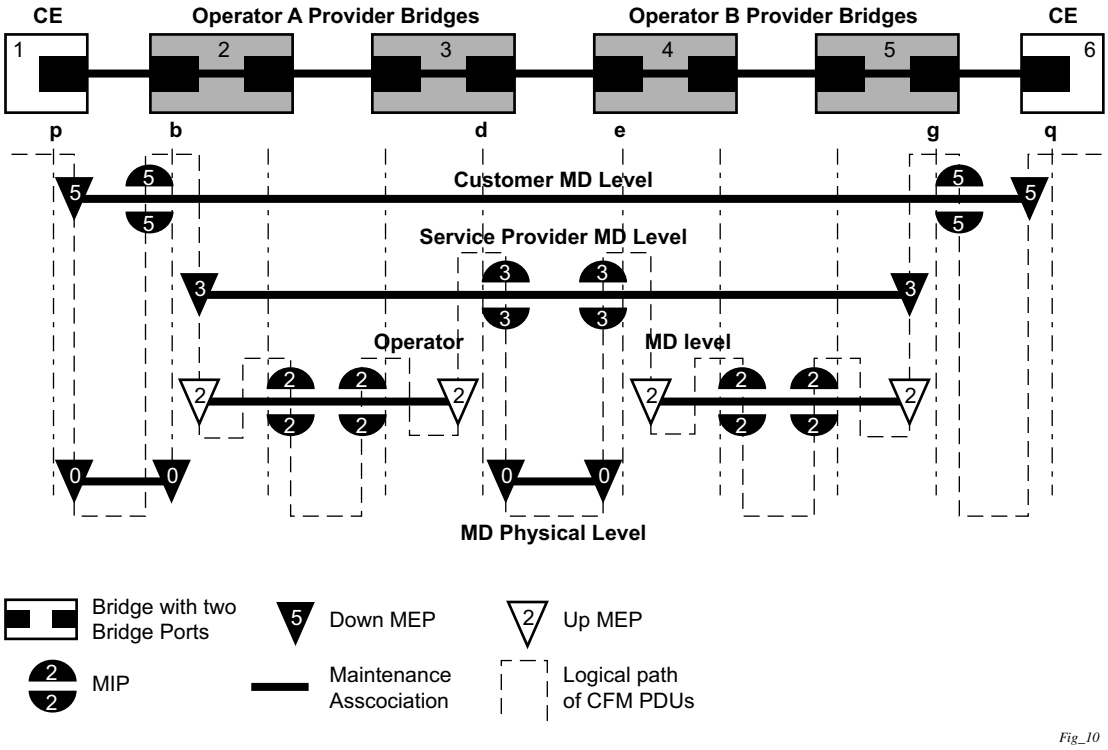


Figure 18: MEP, MIP and MD Levels

Ethernet service OAM can be deployed in the broadband access network. There are two models, residential and wholesale (Figure 19 and Figure 20).

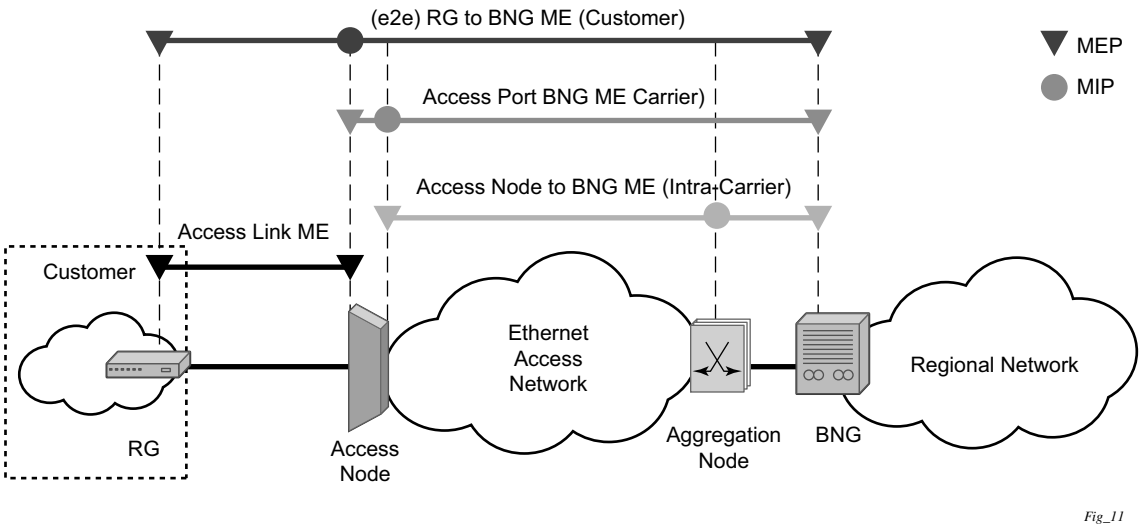


Figure 19: Ethernet OAM Model for Broadband Access - Residential

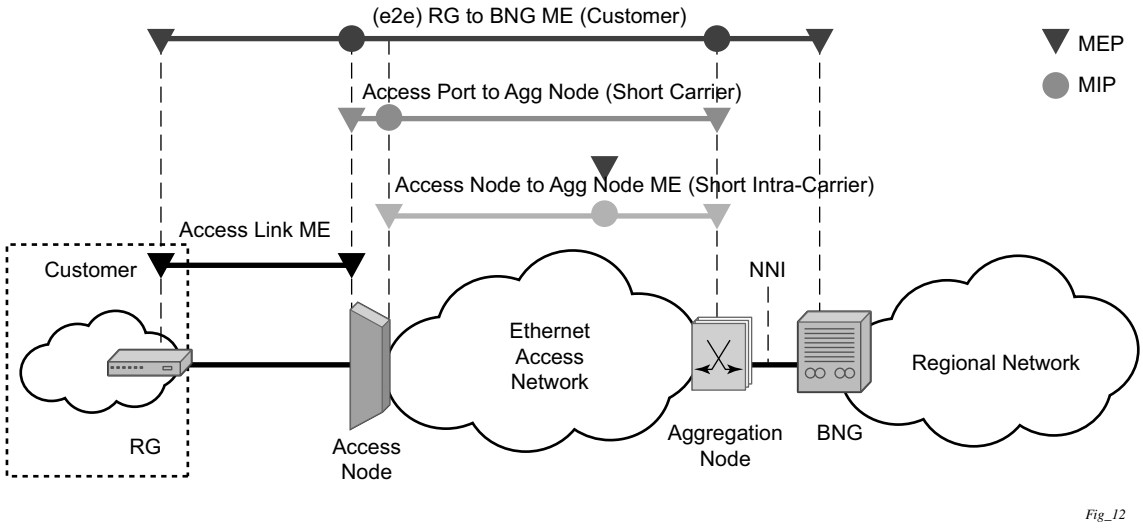


Figure 20: Ethernet OAM Model for Broadband Access - Wholesale

As shown in Figure 19 and Figure 20, the following functions are supported:

- 802.1ag CFM can be enabled or disabled on a SAP or SDP basis.
- Three MD levels, customer, carrier, and intra-carrier, can be configured, modified, or deleted.

- The following MD name formats are supported:
  - → None — no MD name
  - → DNS name
  - → MAC address and 2-octet integer
  - → Character string
- MA with MA-ID for each MD level can be configured, modified, or deleted.
  - → Each MA is uniquely identified by the MD level, short MA name tuple, which is the MA-ID.
  - → The following short MA name formats are supported:
    - Primary VLAN ID (VID)
    - Character string
    - 2-octet integer
    - RFC 2685, *Virtual Private Networks Identifier*
  - → Note: When a VID is used as the short MA name, 802.1ag will not support VLAN translation because the MA-ID must match all the MEPs.
  - → The default format for a short MA name is an integer. Integer value 0 means the MA is not attached to a VID. This is useful for VPLS services on SR/ESS platforms because the VID is locally significant.
- Up and/or down MEP with an MEP-ID on a SAP and SDP for each MD level can be configured, modified, or deleted. Each MEP is uniquely identified by the MA-ID, MEP-ID tuple.
  - → MEP creation on a SAP is allowed only for Ethernet ports (with NULL, q-tags, q-in-q encapsulations).
- MIP creation on a SAP and SDP for each MD level can be enabled and disabled. MIP creation is automatic when it is enabled. When MIP creation is disabled for an MD level, the existing MIP is removed.
- MIP creation is not supported on mesh SDP bindings.

Loopback

A loopback message is generated by an MEP to its peer MEP or an MIP (Figure 21). The functions are similar to an IP ping to verify Ethernet connectivity between the nodes.

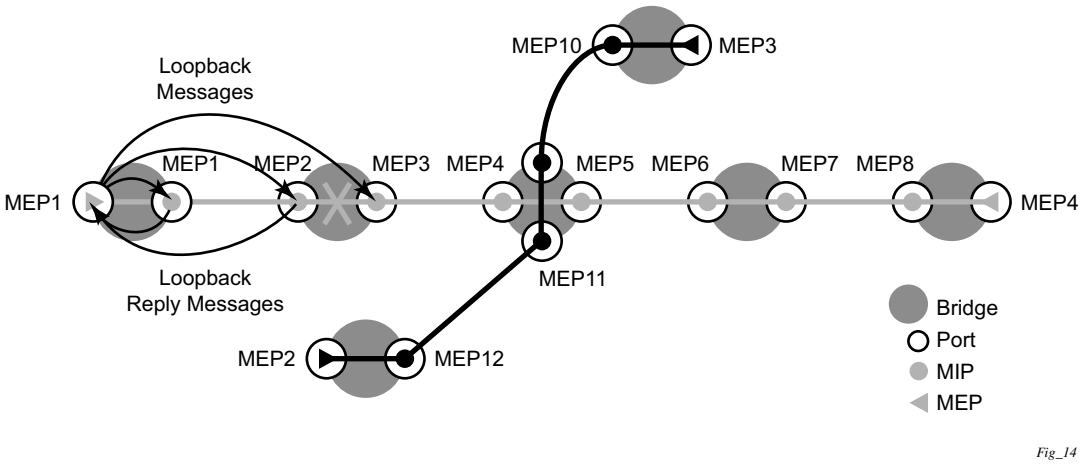


Figure 21: CFM Loopback

The following loopback-related functions are supported:

- Loopback message functionality on an MEP or MIP can be enabled or disabled.
- MEP — Supports generating loopback messages and responding to loopback messages with loopback reply messages.
- MIP — Supports responding to loopback messages with loopback reply messages when loopback messages are targeted to self.
- Displays the loopback test results on the originating MEP.

Linktrace

A linktrace message is originated by an MEP and targeted to a peer MEP in the same MA and within the same MD level (Figure 22). Its function is similar to IP traceroute. Traces a specific MAC address through the serviceThe peer MEP responds with a linktrace reply message after successful inspection of the linktrace message. The MIPs along the path also process the linktrace message and respond with linktrace replies to the originating MEP if the received linktrace message has a TTL greater than 1 and forward the linktrace message if a look up of the target MAC address in the Layer 2 FIB is successful. The originating MEP shall expect to receive multiple linktrace replies and from processing the linktrace replies, it can put together the route to the target bridge.

A traced MAC address is carried in the payload of the linktrace message. Each MIP and MEP receiving the linktrace message checks whether it has learned the target MAC address. In order to use linktrace the target MAC address must have been learned by the nodes in the network. If so, a linktrace message is sent back to the originating MEP. Also, a MIP forwards the linktrace message out of the port where the target MAC address was learned.

The linktrace message itself has a multicast destination address. On a broadcast LAN, it can be receved by multiple nodes connected to that LAN. But, at most, one node will send a reply.

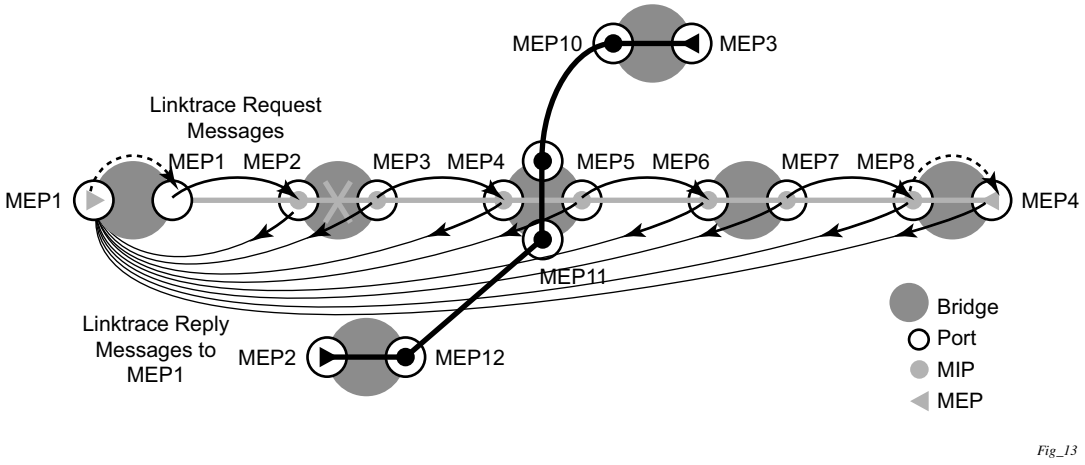


Figure 22: CFM Linktrace

The following linktrace related functions are supported:

- Enable or disables linktrace functions on an MEP.
- MEP — Supports generating linktrace messages and responding with linktrace reply messages.
- MIP — Supports responding to linktrace messages with linktrace reply messages when encoded TTL is greater than 1, and forward the linktrace messages accordingly if a lookup of the target MAC address in the Layer 2 FIB is successful.
- Displays linktrace test results on the originating MEP.

CONTINUITY CHECK (CC)

A Continuity Check Message (CCM) is a multicast frame that is generated by a MEP and multicast to all other MEPs in the same MA. The CCM does not require a reply message. To identify faults, the receiving MEP maintains an internal list of remote MEPs it should be receiving CCM messages from.

This list is based off of the remote-mepid configuration on the association that the MEP is created on. When the local MEP does not receive a CCM from one of the configured remote MEPs within a pre-configured period, the local MEP raises an alarm.

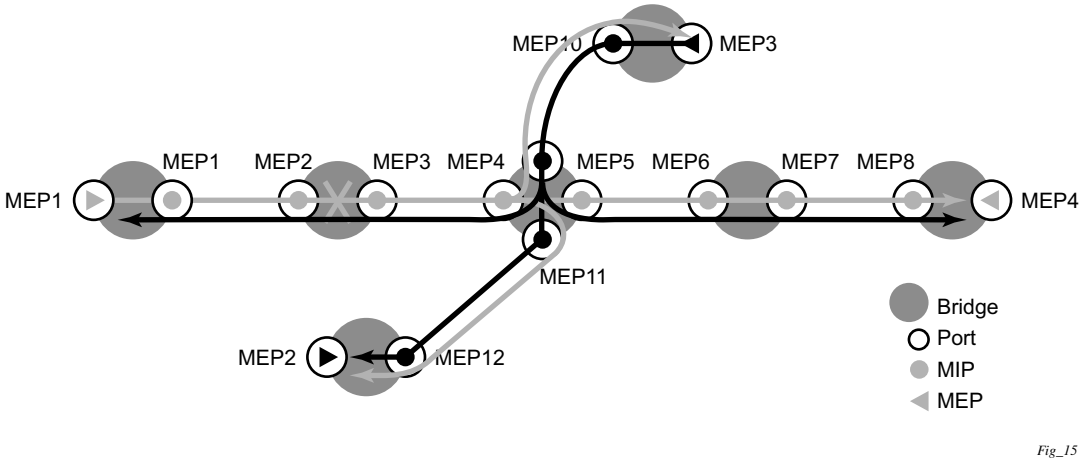


Figure 23: CFM Continuity Check

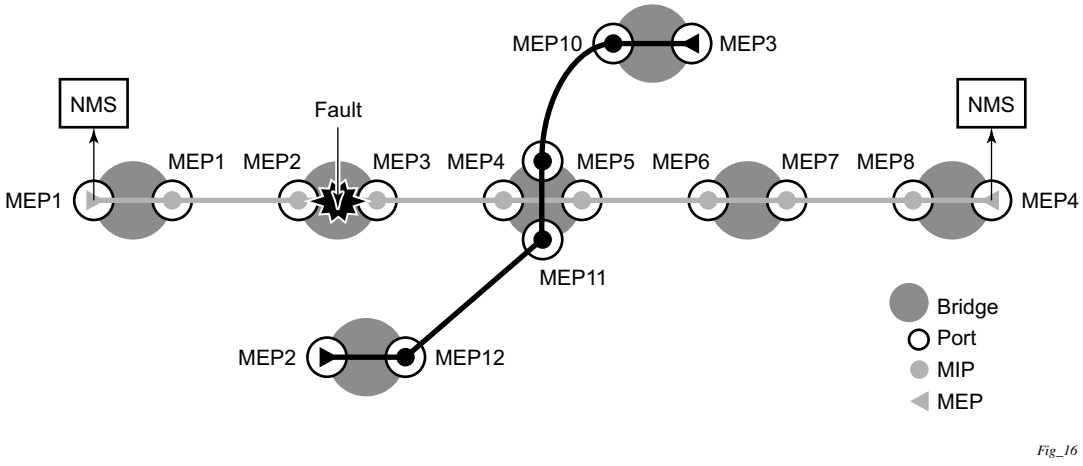


Figure 24: CFM CC Failure Scenario

The following functions are supported:

- Enable and disable CC for an MEP
- Configure and delete the MEP entries in the CC MEP monitoring database manually. It is only required to provision remote MEPs. Local MEPs shall be automatically put into the database when they are created.
- CCM transmit interval in seconds: 1, 10, 60, 600. Default: 10.
- CCM will declare a fault, when:
  - → The CCM stops hearing from one of the remote MEPs for 3.5 times CC interval
  - → Hears from a MEP with a LOWER MD level
  - → Hears from a MEP that is not in our MA
  - → Hears from a MEP that is in the same MA but not in the configured MEP list
  - → Hears from a MEP in the same MA with the same MEP id as the receiving MEP
  - → The CC interval of the remote MEP does not match the local configured CC interval
  - → The remote MEP is declaring a fault
- An alarm is raised and a trap is sent if the defect is greater than or equal to the configured low-priority-defect value.

Rate Limiting CFM Messages

To mitigate malicious DOS attack through CFM OAM messages, rate limiting of CFM traffic is supported.

Service Assurance Agent Overview

In the last few years, service delivery to customers has drastically changed. Services such as VPLS and VPRN are offered. The introduction of Broadband Service Termination Architecture (BSTA) applications such as Voice over IP (VoIP), TV delivery, video and high speed Internet services force carriers to produce services where the health and quality of Service Level Agreement (SLA) commitments are verifiable to the customer and internally within the carrier.

SAA is a feature that monitors network operations using statistics such as jitter, latency, response time, and packet loss. The information can be used to troubleshoot network problems, problem prevention, and network topology planning.

The results are saved in SNMP tables are queried by either the CLI or a management system. Threshold monitors allow for both rising and falling threshold events to alert the provider if SLA performance statistics deviate from the required parameters.

SAA Application

SAA allows two-way timing for several applications. This provides the carrier and their customers with data to verify that the SLA agreements are being properly enforced.

Two-way time measures requests from this node to the specified DNS server. This is done by performing an address request followed by an immediate release of the acquired address once the time measurement has been performed.

Traceroute Implementation

Various applications, such as lsp-trace, traceroute and vprn-trace, pass through the P-chip on the way to the control CPU. At this point, and when it egresses the control CPU, the P-chip should insert a timestamp inside the packet. Only packets processed by the Control CPU are processed.

When interpreting these timestamps care must be taken that some nodes are not capable of providing timestamps, as such timestamps must be associated with the same IP-address that is being returned to the originator to indicate what hop is being measured.

Configuring SAA Test Parameters

Because NTP precision can vary (+/- 1.5ms between nodes even under best case conditions), SAA one-way latency measurements might display negative values, especially when testing network segments with very low latencies.

The following example displays an SAA configuration:

```
A:ALA-48>config>saa# info
----------------------------------------------
        test "t1"
            type
                lsp-ping "to-104" interval 4 send-count 5
            exit
            no shutdown
        exit
----------------------------------------------
A:ALA-48>config>saa#
```

After running the test twice, the result is displayed below:

```
A:ALA-48>config>saa# show saa t1
Test Run: 1
Total number of attempts: 5
Number of requests that failed to be sent out: 1
Number of responses that were received: 4
Number of requests that did not receive any response: 0
Total number of failures: 1, Percentage: 20
Roundtrip Min: 0 ms, Max: 30 ms, Average: 15 ms, Jitter: 1 ms
Per test packet:
    Sequence: 1, Result: The active lsp-id is not found., Roundtrip: 0 ms
    Sequence: 2, Result: Response Received, Roundtrip: 0 ms
    Sequence: 3, Result: Response Received, Roundtrip: 0 ms
    Sequence: 4, Result: Response Received, Roundtrip: 30 ms
    Sequence: 5, Result: Response Received, Roundtrip: 30 ms
Test Run: 2
Total number of attempts: 5
Number of requests that failed to be sent out: 0
Number of responses that were received: 5
Number of requests that did not receive any response: 0
Total number of failures: 0, Percentage: 0
Roundtrip Min: 0 ms, Max: 40 ms, Average: 14 ms, Jitter: 5 ms
Per test packet:
    Sequence: 1, Result: Response Received, Roundtrip: 40 ms
    Sequence: 2, Result: Response Received, Roundtrip: 0 ms
    Sequence: 3, Result: Response Received, Roundtrip: 0 ms
    Sequence: 4, Result: Response Received, Roundtrip: 0 ms
    Sequence: 5, Result: Response Received, Roundtrip: 30 ms
```

OAM Command Reference

Command Hierarchies

Operational Commands

GLOBAL
- **oam**
  - **dns target-addr** *dns-name* **name-server** *ip-address* [**source** *ip-address*] **[count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**record-type** {**ipv4-a-record** | **ipv6-aaaa-record**}]
  - **dns** [*ip-address* | *dns-name*] [**rapid** | **detail**] [**ttl** *time-to-live*] [**tos** *type-of-service*] [**size** *bytes*] [**pattern pattern**] [**source** *ip-address* | *ipv6-address* | *dns-name*] [**interval** *seconds*] [{**next-hop** *ip-address*} | {**interface** *interface-name*} | **bypass-routing**] [**count** *requests*] [**do-not-fragment**] [**router** *router-instance*] [**timeout** *timeout*]
  - **traceroute** [*ip-address* | *dns-name*] [**ttl** *ttl*] [**wait** *milli-seconds*] [**no-dns**][**source** *src-ip-address*] [**tos** *type-of-service*] [**router** [*router-instance*]

ATM Diagnostics

GLOBAL
- **oam**
  - **atm-ping** *port-id*:*vpi*/*vci* [**end-to-end** | **segment**] [**dest** *destination-id*][**send-count** *send-count*][**timeout** *seconds*][**interval** *seconds*]

LDP Diagnostics

GLOBAL
- **oam**
  - **ldp-treetrace** {**prefix** *ip-prefix/mask*} [**max-ttl** *ttl-value*] [**max-path** *max-paths*] [**timeout** *timeout*] [**retry-count** *retry-count*] [**fc** *fc-name* [**profile** *profile*]]
- **config**
  - **test-oam**
    - [**no**] **ldp-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*[...(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**

LSP Diagnostics

GLOBAL
— **oam**
— **lsp-ping** {{[*lsp-name]* [**path** path-name]} | {**prefix** ip-prefix/mask}} [**fc** *fc-name*] [**profile** {**in** | **out**}]] [**size** *octets*] [**ttl** *label-ttl*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**path-destination** *ip-address*] [**interface** *if-name* | **next-hop** *ip-address*]][**detail**]
— **lsp-trace** {{[*lsp-name]* [**path** path-name]} | {**prefix** ip-prefix/mask}} [**fc** *fc-name*] [**profile** {**in** | **out**}]] [**max-fail** *no-response-count*] [**probe-count** *probes-per-hop*] [**size** *octets*][**min-ttl** *min-label-ttl*]] [**max-ttl** *max-label-ttl*] [**timeout** *timeout*] [[**interval** *interval*] [**path-destination** *ip-address*] [**interface** *if-name* | **next-hop** *ip-address*]][**detail**]

SDP Diagnostics

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

Service Diagnostics

GLOBAL
— **oam**
— **ancp** {**subscriber** *sub-ident-string* | **ancp-string** *ancp-string*} **loopback** [**count** *count*] [**timeout** *seconds*] [**alarm**]
— **ancp subscriber** *sub-ident-string* **loopback** [**count** *send-count*] [**timeout** *seconds*] [**alarm**]
— **svc-ping** {*ip-addr* | *dns-name*} **service** *service-id* [**local-sdp**] [**remote-sdp**]
— **host-connectivity-verify service** *service-id* [**sap** *sap-id*]
— **host-connectivity-verify subscriber** *sub-ident-string* [**sla-profile** *sla-profile-name*]
— **vprn-ping** *service-id* **source** *src-ip* **destination** *ip-address* [**fc** *fc-name* [**profile** {**in** | **out**]] [**size** *size*] [**ttl** *vc-label-ttl*] [**return-control**] [**interval** *interval*] [**count** *send-count*] [**timeout** *timeout*]
— **vprn-trace** *service-id* **source** *src-ip* **destination** *ip-address* [**fc** *fc-name* [**profile** {**in** | **out**]] [**size** *size*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**return-control**] [**probe-count** *send-count*] [**interval** *seconds*] [**timeout** *timeout*]

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* [**fc** *fc-name* [**profile** {**in** | **out**}]] [**size** *octets*] [**reply-mode** *ip-routed*|*countrol-channel*] [**probe-count** *probes-per-hop*] [**timeout** *timeout*] [**interval** *interval*] [**min-ttl** *min-vc-label-ttl*] [**max-ttl** max-*vc-label-ttl*] [**max-fai**l *no-response-count*] [**detail**]

VPLS MAC Diagnostics

GLOBAL
— **oam**
— **cpe-ping** **service** *service-id* **destination** *dst-ieee-address* **source** *ip-address* [**source-mac** *ieee-address*][**ttl** *vc-label-ttl*] [**count** *send-count*] [**send-control**] [**return-control**] [**interval** *interval*]
— **dns** **target-addr** *dns-name* **name-server** *ip-address* [**source** *ip-address*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]
— **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-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**]
— **mac-trace** *service-id* **destination** *ieee-address* [**size** *octets*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**send-control**] [**return-control**] [**source** *ieee-address*] [**probe-count** *probes-per-hop*] [**interval** *interval*]
— **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*]
— **mfib-ping** **service** *service-id* **source** *src-ip* **destination** *mcast-address* [**size** *size*] [**ttl** *vc-label-ttl*] [**return-control**] [**interval** *interval*] [**count** *send-count*] [**timeout** *timeout*]

Ethernet in the First Mile (EFM) Commands

— **efm** *port-id*
— **local-loopback** {**start** | **stop**}
— **remote-loopback** {**start** | **stop**}

Dot1ag OAM Commands

oam
— **dot1ag linktrace** *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**ttl** *ttl-value*]
— **dot1ag loopback** *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**send-count** *send-count*] [**size** *data-size*] [**priority** *priority*]

SAA Command Reference

Command Hierarchies

Configuration Commands

config
- **saa**
  - [**no**] **test** *test-name* [**owner** *test-owner*]
    - **description** *description-string*
    - **no description**
    - [**no**] **jitter-event** **rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]
    - [**no**] **latency-event** **rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]
    - [**no**] **loss-event** **rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]
    - [**no**] **shutdown**
    - [**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*]
      - **dns** **target-addr** *dns-name* **name-server** *ip-address* [**source** *ip-address*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]
      - **icmp-ping** [*ip-address* | *dns-name*] [**rapid** | **detail**] [**ttl** *time-to-live*] [**tos** *type-of-service*] [**size** *bytes*] [**pattern** *pattern*] [**source** *ip-address* | *dns-name*] [**interval** *seconds*] [{**next-hop** *ip-address*}|{**interface** *interface-name*}|**bypass-routing**] [**count** *requests*] [**do-not-fragment**] [**router** *router-instance*] [**timeout** *timeout*]
      - **icmp-trace** [*ip-address* | *dns-name*] [**ttl** *time-to-live*] [**wait** *milli-seconds*] [**tos** *type-of-service*] [**source** *ip-address*] [**tos** *type-of-service*] [**router** *router-instance*]
      - **lsp-ping** {{*lsp-name* [**path** *path-name*]}|{**prefix** *ip-prefix/mask*}} [**size** *octets*] [**ttl** *label-ttl*] [**timeout** *timeout*] [**interval** *interval*] [**fc** {**be**|**l2**|**af**|**l1**|**h2**|**ef**|**h1**|**nc**} [**profile** {in|out}]] [**send-count** *send-count*]
      - **lsp-trace** {*lsp-name* [**path** *path-name*]} | {**prefix** *ip-prefix/mask*}} [**size** *octets*] [**min-ttl** *min-label-ttl*] [**max-ttl** *max-label-ttl*] [**max-fail** *no-response-count*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**fc** *fc-name* [**profile** {**in** | **out**}]]
      - **mac-ping** **service** *service-id* **destination** *ieee-address* [**size** *octets*] [**ttl** *vc-label-ttl*] [**send-control**] [**return-control**] [**source** *ieee-address*] [**interval** *interval*] [**count** *send-count*]
      - **mac-trace** **service** *service-id* **destination** *ieee-address* [**size** *octets*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**send-control**] [**return-control**] [**source** ieee-address] [**probe-count** *probes-per-hop*] [**interval** *interval*]
      - **sdp-ping** *orig-sdp-id* [**resp-sdp** *resp-sdp-id*] [**fc** *fc-name* [**profile** {**in** | **out**}]] [**timeout** *seconds*] [**interval** *seconds*] [**size** *octets*] [**count** *send-count*]
      - **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* [**fc fc-name** [**profile** {**in** | **out**}]] [**size** *octets*] [**probe-count** *probes-per-hop*] [**timeout** *timeout*] [**interval** *interval*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**max-fail** *no-response-count*] [**detail**]
— **vprn-ping** *service-id* source *src-ip* **destination** *dst-ip* [**size** *size*] [**ttl** *vc-label-ttl*] [**return-control**] [**interval** *interval*] [**count** *send-count*] [**timeout** *timeout*]
— **vprn-trace** *service-id* source *src-ip* **destination** *dst-ip* [**size** *size*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**return-control**] [**probe-count** *probes-per-hop*] [**interval** *seconds*] [**timeout** *timeout*]

SAA Diagnostics

GLOBAL
— oam
— **saa** *test-name* [**owner** *test-owner*] {**start**|**stop**}

Show Commands

show
- **dot1ag**
  - **association** [*ma-index*] [**detail**]
  - **cfm-stack-table** [**port** [*port-id* [**vlan** *vlan-id*]]|**sdp** *sdp-id*[:*vc-id*]][**level** 0..7] [**direction up** | **down**]
  - **domain** [*md-index*] [**association** *ma-index* | **all-associations**] [**detail**]
  - **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**loopback**] [**linktrace**]
  - *ty*] {**true** | **false**}]
- **saa** [*test-name* [**owner** *test-owner*]]
- **test-oam**
  - **ldp-treetrace** [**prefix** *ip-prefix/mask*] [**detail**]

Clear Commands

clear
- **saa** [*test-name* [**owner** *test-owner*]]

Debug Commands

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

OAM and SAA Commands

Command Hierarchies

Operational Commands

shutdown

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

Context config>saa>test

In order to modify an existing test it must first be shut down. When a test is created it will be in shutdown mode until a **no shutdown** command is executed.

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

Use the **no** form of the command to set the state of the test to operational.

shutdown

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

Context config>test-oam>ldp-treetrace

Description This command suspends the background process running the LDP ECMP OAM tree discovery and path probing features. The configuration is not deleted.

Use the **no** form of the command to enable the background process.

dns

Syntax **dns target-addr** *dns-name* **name-server** *ip-address* [**source** *ip-address*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**record-type** {**ipv4-a-record | ipv6-aaaa-record**}]

Context oam

Description This command performs DNS name resolution. If ipv4-a-record is specified, dns-names are queried for A-records only. If ipv6-aaaa-record is specified, AAAA-records are queried first, and if a successful reply is not received, the dns-server is queried for A-records.

Parameters *dns-name* — [max 255 characters]

ip-address — The IP or IPv6 address of the primary DNS server.

ipv4-address - a.b.c.d

ipv6-address - x:x:x:x:x:x:x:x (eight 16-bit pieces)

x:x:x:x:x:x:d.d.d.d

x - [0..FFFF]H

d - [0..255]D

send-count — [1..100]

Default 1

timeout — [1..100] seconds

Default 5

interval — [1..100] seconds

Default 1

ping

Syntax **ping** [*ip-address* | *dns-name*] [**rapid** | **detail**] [**ttl** *time-to-live*] [**tos** *type-of-service*] [**size** *bytes*] [**pattern** *pattern*] [**source** *ip-address* | *dns-name*] [**interval** *seconds*] [{**next-hop** *ip-address*} | {**interface** *interface-name*} | **bypass-routing**] [**count** *requests*] [**do-not-fragment**] [**router** *router-instance*] [**timeout** *timeout*]

Context <GLOBAL>

Description This command verifies the reachability of a remote host.

Parameters *ip-address* — The far-end IP address to which to send the **svc-ping** request message in dotted decimal notation.

Values

ipv4-address:	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x[-interface]
	x:x:x:x:x:x:d.d.d.d[-interface]
x:	[0 — FFFF]H
d:	[0 — 255]D
interface:	32 characters maximum, mandatory for link local addresses

dns-name — The DNS name of the far-end device to which to send the **svc-ping** request message, expressed as a character string.

rapid — Packets will be generated as fast as possible instead of the default 1 per second.

detail — Displays detailed information.

ttl *time-to-live* **—** The TTL value for the MPLS label, expressed as a decimal integer.

Values 1 — 128

tos *type-of-service* **—** Specifies the service type.

Values 0 — 255

size *bytes* **—** The request packet size in bytes, expressed as a decimal integer.

Values 0 — 16384

pattern ***pattern*** **—** The date portion in a ping packet will be filled with the pattern value specified. If not specified, position info will be filled instead.

Values 0 — 65535

source *ip-address* **—** Specifies the IP address to be used.

Values	ipv4-address:	a.b.c.d
	ipv6-address:	x:x:x:x:x:x:x:x
		x:x:x:x:x:x:d.d.d.d
		x: [0 — FFFF]H
		d: [0 — 255]D

router router-instance **—** Specifies the router name or service ID.

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

Default Base

bypass-routing — Specifies whether to send the ping request to a host on a directly attached network bypassing the routing table.

interface ***interface-name*** **—** Specifies the name of an IP interface. The name must already exist in the **config>router>interface** context.

next-hop *ip-address* **—** Only displays static routes with the specified next hop IP address.

Values	ipv4-address:	a.b.c.d (host bits must be 0)
	ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x: [0 — FFFF]H
		d: [0 — 255]D

count *requests* **—** Specifies the number of times to perform an OAM ping probe operation. Each OAM echo message request must either timeout or receive a reply before the next message request is sent.

Values 1 — 100000

Default 5

do-not-fragment — Sets the DF (Do Not Fragment) bit in the ICMP ping packet.

timeout *seconds* **—** Overrides the default **timeout** value and is the amount of time that the router will wait for a message reply after sending the message request. Upon the expiration of message timeout, 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.

Default 5

Values 1 — 10

traceroute

Syntax **traceroute** [*ip-address* | *dns-name*] [**ttl** *ttl*] [**wait** *milli-seconds*] [**no-dns**] [**source** *ip-address*] [**tos** *type-of-service*] [**router** *router-instance*]

Context <GLOBAL>

Description The TCP/IP traceroute utility determines the route to a destination address. DNS lookups of the responding hosts is enabled by default.

```
*A:ALA-1# traceroute 192.168.xx.xx4
traceroute to 192.168.xx.xx4, 30 hops max, 40 byte packets
 1  192.168.xx.xx4 0.000 ms  0.000 ms  0.000 ms
*A:ALA-1#
```

Parameters *ip-address* — The far-end IP address to which to send the traceroute request message in dotted decimal notation.

Values

ipv4-address :	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x
	x:x:x:x:x:x:d.d.d.d
	x: [0 — FFFF]H
	d: [0 — 255]D

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

ttl *ttl* — The maximum Time-To-Live (TTL) value to include in the traceroute request, expressed as a decimal integer.

Values 1 — 255

wait *milliseconds* **—** The time in milliseconds to wait for a response to a probe, expressed as a decimal integer.

Default 5000

Values 1 — 60000

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 are performed

source *ip-address* **—** The source IP address to use as the source of the probe packets in dotted decimal notation. If the IP address is not one of the device's interfaces, an error is returned.

tos *type-of-service* **—** The type-of-service (TOS) bits in the IP header of the probe packets, expressed as a decimal integer.

Values 0 — 255

router *router-name* **—** Specify the alphanumeric character string up to 32 characters.

Default Base

router *service-id* **—** The unique service identification number identifying the service in the service domain. This ID must be unique to this service and may not be used for any other service of any type. The *service-id* must be the same number used for every 7750 SR on which this service is defined.

Values 1 — 2147483647

ATM Diagnostics

atm-ping

Syntax **atm-ping** *port-id*: *vpi/vci* [**end-to-end** | **segment**] [**dest** *destination-id*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *seconds*]

Context <GLOBAL>

Description This command tests ATM path connectivity and round trip time on an ATM VCC.

Parameters *port-id:vpi/vci* — Specifies the ID of the access port of the target VC. This parameter is required.

Values

port-id	*slot/mda/port*
aps-id	aps-*group-id*
	aps keyword
	group-id 1 — 64
vpi	0 — 4095 (NNI)
	0 — 255 (UNI)
vci	1, 2, 5 — 65535

end-to-end | **segment —** Specifies whether the ATM OAM loopback cell is destined to the first segment point in the line direction or the PVCC's connection endpoint.

dest *destination-id* **—** Defines the LLID field in an OAM loopback cell. If set to all 1s, only the connection end (end-to-end ping) or segment end (segment ping) will respond to the ping. If the 'segment' parameter is specified and 'dest' is set to a specific destination, only the destination will respond to the ping.

Values A 16 byte octet string, with each octet separated by a colon, if not specified the value of all 0x11 will be used.

send-count *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 timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *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. Upon the expiration of message timeout, 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 5

Values 1 — 10

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, 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.

Default 1

Values 1 — 10

Service Diagnostics

ancp

Syntax **ancp** {**subscriber** *sub-ident-string* | **ancp-string** *ancp-string*} **loopback** [**count** *count*] [**timeout** *seconds*] [**alarm**]
ancp subscriber *sub-ident-string* **loopback** [**count** *send-count*] [**timeout** *seconds*] [**alarm**]

Context <global>

Description This command sends an OAM request to the access node. ANCP can be used to send OAM messages to the access node. The access node must be able to accept these messages and will signal such support by the capability negotiations. If the operator attempts to send an OAM command to an access node that does not support such command the operation results in an error.

Parameters **subscriber *sub-ident-string* —** Specifies an existing subscriber-id. The node will use the ancp-string associated with the provided subscriber-id to identify the circuit.

ancp-string *ancp-string* **—** Specifies an existing ANCP string.

count *send-count* **—** Specifies the number of messages the access node will use to test the circuit. If omitted, the number will be determined by the access node via local policy.

1 — 32

timeout *seconds* **—** Specifies how long the controlling node will wait for a result.

0 — 300

alarm — Specifies that the CLI the result will be retuned to the CLI and a trap will be issued to indicate the test finished. If the flag is used through SNMP the results will be available in the results MIB and after the node sent the trap to indicate the results are ready.

loopback — Sends an OAM loopback test request to the access node

sdp-mtu

Syntax **sdp-mtu** *orig-sdp-id* **size-inc** *start-octets end-octets* [**step** *step-size*] [**timeout** *seconds*] [**interval** *seconds*]

Context <GLOBAL>

Description Performs MTU Path tests on an SDP to determine the largest path-mtu supported on an SDP. The **size-inc** parameter can be used to easily determine the **path-mtu** of a given SDP-ID. The forwarding class is assumed to be Best-Effort Out-of-Profile. The message reply is returned with IP/GRE encapsulation from the far-end 7750 SR. OAM request messages sent within an IP/GRE SDP must have the 'DF' IP header bit set to 1 to prevent message fragmentation.
To terminate an **sdp-mtu** in progress, use the CLI break sequence <Ctrl-C>.

Special Cases

SDP Path MTU Tests — SDP Path MTU tests can be performed using the **sdp-mtu size-inc** keyword to easily determine the **path-mtu** of a given SDP-ID. The forwarding class is assumed to be Best-Effort Out-of-Profile. The message reply is returned with IP/GRE encapsulation from the far-end 7750 SR.

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. Once a response is received, the next size message is sent.
The response message indicates the result of the message request.

After the last reply has been received or response timeout, the maximum size message replied to indicates the largest size OAM Request message that received a valid reply.

Parameters

orig-sdp-id — The SDP-ID to be used by **sdp-ping,** expressed as a decimal integer. The far-end address of the specified SDP-ID is the expected *responder-id* within each reply received. The specified SDP-ID defines the encapsulation of the SDP tunnel encapsulation used to reach the far end. This can be IP/GRE 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 — 17407

size-inc *start-octets end-octets* **—** Indicates an incremental Path MTU test will be performed with by sending a series of message requests with increasing MTU sizes. The *start-octets* and *end-octets* parameters are described below.

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

Values 40 — 9198

end-octets — The ending size in octets of the last message sent for an incremental MTU test, expressed as a decimal integer. The specified value must be greater than *start-octets*.

Values 40 — 9198

step *step-size* **—** 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.

Default 32

Values 1 — 512

timeout *seconds* **—** 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. Upon the expiration of message timeout, 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.

Default 5

Values 1 — 10

interval *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, 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.

Default 1

Values 1 — 10

Output **Sample SDP MTU Path Test Sample 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 <GLOBAL>

Description Tests a service ID for correct and consistent provisioning between two service end points.

The **svc-ping** command accepts a far-end IP address and a Service-ID for local and remote service testing. The following information can be determined from **svc-ping**:

1. Local and remote service existence
2. Local and remote service state
3. Local and remote service type correlation
4. Local and remote customer association
5. Local and remote service-to-SDP bindings and state
6. Local and remote ingress and egress service label association

Unlike **sdp-ping**, only a single message will be sent per command; no count nor interval parameter is supported and round trip time is not calculated. A timeout value of 10 seconds is used before failing the request. The forwarding class is assumed to be Best-Effort Out-of-Profile

If no request is sent or a reply is not received, all remote information will be shown as N/A.

To terminate a **svc-ping** in progress, use the CLI break sequence <Ctrl-C>.

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

Field	Description	Values
Request Result	The result of the **svc-ping** request message.	Sent - Request Timeout
		Sent - Request Terminated
		Sent - Reply Received
		Not Sent - Non-Existent Service-ID
		Not Sent - Non-Existent SDP for Service
		Not Sent - SDP For Service Down
		Not Sent - Non-existent Service Egress Label
Service-ID	The ID of the service being tested.	*service-id*
Local Service Type	The type of service being tested. If *service-id* does not exist locally, N/A is displayed.	Epipe, Ipipe, Fpipe, Apipe
		TLS
		IES
		Mirror-Dest
		N/A
Local Service Admin State	The local administrative state of *service-id*. If the service does not exist locally, the administrative state will be Non-Existent.	Admin-Up
		Admin-Down
		Non-Existent
Local Service Oper State	The local operational state of *service-id*. If the service does not exist locally, the state will be N/A.	Oper-Up
		Oper-Down
		N/A

Field	Description	Values (Continued)
Remote Service Type	The remote type of service being tested. If *service-id* does not exist remotely, N/A is displayed.	Epipe, Ipipe, Fpipe, Apipe TLS IES Mirror-Dest N/A
Remote Service Admin State	The remote administrative state of *service-id*. If the service does not exist remotely, the administrative state is Non-Existent.	Up Down Non-Existent
Local Service MTU	The local **service-mtu** for *service-id*. If the service does not exist, N/A is displayed.	*service-mtu* N/A
Remote Service MTU	The remote **service-mtu** for *service-id*. If the service does not exist remotely, N/A is displayed.	*remote-service-mtu* N/A
Local Customer ID	The local *customer-id* associated with *service-id*. If the service does not exist locally, N/A is displayed.	*customer-id* N/A
Remote Customer ID	The remote *customer-id* associated with *service-id*. If the service does not exist remotely, N/A is displayed.	*customer-id* N/A
Local Service IP Address	The local system IP address used to terminate remotely configured SDP-ID (as the **far-end** address). If an IP interface has not been configured to be the system IP address, N/A is displayed.	*system-ip-address* N/A
Local Service IP Interface Name	The name of the local system IP interface. If the local system IP interface has not been created, N/A is displayed.	*system-interface-name* N/A
Local Service IP Interface State	The state of the local system IP interface. If the local system IP interface has not been created, Non-Existent is displayed.	Up Down Non-Existent
Expected Far-end Address	The expected IP address for the remote system IP interface. This must be the **far-end** address entered for the **svc-ping** command.	*orig-sdp-far-end-addr* *dest-ip-addr* N/A
Actual Far-end Address	The returned remote IP address. If a response is not received, the displayed value is N/A. If the far-end service IP interface is down or non-existent, a message reply is not expected. **sdp-ping** should also fail.	*resp-ip-addr* N/A

Field	Description	Values (Continued)
Responders Expected Far-end Address	The expected source of the originator's SDP-ID from the perspective of the remote 7750 SR terminating the SDP-ID. If the far-end cannot detect the expected source of the ingress SDP-ID or the request is transmitted outside the SDP-ID, N/A is displayed.	*resp-rec-tunnel-far-end-address* N/A
Originating SDP-ID	The SDP-ID used to reach the **far-end** IP address if **sdp-path** is defined. The originating SDP-ID must be bound to the *service-id* and terminate on the **far-end** IP address. If an appropriate originating SDP-ID is not found, Non-Existent is displayed.	orig-sdp-id Non-Existent
Originating SDP-ID Path Used	Whether the Originating 7750 SR used the originating SDP-ID to send the **svc-ping** request. If a valid originating SDP-ID is found, operational and has a valid egress service label, the originating 7750 SR should use the SDP-ID as the requesting path if **sdp-path** has been defined. If the originating 7750 SR uses the originating SDP-ID as the request path, Yes is displayed. If the originating 7750 SR does not use the originating SDP-ID as the request path, No is displayed. If the originating SDP-ID is non-existent, N/A is displayed.	Yes No N/A
Originating SDP-ID Administrative State	The local administrative state of the originating SDP-ID. If the SDP-ID has been shutdown, Admin-Down is displayed. If the originating SDP-ID is in the no shutdown state, Admin-Up is displayed. If an originating SDP-ID is not found, N/A is displayed.	Admin-Up Admin-Up N/A
Originating SDP-ID Operating State	The local operational state of the originating SDP-ID. If an originating SDP-ID is not found, N/A is displayed.	Oper-Up Oper-Down N/A
Originating SDP-ID Binding Admin State	The local administrative state of the originating SDP-IDs binding to *service-id*. If an SDP-ID is not bound to the service, N/A is displayed.	Admin-Up Admin-Up N/A
Originating SDP-ID Binding Oper State	The local operational state of the originating SDP-IDs binding to *service-id*. If an SDP-ID is not bound to the service, N/A is displayed.	Oper-Up Oper-Down N/A
Responding SDP-ID	The SDP-ID used by the far end to respond to the **svc-ping** request. If the request was received without the **sdp-path** parameter, the responding 7750 SR 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 7750 SR that is bound to the *service-id*, Non-Existent is displayed.	*resp-sdp-id* Non-Existent

Field	Description	Values (Continued)
Responding SDP-ID Path Used	Whether the responding 7750 SR used the responding SDP-ID to respond to the **svc-ping** request. If the request was received via the originating SDP-ID and a valid return SDP-ID is found, operational and has a valid egress service label, the far-end 7750 SR should use the SDP-ID as the return SDP-ID. If the far end uses the responding SDP-ID as the return path, Yes is displayed. If the far end does not use the responding SDP-ID as the return path, No is displayed. If the responding SDP-ID is non-existent, N/A is displayed.	Yes No N/A
Responding SDP-ID Administrative State	The administrative state of the far-end SDP-ID associated with the return path for *service-id*. When a return path is administratively down, Admin-Down is displayed. If the return SDP-ID is administratively up, Admin-Up is displayed. If the responding SDP-ID is non-existent, N/A is displayed.	Admin-Up Admin-Up N/A
Responding SDP-ID Operational State	The operational state of the far-end SDP-ID associated with the return path for *service-id*. When a return path is operationally down, Oper-Down is displayed. If the return SDP-ID is operationally up, Oper-Up is displayed. If the responding SDP-ID is non-existent, N/A is displayed.	Oper-Up Oper-Down N/A
Responding SDP-ID Binding Admin State	The local administrative state of the responder's SDP-ID binding to *service-id*. If an SDP-ID is not bound to the service, N/A is displayed.	Admin-Up Admin-Down N/A
Responding SDP-ID Binding Oper State	The local operational state of the responder's SDP-ID binding to *service-id*. If an SDP-ID is not bound to the service, N/A is displayed.	Oper-Up Oper-Down N/A
Originating VC-ID	The originator's VC-ID associated with the SDP-ID to the far-end address that is bound to *service-id*. If the SDP-ID signaling is off, *originator-vc-id* is 0. If the *originator-vc-id* does not exist, N/A is displayed.	*originator-vc-id* N/A
Responding VC-ID	The responder's VC-ID associated with the SDP-ID to *originator-id* that is bound to *service-id*. If the SDP-ID signaling is off or the service binding to SDP-ID does not exist, *responder-vc-id* is 0. If a response is not received, N/A is displayed.	*responder-vc-id* N/A
Originating Egress Service Label	The originating service label (VC-Label) associated with the *service-id* for the originating SDP-ID. If *service-id* does not exist locally, N/A is displayed. If *service-id* exists, but the egress service label has not been assigned, Non-Existent is displayed.	*egress-vc-label* N/A Non-Existent

Field	Description	Values (Continued)
Originating Egress Service Label Source	The originating egress service label source. If the displayed egress service label is manually defined, Manual is displayed. If the egress service label is dynamically signaled, Signaled is displayed. If the *service-id* does not exist or the egress service label is non-existent, N/A is displayed.	Manual Signaled N/A
Originating Egress Service Label State	The originating egress service label state. If the originating 7750 SR considers the displayed egress service label operational, Up is displayed. If the originating 7750 SR considers the egress service label inoperative, Down is displayed. If the *service-id* does not exist or the egress service label is non-existent, N/A is displayed.	Up Down N/A
Responding Service Label	The actual responding service label in use by the far-end 7750 SR for this *service-id* to the originating 7750 SR. If *service-id* does not exist in the remote 7750 SR, N/A is displayed. If *service-id* does exist remotely but the remote egress service label has not been assigned, Non-Existent is displayed.	*rec-vc-label* N/A Non-Existent
Responding Egress Service Label Source	The responder's egress service label source. If the responder's egress service label is manually defined, Manual is displayed. If the responder's egress service label is dynamically signaled, Signaled is displayed. If the *service-id* does not exist on the responder or the responder's egress service label is non-existent, N/A is displayed.	Manual Signaled N/A
Responding Service Label State	The responding egress service label state. If the responding 7750 SR considers its egress service label operational, Up is displayed. If the responding 7750 SR considers its egress service label inoperative, Down is displayed. If the *service-id* does not exist or the responder's egress service label is non-existent, N/A is displayed.	Up Down N/A
Expected Ingress Service Label	The locally assigned ingress service label. This is the service label that the far-end is expected to use for *service-id* when sending to the originating 7750 SR. If *service-id* does not exist locally, N/A is displayed. If *service-id* exists but an ingress service label has not been assigned, Non-Existent is displayed.	*ingress-vc-label* N/A Non-Existent
Expected Ingress Label Source	The originator's ingress service label source. If the originator's ingress service label is manually defined, Manual is displayed. If the originator's ingress service label is dynamically signaled, Signaled is displayed. If the *service-id* does not exist on the originator or the originators ingress service label has not been assigned, N/A is displayed.	Manual Signaled N/A

Field	Description	Values (Continued)
Expected Ingress Service Label State	The originator's ingress service label state. If the originating 7750 SR considers its ingress service label operational, Up is displayed. If the originating 7750 SR considers its ingress service label inoperative, Down is displayed. If the *service-id* does not exist locally, N/A is displayed.	Up Down N/A
Responders Ingress Service Label	The assigned ingress service label on the remote 7750 SR. This is the service label that the far end is expecting to receive for *service-id* when sending to the originating 7750 SR. If *service-id* does not exist in the remote 7750 SR, N/A is displayed. If *service-id* exists, but an ingress service label has not been assigned in the remote 7750 SR, 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 7750 SR. If the ingress service label is manually defined on the remote 7750 SR, Manual is displayed. If the ingress service label is dynamically signaled on the remote 7750 SR, Signaled is displayed. If the *service-id* does not exist on the remote 7750 SR, N/A is displayed.	Manual Signaled N/A
Responders Ingress Service Label State	The assigned ingress service label state on the remote 7750 SR. If the remote 7750 SR considers its ingress service label operational, Up is displayed. If the remote 7750 SR considers its ingress service label inoperative, Down is displayed. If the *service-id* does not exist on the remote 7750 SR or the ingress service label has not been assigned on the remote 7750 SR, N/A is displayed.	Up Down N/A

Parameters *ip-address* — The far-end IP address to which to send the **svc-ping** request message in dotted decimal notation.

service *service-id* **—** The service ID of the service being tested must be indicated with this parameter. The Service ID need not exist on the local 7750 SR to receive a reply message.

Values 1 — 2147483647

local-sdp — Specifies the **svc-ping** request message should be sent using the same service tunnel encapsulation labeling as service traffic. If **local-sdp** is specified, the command attempts to use an egress SDP-ID bound to the service with the specified **far-end** IP address with the VC-Label for the service. The far-end address of the specified SDP-ID is the expected *responder-id* within the reply received. The SDP-ID defines the encapsulation of the SDP tunnel encapsulation used to reach the far end; this can be IP/GRE 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.

Local Service State	local-sdp Not Specified		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 **svc-ping** reply message from the **far-end** should be sent using the same service tunnel encapsulation labeling as service traffic.
If **remote-sdp** is specified, the **far-end** responder attempts to use an egress SDP-ID bound to the service with the message originator as the destination IP address with the VC-Label for the service. The SDP-ID defines the encapsulation of the SDP tunnel encapsulation used to reply to the originator; this can be IP/GRE 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.

Remote Service State	Message Encapsulation	
	remote-sdp Not Specified	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)

Sample Output

```
*A:router1> svc-ping far-end 10.10.10.10 service 101 local-sdp remote-sdp
Request Result: Sent - Reply Received

Service-ID: 101

Err       Basic Info              Local     Remote
---       -----------------       ------    ------
__        Type:                   TLS       TLS
__        Admin State:            Up        Up
__        Oper State:             Up        Up
__        Service-MTU:            1514      1514
__        Customer ID:            1001      1001

Err       System IP Interface Info
---       ------------------------------------------------------------
Local Interface Name: "7750 SR-System-IP-Interface (Up to 32 chars)…"
__        Local IP Interface State:         Up
__        Local IP Address:                 10.10.10.11
__        IP Address Expected By Remote:    10.10.10.11
__        Expected Remote IP Address:       10.10.10.10
__        Actual Remote IP Address:         10.10.10.10

Err       SDP-ID Info             Local     Remote
---       -----------------       ------    ------
__        Path Used:              Yes       Yes
__        SDP-ID:                 123       325
__        Administrative State:   Up        Up
__        Operative State:        Up        Up
__        Binding Admin State:    Up        Up
__        Binding Oper State:     Up        Up
__        Binding VC-ID:          101       101

Err       Service Label Information   Label     Source        State
---       -------------------------   -----     -----------   -----
__        Local Egress Label:         45        Signaled      Up
__        Remote Expected Ingress:    45        Signaled      Up
__        Remote Egress:              34        Signaled      Up
__        Local Expected Ingress:     34        Signaled      Up
```

host-connectivity-verify

Syntax **host-connectivity-verify service** *service-id* [**sap** *sap-id*]
host-connectivity-verify subscriber *sub-ident-string* [**sla-profile** *sla-profile-name*]

Context <GLOBAL>

Description This command enables host connectivity verification checks.

Parameters **service** *service-id* **—** Specifies the service ID to diagnose or manage.

Values 1 — 2147483647

sap *sap-id* — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for command syntax.

sub-profile *sub-profile-name* **—** Specifies an existing subscriber profile name. The subscriber profile is configured in the **config>subscr-mgmt>sub-profile** context.

sla-profile *sla-profile-name* **—** Specifies an existing SLA profile name. The SLA profile is configured in the **config>subscr-mgmt>sla-profile** context.

vprn-ping

Syntax **vprn-ping** *service-id* **source** *ip-address* **destination** *ip-address* [**fc** *fc-name* [**profile** [**in** | **out**]][**size** *size*] [**ttl** *vc-label-ttl*] [**return-control**] [**interval** *interval*] [**count** *send-count*] [**timeout** *timeout*]

Context <GLOBAL>
config>saa>test>type

Description This command performs a VPRN ping.

Parameters **service** *service-id* **—** The VPRN service ID to diagnose or manage.

Values 1 — 2147483647

source *ip-address* **—** The IP prefix for the source IP address in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255

destination *ip-address* **—** The IP prefix for the destination IP address in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255

fc-name — The forwarding class of the MPLS echo request encapsulation.

Default be

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

profile {**in** | **out**} **—** The profile state of the MPLS echo request encapsulation.

Default out

size *octets* **—** The OAM request packet size in octets, expressed as a decimal integer.

Values 1 — 65535

ttl *vc-label-ttl* **—** The TTL value in the VC label for the OAM request, expressed as a decimal integer.

Default 255

Values 1 — 255

return-control — Specifies the response to come on the control plane.

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second 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.

Default 1

Values 1 — 10

count *send-count* **—** The number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *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. Upon the expiration of message timeout, 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 5

Values 1 — 10

Sample Output

```
A:PE_1# oam vprn-ping 25 source 10.4.128.1 destination 10.16.128.0
Sequence Node-id                                Reply-Path Size     RTT
-------------------------------------------------------------------------------
[Send request Seq. 1.]
1        10.128.0.3:cpm                          In-Band   100      0ms
-------------------------------------------------------------------------------
...
A:PE_1#
-------------------------------------------------------------------------------
A:PE_1#
```

vprn-trace

Syntax **vprn-trace** *service-id* **source** *src-ip* **destination** *ip-address* [**fc** *fc-name* [**profile** [**in** | **out**]] [**size** *size*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**return-control**] [**probe-count** *probes-per-hop*] [**interval** *seconds*] [**timeout** *timeout*]

Context <GLOBAL>
config>saa>test>type

Description Performs VPRN trace.

Parameters **service** *service-id* **—** The VPRN service ID to diagnose or manage.

Values 1 — 2147483647

source *src-ip* **—** The IP prefix for the source IP address in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255

fc-name — The forwarding class of the MPLS echo request encapsulation.

Default be

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

profile {**in** | **out**} **—** The profile state of the MPLS echo request encapsulation.

Default out

destination *dst-ip* **—** The IP prefix for the destination IP address in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255

size *octets* **—** The OAM request packet size in octets, expressed as a decimal integer.

min-ttl *vc-label-ttl* **—** The minimum TTL value in the VC label for the trace test, expressed as a decimal integer.

Default 1

Values 1 — 255

max-ttl *vc-label-ttl* **—** The maximum TTL value in the VC label for the trace test, expressed as a decimal integer.

Default 4

Values 1 — 255

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.

probe-count *send-count* **—** The number of OAM requests sent for a particular TTL value, expressed as a decimal integer.

Default 1

Values 1 — 10

interval *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.

Default 1

Values 1 — 10

timeout *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. Upon the expiration of message timeout, 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 3

Values 1 — 10

Sample Output

```
A:PE_1# oam vprn-trace 25 source 10.4.128.1 destination 10.16.128.0
TTL Seq Reply Node-id         Rcvd-on         Reply-Path RTT
-------------------------------------------------------------------------------
[Send request TTL: 1, Seq. 1.]
1   1   1     10.128.0.4      cpm             In-Band    0ms
  Requestor 10.128.0.1 Route: 0.0.0.0/0
    Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
    Next Hops: [1] ldp tunnel
    Route Targets: [1]: target:65100:1
  Responder 10.128.0.4 Route: 10.16.128.0/24
    Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
    Next Hops: [1] ldp tunnel
    Route Targets: [1]: target:65001:100

[Send request TTL: 2, Seq. 1.]
2   1   1     10.128.0.3      cpm             In-Band    0ms
  Requestor 10.128.0.1 Route: 0.0.0.0/0
    Vpn Label: 131071 Metrics 0 Pref 170 Owner bgpVpn
    Next Hops: [1] ldp tunnel
    Route Targets: [1]: target:65100:1
  Responder 10.128.0.3 Route: 10.16.128.0/24
    Vpn Label: 0 Metrics 0 Pref 0 Owner local
    Next Hops: [1] ifIdx 2 nextHopIp 10.16.128.0

[Send request TTL: 3, Seq. 1.]
[Send request TTL: 4, Seq. 1.]
...
-------------------------------------------------------------------------------
A:PE_1#
```

VPLS MAC Diagnostics

mac-populate

Syntax **mac-populate** *service-id* **mac** *ieee-address* [**flood**] [**age** *seconds*] [**force**]

Context oam

Description This command populates the FIB with an OAM-type MAC entry indicating the node is the egress node for the MAC address and optionally floods the OAM MAC association throughout the service. The **mac-populate** command installs an OAM MAC into the service FIB indicating the device is the egress node for a particular MAC address. The MAC address can be bound to a particular SAP (the **target-sap**) or can be associated with the control plane in that any data destined to the MAC address is forwarded to the control plane (cpm). As a result, if the service on the node has neither a FIB nor an egress SAP, then it is not allowed to initiate a **mac-populate**.

The MAC address that is populated in the FIBs in the provider network is given a type OAM, so that it can be treated distinctly from regular dynamically learned or statically configured MACs. Note that OAM MAC addresses are operational MAC addresses and are not saved in the device configuration. An exec file can be used to define OAM MACs after system initialization.

The **force** option in **mac-populate** forces the MAC in the table to be type OAM in the case it already exists as a dynamic, static or an OAM induced learned MAC with some other type binding.
An OAM-type MAC cannot be overwritten by dynamic learning and allows customer packets with the MAC to either ingress or egress the network while still using the OAM MAC entry.

The **flood** option causes each upstream node to learn the MAC (that is, populate the local FIB with an OAM MAC entry) and to flood the request along the data plane using the flooding domain.The flooded **mac-populate** request can be sent via the data plane or the control plane. The **send-control** option specifies the request be sent using the control plane. If **send-control** is not specified, the request is sent using the data plane.
An **age** can be provided to age a particular OAM MAC using a specific interval. By default, OAM MAC addresses are not aged and can be removed with a **mac-purge** or with an FDB clear operation.

When split horizon group (SHG) is configured, the flooding domain depends on which SHG the packet originates from. The **target-sap** *sap-id* value dictates the originating SHG information.

Parameters **service** *service-id* **—** The Service ID of the service to diagnose or manage.

Values 1 — 2147483647

destination *ieee-address* **—** The MAC address to be populated.

flood — Sends the OAM MAC populate to all upstream nodes.

Default MAC populate only the local FIB.

age *seconds* **—** The age for the OAM MAC, expressed as a decimal integer.

Default The OAM MAC does not age.

Values 1 — 65535

force — Converts the MAC to an OAM MAC even if it currently another type of MAC.

Default Do not overwrite type.

target-sap *sap-id* **—** The local target SAP bound to a service on which to associate the OAM MAC. By default, the OAM MAC is associated with the control place, that is, it is associated with the CPU on the router.
When the **target-sap** *sap-id* value is not specified the MAC is bound to the CPM. The originating SHG is o (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). See Common CLI Command Descriptions on page 261 for sap-id command syntax.

mac-purge

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

Context <GLOBAL>
config>saa>test>type

Description This command removes an OAM-type MAC entry from the FIB and optionally floods the OAM MAC removal throughout the service. A **mac-purge** can be sent via the forwarding path or via the control plane. When sending the MAC purge using the data plane, the TTL in the VC label is set to 1. When sending the MAC purge using the control plane, the packet is sent directly to the system IP address of the next hop.

A MAC address is purged only if it is marked as OAM. A mac-purge request is an HVPLS OAM packet, with the following fields. The Reply Flags is set to 0 (since no reply is expected), the Reply Mode and Reserved fields are set to 0. The Ethernet header has source set to the (system) MAC address, the destination set to the broadcast MAC address. There is a VPN TLV in the FEC Stack TLV to identify the service domain.

If the register option is provided, the R bit in the Address Delete flags is turned on.

The **flood** option causes each upstream node to be sent the OAM MAC delete request and to flood the request along the data plane using the flooding domain. The flooded **mac-purge** request can be sent via the data plane or the control plane. The **send-control** option specifies the request be sent using the control plane. If **send-control** is not specified, the request is sent using the data plane.

The **register** option reserves the MAC for OAM testing where it is no longer an active MAC in the FIB for forwarding, but it is retained in the FIB as a registered OAM MAC. Registering an OAM MAC prevents relearns for the MAC based on customer packets. Relearning a registered MAC can only be done through a **mac-populate** request. The originating SHG is always 0 (zero).

Parameters **service** *service-id* **—** The Service ID of the service to diagnose or manage.

Values 1 — 2147483647

target *ieee-address* **—** The MAC address to be purged.

flood — Sends the OAM MAC purge to all upstream nodes.

Default MAC purge only the local FIB.

send-control — 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.

IGMP Snooping Diagnostics

mfib-ping

Syntax **mfib-ping service** *service-id* **source** *src-ip* **destination** *mcast-address* [**size** *size*] [**ttl** *vc-label-ttl*] [**return-control**] [**interval** *interval*] [**count** *send-count*] [**timeout** *timeout*]

Context oam
config>saa>test>type

Description The mfib-ping utility determines the list of SAPs which egress a certain IP multicast stream (identified by source unicast and destination multicast IP addresses) within a VPLS service. An mfib-ping packet is always sent via the data plane.

An mfib-ping is forwarded across the VPLS following the MFIB. If an entry for the specified source unicast and destination multicast IP addresses exist in the MFIB for that VPLS, 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 the specified IP multicast stream.

An mfib-ping reply can be sent using the data plane or the control plane. The return-control option specifies the reply be sent using the control plane. If return-control is not specified, the reply is sent using the data plane.

Parameters **service** *service-id* **—** The service ID of the VPLS to diagnose or manage.

Values 1 — 2147483647

source *src-ip* **—** The source IP address for the OAM request.

destination *mcast-address* **—** The destination multicast address for the OAM request.

size *size* **—** The multicast OAM request packet size in octets, expressed as a decimal integer. The request payload is padded to the specified size with a 6 byte PAD header and a byte payload of 0xAA as necessary.

If the octet size specified is less than the minimum packet, the minimum sized packet necessary to send the request is used.

Default No OAM packet padding.

Values 1 — 65535

ttl *vc-label-ttl* **—** The TTL value in the VC label for the OAM request, expressed as a decimal integer.

Default 255

Values 1 — 255

return-control **—** Specifies the OAM reply has to be sent using the control plane instead of the data plane.

Default OAM reply is sent using the data plane.

interval *interval* **—** The interval parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the interval is set to 1 second 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.

Default 1

Values 1 — 10

count *send-count* **—** The number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent.

The message interval value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *seconds* **—** 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 7750 SR will wait for a message reply after sending the next message request.

Upon the expiration of message timeout, the requesting 7750 SR 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.

Default 5

Values 1 — 100

Special Cases **MFIB 224.0.0.X pings —** Mfib-ping requests directed to a destination address in the special 224.0.0.X range are flooded throughout the service flooding domain and will receive a response from all operational SAPs. Note that SAPs that are operationally down do not reply. If EMG is enabled, mfib-ping will return only the first SAP in each chain.

Multicast FIB Connectivity Test Sample Output

```
A:ALA-A# oam mfib-ping service 10 source 10.10.10.1 destination 225.0.0.1 count 2
Seq Node-id                                                 Path     Size  RTT
-------------------------------------------------------------------------------
[Send request Seq. 1.]
1   51.51.51.51:sap1/1/1                                  Self     100   0ms
1   54.54.54.54:sap1/1/2                                  In-Band  100   20ms
1   54.54.54.54:sap1/1/3                                  In-Band  100   10ms
1   52.52.52.52:sap1/1/3                                  In-Band  100   20ms
[Send request Seq. 2.]
2   51.51.51.51:sap1/1/1                                  Self     100   0ms
2   52.52.52.52:sap1/1/2                                  In-Band  100   10ms
2   54.54.54.54:sap1/1/2                                  In-Band  100   10ms
2   52.52.52.52:sap1/1/3                                  In-Band  100   20ms
2   54.54.54.54:sap1/1/3                                  In-Band  100   30ms
-------------------------------------------------------------------------------
```

```
A:ALA-AIM# oam mfib-ping service 1 source 11.11.0.0 destination 224.0.0.1
Seq Node-id                                                 Path     Size  RTT
-------------------------------------------------------------------------------
[Send request Seq. 1.]
1   10.20.1.3:sap1/1/5:1                       Not in MFIB Self     40    0ms
1   10.20.1.3:sap1/1/2:1                                   Self     40    10ms
[Echo replies received: 2]
-------------------------------------------------------------------------------
A:ALA-AIM#
```

EFM Commands

efm

Syntax **efm** *port-id*

Context oam

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

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

local-loopback

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

Context oam>emf

Description This command enables local loopback tests on the specified port.

remote-loopback

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

Context oam>emf

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

In order for EFM OAM tunneling to function properly, EFM OAM tunneling should be configured for VLL services or a VPLS service with two SAPs only.

Dot1ag OAM Commands

dot1ag linktrace

Syntax **dot1ag linktrace** *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**ttl** *ttl-value*]

Context oam

Description The command specifies to initiate a linktrace test.

Parameters *mac-address* — Specifies a unicast destination MAC address.

mep *mep-id* **—** Specifies the target MAC address.

Values 1 — 8191

domain *md-index* **—** Specifies the MD index.

Values 1 — 4294967295

association *ma-index* **—** Specifies the MA index.

Values 1 — 4294967295

ttl *ttl-value* **—** Specifies the TTL for a returned linktrace.

Values 0 — 255

dot1ag loopback

Syntax **dot1ag loopback** *mac-address* **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**send-count** *send-count*] [**size** *data-size*] [**priority** *priority*]

Context oam

Description The command specifies to initiate a loopback test.

Parameters *mac-address* — Specifies a unicast MAC address.

mep *mep-id* **—** Specifies target MAC address.

Values 1 — 8191

domain *md-index* **—** Specifies the MD index.

Values 1 — 4294967295

association *ma-index* **—** Specifies the MA index.

Values 1 — 4294967295

send-count *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.

Default 1

Values 1 — 5

size *data-size* **—** The packet size in bytes, expressed as a decimal integer.

Values 0 — 1500

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

Values 0 — 7

Service Assurance Agent (SAA) Commands

saa

Syntax **saa**

Context config

Description This command creates the context to configure the Service Assurance Agent (SAA) tests.

test

Syntax **test** *name* [**owner** *test-owner*]
no test *name*

Context config>saa

Description This command identifies a test and create/modify 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 can only be modified while it is shut down.

The **no** form of this command removes the test from the configuration. In order to remove a test it can not be active at the time.

Parameters *name* — Identify the saa test name to be created or edited.

owner *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".

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 **description** command associates a text string with a configuration context to help identify the content in the configuration file.

The **no** form of this command removes the string from the configuration.

Default No description associated with the configuration context.

Parameters *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 (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

jitter-event

Syntax **jitter-event rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]
no jitter-event

Context config>saa>test

Description 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.

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.

Default 0

Values 0 — 2147483647 milliseconds

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.

Default 0

Values 0 — 2147483647 milliseconds

direction — Specifies the direction for OAM ping responses received for an OAM ping test run.

Values **inbound** — Monitor the value of jitter calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run.
outbound — Monitor the value of jitter calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run.
roundtrip — Monitor the value of jitter calculated for the round trip, two-way, OAM ping requests and replies for an OAM ping test run.

Default roundtrip

latency-event

Syntax **latency-event rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]
no latency-event

Context config>saa>test

Description 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.

Default 0

Values 0 — 2147483647 milliseconds

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.

Default 0

Values 0 — 2147483647 milliseconds

direction — Specifies the direction for OAM ping responses received for an OAM ping test run.

Values **inbound** — Monitor the value of jitter calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run.
outbound — Monitor the value of jitter calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run.
roundtrip — Monitor the value of jitter calculated for the round trip, two-way, OAM ping requests and replies for an OAM ping test run.

Default roundtrip

loss-event

Syntax **loss-event rising-threshold** *threshold* [**falling-threshold** *threshold*] [*direction*]
no loss-event

Context config>saa>test

Description Specifies that at the termination of an SAA testrun, the calculated loss event value is evaluated against the configured rising and falling loss event thresholds. SAA threshold events are generated as required.

The configuration of loss event thresholds is optional.

Parameters **rising-threshold** *threshold* **—** Specifies a rising threshold loss event value. When the test run is completed, the calculated loss event value is compared to the configured loss event rising threshold. If the test run loss event value is greater than the configured rising threshold value then an SAA threshold event is generated. The SAA threshold event is tmnxOamSaaThreshold, logger application OAM, event #2101.

Default 0

Values 0 — 2147483647 packets

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.

Default 0

Values 0 — 2147483647 packets

direction — Specifies the direction for OAM ping responses received for an OAM ping test run.

Values **inbound** — Monitor the value of jitter calculated for the inbound, one-way, OAM ping responses received for an OAM ping test run.
outbound — Monitor the value of jitter calculated for the outbound, one-way, OAM ping requests sent for an OAM ping test run.
roundtrip — Monitor the value of jitter calculated for the round trip, two-way, OAM ping requests and replies for an OAM ping test run.

Default roundtrip

type

Syntax **type**
no type

Context config>saa>test

Description This command creates 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 shut down mode.

Once a test type has been configured the command can be modified by re-entering the command, the test type must be the same as the previously entered test type.

To change the test type, the old command must be removed using the **config>saa>test>no type** command.

cpe-ping

Syntax **cpe-ping service** *service-id* **destination** *ip-address* **source** *ip-address* [**ttl** *vc-label-ttl*] [**return-control**] [**source-mac** *ieee-address*] [**fc** *fc-name* [**profile** [**in** | **out**]] [**interval** *interval*] [**count** *send-count*] [**send-control]**

Context <GLOBAL>
config>saa>test>type

Description This ping utility determines the IP connectivity to a CPE within a specified VPLS service.

Parameters **service** *service-id* **—** The service ID of the service to diagnose or manage.

Values 1 — 2147483647

destination *ip-address* **—** Specifies the IP address to be used as the destination for performing an OAM ping operations.

source *ip-address* **—** Specify an unused IP address in the same network that is associated with the VPLS.

ttl *vc-label-ttl* **—** The TTL value in the VC label for the OAM MAC request, expressed as a decimal integer.

Default 255

Values 1 — 255

return-control — Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply sent using the data plane.

source-mac *ieee-address* **—** Specify the source MAC address that will be sent to the CPE. If not specified or set to 0, the MAC address configured for the CPM is used.

fc-name — The forwarding class of the MPLS echo request encapsulation.

Default be

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

profile {**in** | **out**} **—** The profile state of the MPLS echo request encapsulation.

Default out

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second 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.

Default 1

Values 1 — 10

count *send-count* **—** The number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 255

send-control — Specifies the MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM request sent using the data plane.

dns

Syntax **dns target-addr** *dns-name* **name-server** *ip-address* [**source** *ip-address*] [**count** *send-count*] [**timeout** *timeout*] [**interval** *interval*]

Context <GLOBAL>
config>saa>test>type

Description This command configures a DNS name resolution test.

Parameters **target-addr —** The IP host address to be used as the destination for performing an OAM ping operation.

dns-name — The DNS name to be resolved to an IP address.

name-server *ip-address* **—** Specifies the server connected to a network that resolves network names into network addresses.

source *ip-address* **—** Specifies the IP address to be used as the source for performing an OAM ping operation.

send-count *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 timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *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. Upon the expiration of message timeout, 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 5

Values 1 — 10

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, 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.

Default 1

Values 1 — 10

icmp-ping

Syntax **icmp-ping** [*ip-address* | *dns-name*] [**rapid** | **detail**] [**ttl** *time-to-live*] [**tos** *type-of-service*] [**size** *bytes*] [**pattern** *pattern*] [**source** *ip-address* | *dns-name*] [**interval** *seconds*] [{**next-hop** *ip-address*} | {**interface** *interface-name*} | **bypass-routing**] [**count** *requests*] [**do-not-fragment**] [**router** *router-instance*] [**timeout** *timeout*]

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 **svc-ping** request message in dotted decimal notation.

Values

ipv4-address:	a.b.c.d	
ipv6-address:	x:x:x:x:x:x:x:x	
	x:x:x:x:x:x:d.d.d.d	
	x:	[0 — FFFF]H
	d:	[0 — 255]D

dns-name — The DNS name of the far-end device to which to send the **svc-ping** request message, expressed as a character string up to 63 characters maximum.

Values

ipv6-address:	x:x:x:x:x:x:x:x[-interface]
	x:x:x:x:x:x:d.d.d.d[-interface]
	x: [0 — FFFF]H
	d: [0 — 255]D
	interface (32 chars max, mandatory for link local addresses)

rapid — Packets will be generated as fast as possible instead of the default 1 per second.

detail — Displays detailed information.

ttl *time-to-live* **—** The TTL value for the MPLS label, expressed as a decimal integer.

Values 1 — 128

tos *type-of-service* **—** Specifies the service type.

Values 0 — 255

size *bytes* **—** The request packet size in bytes, expressed as a decimal integer.

Values 0 — 16384

pattern ***pattern*** **—** The date portion in a ping packet will be filled with the pattern value specified. If not specified, position info will be filled instead.

Values 0 — 65535

source *ip-address*|*dns-name* **—** Specifies the IP address to be used.

Values	ipv4-address:	a.b.c.d
	ipv6-address:	x:x:x:x:x:x:x:x
		x:x:x:x:x:x:d.d.d.d
		x: [0 — FFFF]H
		d: [0 — 255]D
	dns-name:	128 characters max

interval *seconds* **—** This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, 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.

Default 1

Values 1 — 10

next-hop *ip-address* **—** Only displays static routes with the specified next hop IP address.

Values	ipv4-address:	a.b.c.d (host bits must be 0)
	ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x: [0 — FFFF]H
		d: [0 — 255]D

interface ***interface-name*** **—** The name used to refer to the interface. The name must already exist in the **config>router>interface** context.

bypass-routing — Specifies whether to send the ping request to a host on a directly attached network bypassing the routing table.

count *requests* **—** Specifies the number of times to perform an OAM ping probe operation. Each OAM echo message request must either timeout or receive a reply before the next message request is sent.

Values 1 — 100000

Default 5

do-not-fragment — Sets the DF (Do Not Fragment) bit in the ICMP ping packet.

router *router-instance* **—** Specifies the router name or service ID.

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

Default Base

timeout *timeout* **—** Overrides the default **timeout** value and is the amount of time that the router will wait for a message reply after sending the message request. Upon the expiration of message timeout, 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 5

Values 1 — 10

icmp-trace

Syntax **icmp-trace** [*ip-address* | *dns-name*] [**ttl** *time-to-live*] [**wait** *milli-seconds*] [**tos** *type-of-service*] [**source** *ip-address*] [**tos** *type-of-service*] [**router** *router-instance*]

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 **svc-ping** request message in dotted decimal notation.

Values

ipv4-address:	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x
	x:x:x:x:x:x:d.d.d.d
	x: [0 — FFFF]H
	d: [0 — 255]D

dns-name — The DNS name of the far-end device to which to send the **svc-ping** request message, expressed as a character string to 63 characters maximum.

ttl *time-to-live* **—** The TTL value for the MPLS label, expressed as a decimal integer.

Values 1 — 255

wait *milliseconds* **—** The time in milliseconds to wait for a response to a probe, expressed as a decimal integer.

Default 5000

Values 1 — 60000

tos *type-of-service* **—** Specifies the service type.

Values 0 — 255

source *ip-address* **—** Specifies the IP address to be used.

Values

ipv4-address:	a.b.c.d
ipv6-address:	x:x:x:x:x:x:x:x
	x:x:x:x:x:x:d.d.d.d
	x: [0 — FFFF]H
	d: [0 — 255]D

router *router-instance* **—** Specifies the router name or service ID.

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

Default Base

lsp-ping

Syntax **lsp-ping** {{[*lsp-name*] [**path** *path-name*]} | {**prefix** *ip-prefix/mask*}} [**fc** *fc-name*] [**profile** {**in** | **out**}]] [**size** *octets*] [**ttl** *label-ttl*] [**send-count** *send-count*] [**timeout** *timeout*] [**interval** *interval*] [**path-destination** *ip-address*] [**interface** *if-name* | **next-hop** *ip-address*]][**detail**]

Context oam>
config>saa>test>type

Description Performs in-band LSP connectivity tests.

The **lsp-ping** command performs an LSP ping using the protocol and data structures defined in the RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*.

The LSP ping operation is modeled after the IP ping utility which uses ICMP echo request and reply packets to determine IP connectivity.

In an LSP ping, the originating device creates an MPLS echo request packet for the LSP and path to be tested. The MPLS echo request packet is sent through the data plane and awaits an MPLS echo reply packet from the device terminating the LSP. The status of the LSP is displayed when the MPLS echo reply packet is received.

Parameters *lsp-name* — Name that identifies an LSP to ping. The LSP name can be up to 32 characters long.

path *path-name* **—** The LSP pathname along which to send the LSP ping request.

Default The active LSP path.

Values Any path name associated with the LSP.

prefix *ip-prefix/mask* **—** Specifies the address prefix and subnet mask of the destination node.

fc *fc-name* **—** The **fc** parameter is used to indicate the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

The LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7750 SR that receives the message request. The egress mappings of the egress network interface on the far-end 7750 SR controls the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating 7750 SR.

Default be

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

profile {**in** | **out**} **—** The profile state of the MPLS echo request encapsulation.

Default out

size *octets* — The MPLS echo request packet size in octets, expressed as a decimal integer. The request payload is padded with zeroes to the specified size.

Default 68 — The system sends the minimum packet size, depending on the type of LSP. No padding is added.

Values 84 — 65535

ttl *label-ttl* — The TTL value for the MPLS label, expressed as a decimal integer.

Default 255

Values 1 — 255

send-count *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 timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *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. Upon the expiration of message timeout, 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 5

Values 1 — 10

interval *interval* — The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, 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.

Default 1

Values 1 — 10

path-destination *ip-address* — Specifies the IP address of the path destination.

interface ***interface-name*** — Specifies the name of an IP interface. The name must already exist in the **config>router>interface** context.

next-hop *ip-address* — Only displays static routes with the specified next hop IP address.

Values

ipv4-address:	a.b.c.d (host bits must be 0)
ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
	x:x:x:x:x:x:d.d.d.d
	x: [0 — FFFF]H
	d: [0 — 255]D

lsp-trace

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

Context <GLOBAL>
config>saa>test>type

Description Displays the hop-by-hop path for an LSP.

The **lsp-trace** command performs an LSP traceroute using the protocol and data structures defined in the IETF draft (draft-ietf-mpls-lsp-ping-02.txt).

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 awaits a TTL exceeded response or the MPLS echo reply packet from the device terminating the LSP. The devices that reply to the MPLS echo request packets with the TTL exceeded and the MPLS echo reply are displayed.

Parameters *lsp-name* — Name that identifies an LSP to ping. The LSP name can be up to 32 characters long.

path *path-name* **—** The LSP pathname along which to send the LSP trace request.

Default The active LSP path.

Values Any path name associated with the LSP.

prefix *ip-prefix/mask* **—** Specifies the address prefix and subnet mask of the destination node.

size *octets* **—** The MPLS echo request packet size in octets, expressed as a decimal integer. The request payload is padded with zeroes to the specified size.

Default 68 — The system sends the minimum packet size, depending on the type of LSP. No padding is added.

Values 84 — 65535

min-ttl *min-label-ttl* **—** The minimum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer.

Default 1

Values 1 — 255

max-ttl *max-label-ttl* **—** The maximum TTL value in the MPLS label for the LDP treetrace test, expressed as a decimal integer.

Default 30

Values 1 — 255

max-fail *no-response-count* **—** The maximum number of consecutive MPLS echo requests, expressed as a decimal integer that do not receive a reply before the trace operation fails for a given TTL.

Default 5

Values 1 — 255

send-count *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 timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *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 7750 SR will wait for a message reply after sending the message request. Upon the expiration of message timeout, the requesting 7750 SR 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.

Default 3

Values 1 — 10

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, 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.

Default 1

Values 1 — 10

fc *fc-name* **—** The **fc** parameter is used to indicate the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

The LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7750 SR that receives the message request. The egress mappings of the egress network interface on the far-end 7750 SR controls the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating 7750 SR.

fc-name — The forwarding class of the MPLS echo request encapsulation.

Default be

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

profile {**in** | **out**} **—** The profile state of the MPLS echo request encapsulation.

Default out

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 plan.

A **mac-ping** reply can be sent using the data plane or the control plane. The **return-control** option specifies the reply be sent using the control plane. If **return-control** is not specified, the request is sent using the data plane.

A **mac-ping** with data plane reply can only be initiated on nodes that can have an egress MAC address binding. A node without a FIB and without any SAPs cannot have an egress MAC address binding, so it is not a node where replies in the data plane 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. Note that if the **mac-trace** is originated from a non-zero SHG, such packets will not go out to the same SHG.

If EMG is enabled, mac-ping will return only the first SAP in each chain.

Parameters **service** *service-id* **—** The service ID of the service to diagnose or manage.

Values 1 — 2147483647

destination *ieee-address* **—** The destination MAC address for the OAM MAC request.

size *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 sized packet necessary to send the request is used.

Default No OAM packet padding.

Values 1 — 65535

ttl *vc-label-ttl* **—** The TTL value in the VC label for the OAM MAC request, expressed as a decimal integer.

Default 255

Values 1 — 255

send-control — Specifies the MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM request sent using the data plane.

return-control — Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply sent using the data plane.

source *src-ieee-address* **—** The source MAC address from which the OAM MAC request originates. By default, the system MAC address for the chassis is used.

Default The system MAC address.

Values Any unicast MAC value.

fc *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

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second 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.

Default 1

Values 1 — 10

count *send-count* **—** The number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

timeout *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. Upon the expiration of message timeout, 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 5

Values 1 — 10

mac-trace

Syntax **mac-trace service** *service-id* **destination** *ieee-address* [**size** *octets*] [**min-ttl** *vc-label-ttl*] [**max-ttl** *vc-label-ttl*] [**send-control**] [**return-control**] [**source** *ieee-address*] [**probe-count** *probes-per-hop*] [**interval** *interval*] [**timeout** *timeout*]

Context <GLOBAL>
config>saa>test>type

Description Displays the hop-by-hop path for a destination MAC address within a VPLS.

The MAC traceroute operation is modeled after the IP traceroute utility which uses ICMP echo request and reply packets with increasing TTL values to determine the hop-by-hop route to a destination IP. The MAC traceroute command uses Alcatel-Lucent OAM packets with increasing TTL values to determine the hop-by-hop route to a destination MAC.

In a MAC traceroute, the originating device creates a MAC ping echo request packet for the MAC to be tested with increasing values of the TTL. The echo request packet is sent through the control plane or data plane and awaits a TTL exceeded response or the echo reply packet from the device with the destination MAC. The devices that reply to the echo request packets with the TTL exceeded and the echo reply are displayed.

When a **source** *ieee-address* value is specified and the source MAC address is locally registered within a split horizon group (SHG), 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. Note that if the **mac-ping** is originated from a non-zero SHG, such packets will not go out to the same SHG.

If EMG is enabled, mac-trace will return only the first SAP in each chain.

Parameters **service** *service-id* **—** The Service ID of the service to diagnose or manage.

Values 1 — 2147483647

destination *ieee-address* **—** The destination MAC address to be traced.

size *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 sized packet necessary to send the request is used.

Default No OAM packet padding.

Values 1 — 65535

min-ttl *vc-label-ttl* **—** The minimum TTL value in the VC label for the MAC trace test, expressed as a decimal integer.

Default 1

Values 1 — 255

max-ttl *vc-label-ttl* **—** The maximum TTL value in the VC label for the MAC trace test, expressed as a decimal integer.

Default 4

Values 1 — 255

send-control — Specifies the MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM request sent using the data plane.

return-control — Specifies the MAC OAM reply to a data plane MAC OAM request be sent using the control plane instead of the data plane.

Default MAC OAM reply sent using the data plane.

source *ieee-address* **—** The source MAC address from which the OAM MAC request originates. By default, the system MAC address for the chassis is used.

Default The system MAC address.

Values Any unicast MAC value.

send-count *send-count* **—** The number of MAC OAM requests sent for a particular TTL value, expressed as a decimal integer.

Default 1

Values 1 — 100

interval *interval* **—** The **interval** parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the **interval** is set to 1 second, and the **timeout** value is set to 10 seconds, 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.

Default 1

Values 1 — 10

timeout *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. Upon the expiration of message timeout, 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 5

Values 1 — 10

sdp-ping

Syntax **sdp-ping** *orig-sdp-id* [**resp-sdp** *resp-sdp-id*] [**fc** *fc-name* [**profile** {**in** | **out**}]] [**timeout** *seconds*] [**interval** *seconds*] [**size** *octets*] [**count** *send-count*]

Context <GLOBAL>
config>saa>test>type

Description Tests SDPs for uni-directional 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 uni-directional 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.

Result of Request	Displayed Response Message	Precedence
Request timeout without reply	Request Timeout	1
Request not sent due to non-existent *orig-sdp-id*	Orig-SDP Non-Existent	2
Request not sent due to administratively down *orig-sdp-id*	Orig-SDP Admin-Down	3
Request not sent due to operationally down *orig-sdp-id*	Orig-SDP Oper-Down	4
Request terminated by user before reply or timeout	Request Terminated	5
Reply received, invalid *origination-id*	Far End: Originator-ID Invalid	6
Reply received, invalid *responder-id*	Far End: Responder-ID Error	7
Reply received, non-existent *resp-sdp-id*	Far End: Resp-SDP Non-Existent	8
Reply received, invalid *resp-sdp-id*	Far End: Resp-SDP Invalid	9
Reply received, *resp-sdp-id* down (admin or oper)	Far-end: Resp-SDP Down	10
Reply received, No Error	Success	11

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 encapsulation of the SDP tunnel encapsulation used to reach the far end. This can be IP/GRE 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 — 17407

resp-sdp *resp-sdp-id* **—** Optional parameter is used to specify the return SDP-ID to be used by the far-end 7750 SR for the message reply for round trip SDP connectivity testing. If *resp-sdp-id* does not exist on the far-end 7750 SR, terminates on another 7750 SR different than the originating 7750 SR, or another issue prevents the far-end 7750 SR from using *resp-sdp-id*, the SDP Echo Reply will be sent using generic IP/GRE OAM encapsulaton. The received

forwarding class (as mapped on the ingress network interface for the far end) defines the forwarding class encapsulation for the reply message.

Default null. Use the non-SDP return path for message reply.

Values 1 — 17407

fc *fc-name* **—** The **fc** parameter is used to indicate the forwarding class of the SDP encapsulation. The actual forwarding class encoding is controlled by the network egress DSCP or LSP-EXP mappings.

The DSCP or LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7750 SR that receives the message request. The egress mappings of the egress network interface on the far-end 7750 SR controls the forwarding class markings on the return reply message.

The DSCP or LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating 7750 SR. This is displayed in the response message output upon receipt of the message reply.

Default be

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

profile {**in** | **out**} **—** The profile state of the SDP encapsulation.

Default out

timeout *seconds* **—** 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. Upon the expiration of message timeout, 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.

Default 5

Values 1 — 10

interval *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, 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.

Default 1

Values 1 — 10

size *octets* **—** The **size** parameter in octets, expressed as a decimal integer. This parameter is used to override the default message size for the **sdp-ping** request. Changing the message size is a method of checking the ability of an SDP to support a **path-mtu**. The size of the message does not include the SDP encapsulation, VC-Label (if applied) or any DLC headers or trailers.

When the OAM message request is encapsulated in an IP/GRE 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.

Default 40

Values 40 — 9198

count *send-count* **—** The number of messages to send, expressed as a decimal integer. The **count** parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message **interval** value must be expired before the next message request is sent.

Default 1

Values 1 — 100

Special Cases **Single Response Connectivity Tests —** A single response sdp-ping test provides detailed test results.

Upon request timeout, message response, request termination, or request error the following local and remote information will be displayed. Local and remote information will be dependent upon SDP-ID existence and reception of reply.

Field	Description	Values
Request Result	The result of the **sdp-ping** request message.	Sent - Request Timeout Sent - Request Terminated Sent - Reply Received Not Sent - Non-Existent Local SDP-ID Not Sent - Local SDP-ID Down
Originating SDP-ID	The originating SDP-ID specified by **orig-sdp**.	*orig-sdp-id*
Originating SDP-ID Administrative State	The local administrative state of the originating SDP-ID. If the SDP-ID has been shutdown, Admin-Down is displayed. If the originating SDP-ID is in the no shutdown state, Admin-Up is displayed. If the *orig-sdp-id* does not exist, Non-Existent is displayed.	Admin-Up Admin-Down Non-Existent
Originating SDP-ID Operating State	The local operational state of the originating SDP-ID. If *orig-sdp-id* does not exist, N/A will be displayed.	Oper-Up Oper-Down N/A
Originating SDP-ID Path MTU	The local **path-mtu** for *orig-sdp-id*. If *orig-sdp-id* does not exist locally, N/A is displayed.	*orig-path-mtu* N/A

Field	Description	Values
Responding SDP-ID	The SDP-ID requested as the far-end path to respond to the **sdp-ping** request. If **resp-sdp** is not specified, the responding 7750 SR 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 7750 SR used the responding SDP-ID to respond to the **sdp-ping** request. If *resp-sdp-id* is a valid, operational SDP-ID, it must be used for the SDP Echo Reply message. If the far-end uses the responding SDP-ID as the return path, Yes will be displayed. If the far-end does not use the responding SDP-ID as the return path, No will be displayed. If **resp-sdp** 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 *resp-sdp-id* is administratively down, Admin-Down will be displayed. When *resp-sdp-id* is administratively up, Admin-Up will be displayed. When *resp-sdp-id* exists on the far-end 7750 SR but is not valid for the originating 7750 SR, Invalid is displayed. When *resp-sdp-id* does not exist on the far-end 7750 SR, Non-Existent is displayed. When **resp-sdp** is not specified, N/A is displayed.	Admin-Down Admin-Up Invalid Non-Existent N/A
Responding SDP-ID Operational State	The operational state of the far-end SDP-ID associated with the return path for *service-id*. When a return path is operationally down, Oper-Down is displayed. If the return SDP-ID is operationally up, Oper-Up is displayed. If the responding SDP-ID is non-existent, N/A is displayed.	Oper-Up Oper-Down N/A
Responding SDP-ID Path MTU	The remote **path-mtu** for *resp-sdp-id*. If *resp-sdp-id* does not exist remotely, N/A is displayed	*resp-path-mtu* N/A
Local Service IP Address	The local system IP address used to terminate remotely configured SDP-IDs (as the SDP-ID **far-end** address). If an IP address has not been configured to be the system IP address, N/A is displayed.	*system-ip-addr* N/A
Local Service IP Interface Name	The name of the local system IP interface. If the local system IP interface has not been created, N/A is displayed.	*system-interface-name* N/A
Local Service IP Interface State	The state of the local system IP interface. If the local system IP interface has not been created, Non-Existent is displayed.	Up Down Non-Existent
Expected Far End Address	The expected IP address for the remote system IP interface. This must be the **far-end** address configured for the *orig-sdp-id*.	*orig-sdp-far-end-addr* *dest-ip-addr* N/A

Field	Description	Values
Actual Far End Address	The returned remote IP address. If a response is not received, the displayed value is N/A. If the far-end service IP interface is down or non-existent, a message reply is not expected.	*resp-ip-addr* N/A
Responders Expected Far End Address	The expected source of the originators SDP-ID from the perspective of the remote 7750 SR 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

Single Response Round Trip Connectivity Test Sample Output

```
A:router1> sdp-ping 10 resp-sdp 22 fc ef
Request Result: Sent - Reply Received
RTT: 30ms

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

Err  System IP Interface Info
Local Interface Name: "ESR-System-IP-Interface (Up to 32 chars)…"
__   Local IP Interface State:          Up
__   Local IP Address:                  10.10.10.11
__   IP Address Expected By Remote:     10.10.10.11
__   Expected Remote IP Address:        10.10.10.10
__   Actual Remote IP Address:          10.10.10.10

Err   FC Mapping Info      Local        Remote
__    Forwarding Class     Assured      Assured
__    Profile              In           In
```

Multiple Response Connectivity Tests — When the connectivity test count is greater than one (1), a single line is displayed per SDP Echo Request send attempt.

The request number is a sequential number starting with 1 and ending with the last request sent, incrementing by one (1) for each request. This should not be confused with the *message-id* contained in each request and reply message.

A response message indicates the result of the message request. Following the response message is the round trip time value. If any reply is received, the round trip time is displayed.

After the last reply has been received or response timed out, a total is displayed for all messages sent and all replies received. A maximum, minimum and average round trip time is also displayed. Error response and timed out requests do not apply towards the average round trip time.

Multiple Response Round Trip Connectivity Test Sample Output

```
A:router1> sdp-ping 6 resp-sdp 101size 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

Description This command configures a Virtual Circuit Connectivity Verification (VCCV) ping test. A vccv-ping test checks connectivity of a VLL inband. It checks to verify that the destination (target) PE is the egress for the Layer 2 FEC. It provides for a cross-check between the dataplane and the control plane. It is inband which means that the vccv-ping message is sent using the same encapsulation and along the same path as user packets in that VLL. The vccv-ping test is the equivalent of the lsp-ping test for a VLL service. The vccv-ping reuses an lsp-ping message format and can be used to test a VLL configured over both an MPLS and a GRE SDP.

Note that VCCV ping can be initiated on TPE or SPE. If initiated on the SPE, the **reply-mode** parameter must be used with the ip-routed value The ping from the TPE can have either values or can be omitted, in which case the default value is used.

If a VCCV ping is initiated from TPE to neighboring a SPE (one segment only) it is sufficient to only use the *sdpid:vcid* parameter. However, if the ping is across two or more segments, at least the *sdpId:vcId,* **src-ip-address** *ip-addr*, **dst-ip-address** *ip-addr*, **ttl** *vc-label-ttl*and **pw-id** *pw-id* parameters are used where:

- The *src-ip-address* is system IP address of the router proceeding destination router.
- The *pwid* is actually the VC ID of the last pseudowire segment.
- The *vc-label-ttl* must have a value equal or higher than the number of pseudowire segments.

Note that VCCV ping is a multi-segment pseudowire. For a single-hop pseudowire, only the peer VCCV CC bit of the control word is advertised when the control word is enabled on the pseudowire. VCCV ping on multi-segment pseudowires require that the control word be enabled in all segments of the VLL.

If the control word is not enabled on spoke SDP it 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* — The VC ID of the pseudowire being tested must be indicated with this parameter. The VC ID needs to exist on the local router and the far-end peer needs to indicate that it supports VCCV to allow the user to send vccv-ping message.

Values 1 — 17407:1 — 4294967295

src-ip-address *ip-addr* **—** Specifies the source IP address.

Values ipv4-address: a.b.c.d

dst-ip-address *ip-addr* **—** Specifies the destination IP address.

Values ipv4-address: a.b.c.d

pw-id *pw-id* **—** Specifies the pseudowire ID to be used for performing a **vccv-ping** operation. The pseudowire ID is a non-zero 32-bit connection ID required by the FEC 128, as defined in RFE 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*.

reply-mode {**ip-routed** | **control-channel**} **—** The reply-mode parameter indicates to the far-end how to send the reply message.The option control-channel indicates a reply mode in-band using vccv control channel.

Default control-channel

fc *fc-name* **—** The **fc** parameter is used to indicate the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

The LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7750 SR that receives the message request. The egress mappings of the egress network interface on the far-end router controls the forwarding class markings on the return reply message. The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating SR.

Default be

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

profile {**in** | **out**} **—** The profile state of the MPLS echo request encapsulation.

Default out

timeout *seconds* **—** 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. Upon the expiration of message timeout, 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.

Default 5

Values 1 — 10

interval *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, 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.

Default 1

Values 1 — 10

size *octets* **—** The VCCV ping echo request packet size in octets, expressed as a decimal integer. The request payload is padded with zeroes to the specified size.

Default 88

Values 88 — 9198

count *send-count* **—** The number of messages to send, expressed as a decimal integer. The count parameter is used to override the default number of message requests sent. Each message request must either timeout or receive a reply before the next message request is sent. The message interval value must be expired before the next message request is sent.

Default 1

Values 1 — 100

ttl *vc-label-ttl* **—** Specifies the time-to-live value for the vc-label of the echo request message. The outer label TTL is still set to the default of 255 regardless of this value.

Sample Output

Ping from TPE to TPE:

```
*A:ALA-dut-b_a# oam vccv-ping 1:1 src-ip-address 5.5.5.5 dst-ip-address 3.3.3.3 pw-
id 1 ttl 3
VCCV-PING 1:1 88 bytes MPLS payload
Seq=1, reply from 3.3.3.3 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 TPE to SPE:

```
*A:ALA-dut-b_a# oam vccv-ping 1:1
VCCV-PING 1:1 88 bytes MPLS payload
Seq=1, reply from 4.4.4.4 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:ALA-dut-b_a# oam vccv-ping 1:1 src-ip-address 4.4.4.4 dst-ip-address 5.5.5.5 ttl 2
pw-id 200
VCCV-PING 1:1 88 bytes MPLS payload
```

```
Seq=1, reply from 5.5.5.5 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 SPE (on single or multi-segment):

```
*A:ALA-dut-b_a# oam vccv-ping 4:200 reply-mode ip-routed
VCCV-PING 4:200 88 bytes MPLS payload
Seq=1, reply from 5.5.5.5 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:ALA-dut-b_a# oam vccv-ping 4:200 reply-mode ip-routed src-ip-address 5.5.5.5 dst-
ip-address 3.3.3.3 ttl 2 pw-id 1
VCCV-PING 4:200 88 bytes MPLS payload
Seq=1, reply from 3.3.3.3 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* [**fc** *fc-name* [**profile** {**in** | **out**}]] [**size** *octets*] [**reply-mode** *ip-routed*|*control-channel*] [**probe-count** *probes-per-hop*] [**timeout** *timeout*] [**interval** *interval*] [**min-ttl** *min-vc-label-ttl*] [**max-ttl** *max-vc-label-ttl*] [**max-fail** *no-response-count*] [**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 T-PE or at an S-PE. This is equivalent to LSP-Trace and is an iterative process by which the source T-PE or S-PE node sends successive VCCV-Ping messages with incrementing the TTL value, starting from TTL=1.

In each iteration, the T-PE builds the MPLS echo request message in a way similar to VCCV-Ping. The first message with TTL=1 will have the next-hop S-PE T-LDP session source address in the ëRemote PE Addressí field in the PW FEC TLV. Each S-PE which terminates and processes the message will include in the MPLS echo reply message the FEC 128 TLV corresponding the PW segment to its downstream node. The source T-PE or S-PE node can then build the next echo reply message with TTL=2 to test the next-next hop for the MS-PW. It 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.

The user can specify to display the result of the VCCV-trace for a fewer number of PW segments of the end-to-end MS-PW path. In this case, the min-ttl and max-ttl parameters are configured accordingly. However, the T-PE/S-PE node will still probe all hops up to min-ttl in order to correctly build the FEC of the desired subset of segments.

Parameters *sdpid:vcid* — The VC ID of the pseudowire being tested must be indicated with this parameter. The VC ID needs to exist on the local 7x50 SR and the far-end peer needs to indicate that it supports VCCV to allow the user to send vccv-ping message.

Values 1-17407:1 — 4294967295

reply-mode {***ip-routed*** | ***control-channel***} **—** The reply-mode parameter indicates to the far-end how to send the reply message. The option control-channel indicates a reply mode in-band using vccv control channel.

Note that when a VCCV trace message is originated from an S-PE node, the user should used the IPv4 reply mode as the replying node does not know how to set the TTL to reach the sending S-PE node. If the user attempts this, a warning is issued to use the ipv4 reply mode.

Default control-channel

fc fc-name [**profile** {**in** | **out**} **—** 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 controls the mapping back to the internal forwarding class used by the far-end router that receives the message request. The egress mappings of the egress network interface on the far-end router controls the forwarding class markings on the return reply message. The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating router.

fc-name — The forwarding class of the VCCV trace echo request encapsulation.

Default be

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

profile {**in** | **out**} **—** The profile state of the VCCV trace echo request encapsulation.

Default out

size *octets* **—** The VCCV ping echo request packet size in octets, expressed as a decimal integer. The request payload is padded with zeroes to the specified size.

Default 88

Values 88 — 9198

probe-count *probes-per-ho***p —** The number of VCCV trace echo request messages to send per TTL value.

Default 1

Values 1 — 10

timeout *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 7x50 will wait for a message reply after sending the message request. Upon the expiration of message timeout, the

requesting 7x50 assumes that the message response will not be received. A ërequest timeoutí 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.

Default 3

Values 1 — 60

interval *interval* **—** The interval parameter in seconds, expressed as a decimal integer. This parameter is used to override the default request message send interval and defines the minimum amount of time that must expire before the next message request is sent.

If the interval is set to 1 second, and the timeout value is set to 10 seconds, 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.

Default 1

Values 1 — 255

min-ttl *min-vc-label-ttl* **—** The TTL value for the VC label of the echo request message for the first hop of the MS-PW for which the results are to be displayed. This is expressed as a decimal integer. Note that the outer label TTL is still set to the default of 255 regardless of the value of the VC label.

Default 1

Values 1 — 255

max-ttl *max-vc-label-ttl* **—** The TTL value for the VC label of the echo request message for the last hop of the MS-PW for which the results are to be displayed. This is expressed as a decimal integer. Note that the outer label TTL is still set to the default of 255 regardless of the value of the VC label.

Default 8

Values 1 — 255

max-fail *no-response-count* **—** 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.

Default 5

Values 1 — 255

Sample Output

```
*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:138.120.214.60>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)
SAA:

*A:multisim3>config>saa# info
----------------------------------------------
        test "vt1"
            shutdown
            type
                vccv-trace 1:2 fc "af" profile in timeout 2 interval 3 size 200
min-ttl 2 max-ttl 5 max-fail 2 probe-count 3
            exit
        exit
..
----------------------------------------------
*A:multisim3>config>saa#
```

OAM SAA Commands

saa

Syntax **saa** *test-name* [**owner** *test-owner*] {**start** | **stop**}

Context oam

Description Use this command to start or stop an SAA test.

test-name — Name of the SAA test. The test name must already be configured in the **config>saa>test** context.

owner *test-owner* **—** Specifies the owner of an SAA operation up to 32 characters in length.

Values If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

start — This keyword starts the test. A test cannot be started if the same test is still running.

A test cannot be started if it is in a shut-down state. An error message and log event will be generated to indicate a failed attempt to start an SAA testrun.

stop — This keyword stops a test in progress. A test cannot be stopped if it is not in progress. A log message will be generated to indicate that an SAA testrun has been aborted.

LDP Treetrace Commands

ldp-treetrace

Syntax **ldp-treetrace** {**prefix** *ip-prefix/mask*} [**max-ttl** *ttl-value*] [**max-path** *max-paths*] [**timeout** *timeout*] [**retry-count** *retry-count*] [**fc** *fc-name* [**profile** *profile*]]

Context oam

Description This command enables the context to configure LDP treetrace parameters to perform Alcatel-Lucent OAM tree trace test operations manually.

Parameters **prefix** *ip-prefix/mask* **—** Specifies the address prefix and subnet mask of the destination node.

max-ttl *max-label-ttl* **—** The maximum TTL value in the MPLS label for the LSP trace test, expressed as a decimal integer.

Default 30

Values 1 — 255

max-paths *max-paths* **—** The maximum number of paths for a ldp-treetrace test, expressed as a decimal integer.

Default 128

Values 1 — 255

timeout *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. Upon the expiration of message timeout, 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 3

Values 1 — 60

fc *fc-name* **—** The **fc** and **profile** parameters are used to indicate the forwarding class of the MPLS echo request packets. The actual forwarding class encoding is controlled by the network egress LSP-EXP mappings.

The LSP-EXP mappings on the receive network interface controls the mapping back to the internal forwarding class used by the far-end 7750 SR that receives the message request. The egress mappings of the egress network interface on the far-end 7750 SR controls the forwarding class markings on the return reply message.

The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating 7750 SR.

Default be

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

profile *profile* **—** The profile state of the MPLS echo request encapsulation.

Default out

Values in, out

retry-count *retry-count* **—** Specifies the maximum number of consecutive MPLS echo requests, expressed as a decimal integer that do not receive a reply before the trace operation fails for a given TTL.

Default 5

Values 1 — 255

ldp-treetrace

Syntax [**no**] **ldp-treetrace**

Context config>test-oam

Description This command enables the context to configure LDP treetrace parameters to perform OAM tree trace test operations manually**.**

The **no** form of the command disables the LDP treetrace 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. These 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 controls the mapping back to the internal forwarding class used by the far-end 7750 SR that receives the message request. The egress mappings of the egress network interface on the far-end 7750 SR controls the forwarding class markings on the return reply message. The LSP-EXP mappings on the receive network interface controls the mapping of the message reply back at the originating 7750 SR.

Default be

Parameters *fc-name* — Specifies the forwarding class of the MPLS echo request packets.

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

profile {**in** | **out**} **—** Specifies the profile value to be used with the forwarding class specified in the *fc-name* parameter.

path-discovery

Syntax **path-discovery**

Context config>test-oam>ldp-treetrace

Description This command enables the context to configure path discovery parameters.

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* — Specifies the number of minutes to wait before repeating the LDP tree auto discovery process.

Values 60 — 1440

max-path

Syntax **max-path** *max-paths*

Context config>test-oam>ldp-treetrace>path-discovery

Description This command configures specifies the maximum number of paths that can be discovered for a selected IP address FEC.

Default 128

Parameters *max-paths* — Specifies the tree discovery maximum path.

Values 1 — 128

max-ttl

Syntax **max-ttl** *ttl-value*

Context config>test-oam>ldp-treetrace>path-discovery

Description This command configures the maximum label time-to-live value for an LSP trace request during the tree discovery.

Default 30

Parameters *ttl-value* — Specifies the maximum label time-to-live value for an LSP trace request during the tree discovery.

Values 1 — 255

policy-statement

Syntax **policy-statement** *policy-name* [...(up to 5 max)]

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* — Specifies 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 (#, $, spaces, etc.), the entire string must be enclosed within double quotes. The specified policy name(s) must already be defined.

retry-count

Syntax **retry-count** *retry-count*

Context config>oam-test>ldp-treetrace>path-discovery
config>oam-test>ldp-treetrace>path-probing

Description This command configures the path probing maximum number of failures.

Default 3

Parameters *retry-count* — Specifies the maximum number of consecutive timeouts allowed before failing a path probe (ping).

Values 1 — 255

timeout

Syntax **timeout** *timeout*
no timeout

Context config>test-oam>ldp-treetrace>path-discovery

Description This command 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. Upon the expiration of message timeout, 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* — Specifies the timeout parameter, in seconds, within a range of 1 to 60, expressed as a decimal integer.

path-probing

Syntax **path-probing**

Context config>test-oam>ldp-treetrace

Description This command enables the context to configure path probing paramters.

interval

Syntax **interval** *minutes*
no interval

Context config>test-oam>ldp-treetrace>path-probing

Description This command configures the number of minutes to wait before repeating probing (pinging) a discovered path.

Default 1

Parameters *minutes* — Specifies the number of minutes to probe all active ECMP paths for each LSP

Values 1 — 60

retry-count

Syntax **retry-count** *retry-count*

Context config>oam-test>ldp-treetrace>path-discovery
config>oam-test>ldp-treetrace>path-probing

Description This command configures the path probing maximum number of failures.

Default 3

Parameters *retry-count* — Specifies the maximum number of consecutive timeouts allowed before failing a path probe (ping).

Values 1 — 255

timeout

Syntax **timeout** *timeout*
no timeout

Context config>test-oam>ldp-treetrace>path-probing

Description This command 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. Upon the expiration of message timeout, 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* — Specifies the timeout parameter, in minutes, with a range of 1 to 3 minutes, expressed as a decimal integer.

Show Commands

saa

Syntax **saa** [*test-name*] [**owner** *test-owner*]

Context show>saa

Description Use this command to display information about the SAA test.

If no specific test is specified a summary of all configured tests is displayed.

If a specific test is specified 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* — Enter the name of the SAA test for which the information needs to be displayed. The test name must already be configured in the **config>saa>test** context.

This is an optional parameter.

owner *test-owner* **—** Specifies the owner of an SAA operation up to 32 characters in length.

Values 32 characters maximum.

Default If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

Output **SAA Output —** The following table provides SAA field descriptions.

Label	Description
Test Name	The name of the test.
Owner Name	The owner of the test.
Administrative status	Enabled or disabled.
Test type	The type of test configured.
Test runs since last clear	The total number of tests performed since the last time the tests were cleared.
Number of failed tests run	The total number of tests that failed.
Last test run	The last time a test was run.

Sample Output

```
*A:SR-3>config>saa>test$ show saa
===============================================================================
SAA Test Information
===============================================================================
Test name                    : test1
Owner name                   : TiMOS CLI
Administrative status        : Disabled
Test type                    : cpe-ping service 1 source 192.168.1.1
                               destination 192.168.1.1
Test runs since last clear   : 0
Number of failed test runs   : 0
Last test result             : Undetermined
-------------------------------------------------------------------------------
Threshold
Type        Direction Threshold  Value      Last Event          Run #
-------------------------------------------------------------------------------
Jitter-in   Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-out  Rising    None       None       Never               None
            Falling   None       None       Never               None
Jitter-rt   Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-in  Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-out Rising    None       None       Never               None
            Falling   None       None       Never               None
Latency-rt  Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-in     Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-out    Rising    None       None       Never               None
            Falling   None       None       Never               None
Loss-rt     Rising    None       None       Never               None
            Falling   None       None       Never               None
===============================================================================
*A:SR-3>config>saa>test$
```

ldp-treetrace

Syntax **ldp-treetrace** [**prefix** *ip-prefix/mask*] [**detail**]

Context show>test-oam

Description This command displays OAM LDP treetrace information.

Parameters **prefix** *ip-prefix/mask* **—** Specifies the address prefix and subnet mask of the destination node.

detail — Displays detailed information.

Sample Output

```
*A:ALA-48# show test-oam ldp-treetrace
Admin State             : Up             Discovery State      : Done
```

```
Discovery-intvl (min)    : 60             Probe-intvl (min)    : 2
Probe-timeout (min)      : 1              Probe-retry          : 3
Trace-timeout (sec)      : 60             Trace-retry          : 3
Max-TTL                  : 30             Max-path             : 128
Forwarding-class (fc)    : be             Profile              : Out
Total Fecs               : 400            Discovered Fecs      : 400
Last Discovery Start     : 12/19/2006 05:10:14
Last Discovery End       : 12/19/2006 05:12:02
Last Discovery Duration  : 00h01m48s
Policy1                  : policy-1
Policy2                  : policy-2

*A:ALA-48# show test-oam ldp-treetrace detail
Admin State              : Up             Discovery State      : Done
Discovery-intvl (min)    : 60             Probe-intvl (min)    : 2
Probe-timeout (min)      : 1              Probe-retry          : 3
Trace-timeout (sec)      : 60             Trace-retry          : 3
Max-TTL                  : 30             Max-path             : 128
Forwarding-class (fc)    : be             Profile              : Out
Total Fecs               : 400            Discovered Fecs      : 400
Last Discovery Start     : 12/19/2006 05:10:14
Last Discovery End       : 12/19/2006 05:12:02
Last Discovery Duration  : 00h01m48s
Policy1                  : policy-1
Policy2                  : policy-2
===============================================================================
Prefix (FEC) Info
===============================================================================
Prefix              Path Last                 Probe  Discov    Discov
                    Num  Discovered           State  State     Status
-------------------------------------------------------------------------------
11.11.11.1/32       54   12/19/2006 05:10:15  OK     Done      OK
11.11.11.2/32       54   12/19/2006 05:10:15  OK     Done      OK
11.11.11.3/32       54   12/19/2006 05:10:15  OK     Done      OK
……
14.14.14.95/32      72   12/19/2006 05:11:13  OK     Done      OK
14.14.14.96/32      72   12/19/2006 05:11:13  OK     Done      OK
14.14.14.97/32      72   12/19/2006 05:11:15  OK     Done      OK
14.14.14.98/32      72   12/19/2006 05:11:15  OK     Done      OK
14.14.14.99/32      72   12/19/2006 05:11:18  OK     Done      OK
14.14.14.100/32     72   12/19/2006 05:11:20  OK     Done      OK
===============================================================================
Legend: uP - unexplored paths, tO - trace request timed out
        mH - max hop exceeded, mP - max path exceeded
        nR - no internal resource

*A:ALA-48# show test-oam ldp-treetrace prefix 12.12.12.10/32
Discovery State  : Done                Last Discovered  : 12/19/2006 05:11:02
Discovery Status : ' OK '
Discovered Paths : 54                  Failed Hops      : 0
Probe State      : OK                  Failed Probes    : 0

*A:ALA-48# show test-oam ldp-treetrace prefix 12.12.12.10/32  detail
Discovery State  : Done                Last Discovered  : 12/19/2006 05:11:02
Discovery Status : ' OK '
Discovered Paths : 54                  Failed Hops      : 0
Probe State      : OK                  Failed Probes    : 0
===============================================================================
Discovered Paths
```

```
===============================================================================
PathDest            Egr-NextHop         Remote-RtrAddr      Discovery-time
  DiscoveryTtl        ProbeState          ProbeTmOutCnt       RtnCode
-------------------------------------------------------------------------------
127.1.0.5           10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.9           10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.15          10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.19          10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.24          10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.28          10.10.1.2           12.12.12.10         12/19/2006 05:11:01

……..

127.1.0.252         10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
127.1.0.255         10.10.1.2           12.12.12.10         12/19/2006 05:11:01
              7     OK                  0                   EgressRtr
===============================================================================
*A:ALA-48#
```

dot1ag

Syntax **dot1ag**

Context show

Description This command enables the context to display dot1ag information.

association

Syntax **association** [*ma-index*] [**detail**]

Context show>dot1ag

Description This command displays dot1ag association information.

Parameters *ma-index* — Specifies the MA index.

Values 1— 4294967295

detail — Displays detailed information for the dot1ag association.

Sample Output

```
*A:node-1# show dot1ag association
===============================================================================
Dot1ag CFM Association Table
===============================================================================
```

```
Md-index   Ma-index   Name                      CCM-interval Bridge-id
------------------------------------------------------------------------
1          1          test-ma-1                 10           2
1          2          2                         10           20
========================================================================
*A:node-1#


*A:node-1# show dot1ag association 1 detail
-------------------------------------------------------------------------------
Domain 1 Associations:
-------------------------------------------------------------------------------
Md-index          : 1                         Ma-index          : 1
Name Format       : charString                CCM-interval      : 10
Name              : test-ma-1
Bridge-id         : 2                         MHF Creation      : defMHFnone
PrimaryVlan       : 0                         Num Vids          : 0
Remote Mep Id     : 1
Remote Mep Id     : 4
Remote Mep Id     : 5
-------------------------------------------------------------------------------
*A:node-1#
```

cfm-stack-table

Syntax **cfm-stack-table** [**port** [*port-id* [**vlan** *vlan-id*]]|**sdp** *sdp-id*[:*vc-id*]][**level** 0..7] [**direction up** | **down**]

Context show>dot1ag

Description This command displays stack-table information.

Parameters **port** *port-id* **—** Displays the bridge port or aggregated port on which MEPs or MHFs are configured.

vlan *vlan-id* **—** Displays the associated VLAN ID.

sdp *sdp-id*[:*vc-id*] **—** Displays the SDP binding for the bridge.

level **—** Display the MD level of the maintenance point.

Values 0 — 7

direction up | **down —** Displays the direction in which the MP faces on the bridge port.

Sample Output

```
*A:node-1# show dot1ag cfm-stack-table
========================================================================
Dot1ag CFM SAP Stack Table
========================================================================
Sap            Level Dir  Md-index   Ma-index   Mep-id Mac-address
------------------------------------------------------------------------
1/2/1          4     Up   1          1          5      ac:48:01:02:00:01
1/2/3:100      4     Up   1          1          1      ac:48:01:02:00:03
1/2/3:*        4     Up   1          1          4      ac:48:01:02:00:03
========================================================================
```

```
Dot1ag CFM SDP Stack Table
===============================================================================
Sdp            Level Dir  Md-index   Ma-index   Mep-id Mac-address
-------------------------------------------------------------------------------
No Matching Entries
===============================================================================
*A:node-1#
```

domain

Syntax **domain** [*md-index*] [**association** *ma-index* | **all-associations**] [**detail**]

Context show>dot1ag

Description This command displays domain information.

Parameters *md-index* — Displays the index of the MD to which the MP is associated, or 0, if none.

association *ma-index* — Displays the index to which the MP is associated, or 0, if none.

all-associations — Displays all associations to the MD.

detail — Displays detailed domain information.

Sample Output

```
*A:node-1# show dot1ag domain
===============================================================================
Dot1ag CFM Domain Table
===============================================================================
Md-index   Level Name                                          Format
-------------------------------------------------------------------------------
1          4     test-1                                       charString
7          4     AA:BB:CC:DD:EE:FF-0                          macAddressAndUint
===============================================================================
*A:node-1#


*A:node-1# show dot1ag domain 1 detail
===============================================================================
Domain 1
Md-index          : 1                         Level             : 4
Permission        : sendIdNone                MHF Creation      : defMHFnone
Name Format       : charString                Next Ma Index     : 3
Name              : test-1
===============================================================================
*A:node-1#
```

mep

Syntax **mep** *mep-id* **domain** *md-index* **association** *ma-index* [**loopback**] [**linktrace**]

Context show>dot1ag

Description This command displays

Parameters **domain** *md-index* **—** Displays the index of the MD to which the MP is associated, or 0, if none.

association *ma-index* — Displays the index to which the MP is associated, or 0, if none.

loopback — Displays loopback information for the specified MEP.

linktrace — Displays linktrace information for the specified MEP.

Sample Output

Sample Output

```
*A:node-1# show dot1ag mep 4 domain 1 association 1 loopback linktrace
-------------------------------------------------------------------------------
Mep Information
-------------------------------------------------------------------------------
Md-index           : 1                        Direction         : Up
Ma-index           : 1                        Admin             : Enabled
MepId              : 4                        CCM-Enable        : Enabled
IfIndex            : 37847040                 PrimaryVid        : 4095
FngState           : fngReset
LowestDefectPri    : remErrXcon               HighestDefect     : none
Defect Flags       : None
Mac Address        : ac:48:01:02:00:03        CcmLtmPriority    : 7
CcmTx              : 16863                    CcmSequenceErr    : 0
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           : ac:48:01:02:00:03:00:00  SequenceNum       : 1
LtFlags            : None
```

```
-------------------------------------------------------------------------------
Mep Linktrace Replies
-------------------------------------------------------------------------------
No entries found
*A:node-1#
```

Clear Commands

saa

Syntax **saa-test** [*test-name*] [**owner** *test-owner*]

Context clear

Description Clear the SAA results for the latest and the history for this test. If the test name is omitted, all the results for all tests are cleared.

Parameters *test-name* — Name of the SAA test. The test name must already be configured in the **config>saa>test** context.

owner *test-owner* **—** Specifies the owner of an SAA operation up to 32 characters in length.

Default If a *test-owner* value is not specified, tests created by the CLI have a default owner "TiMOS CLI".

Debug Commands

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 to enable LSP ping debugging for TX, RX, or both RX and TX for the for debug direction.

raw | detail — Displays output for the for debug mode.

Tools

This section provides the Tools command reference and hierarchies.

Tools Command Reference

Command Hierarchies

Configuration Commands

Tools Dump Commands

```
tools
    — dump
        — lag lag-id lag-id
        — ldp-treetrace {prefix ip-prefix/mask| manual-prefix ip-prefix/mask}[path-destination ip-address] [trace-tree]
        — persistence
            — submgt [record record-key]
            — summary
        — ppp port-id
        — router router-instance
            — dhcp
                — group-if-mapping [clear]
                — group-if-stats [clear]
            — ldp
                — fec prefixip-prefix/mask
                — fec vc-type {ethernet|vlan} vc-id vc-id
                — instance
                — interface [ip-int-name | ip-address]
                — memory-usage
                — peer ip-address
                — session [ip-addr[: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
                — memory-usage
            — ospf
            — ospf3
```

- **abr** [**detail**]
- **asbr** [**detail**]
- **bad-packet** *interface-name*
- **leaked-routes** [**summary** | **detail**]
- **memory-usage** [**detail**]
- **request-list** [**neighbor** *ip-address*] [**detail**]
- **request-list virtual-neighbor** *ip-address* **area-id** *area-id* [**detail**]
- **retransmission-list** [**neighbor** *ip-address*] [**detail**]
- **retransmission-list virtual-neighbor** *ip-address* **area-id** *area-id* [**detail**]
- **route-summary**
- **route-table** [**type**] [**detail**]

pim

- **iom-failures** [**detail**]

rsvp

- **psb** [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** ***tunnel-id***] [**lspid** ***lsp-id***]
- **rsb** [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** ***tunnel-id***] [**lspid** ***lsp-id***]
- **tcsb**[**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** ***tunnel-id***] [**lspid** ***lsp-id***]

web-rd

- **http-client** [*ip-prefix/mask*]

service

- **base-stats** [**clear**]
- **iom-stats** [**clear**]
- **l2pt-diags**
- **l2pt-diags clear**
- **l2pt-diags detail**
- **radius-discovery** [**svc-id** *service-id*]
- **vpls-fdb-stats** [**clear**]
- **vpls-mfib-stats** [**clear**]

system-resources *slot-number*

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}
    — cron
        — action
            — stop [action-name] [owner action-owner] [all]
        — tod
            — re-evaluate
                — customer customer-id [site customer-site-name]
                — filter filter-type [filter-id]
                — service id service-id [sap sap-id]
                — tod-suite tod-suite-name
    — lag
        — clear-force all-mc
        — clear-force lag-id lag-id [sub-group sub-group-id]
        — clear-force peer-mc ip-address
        — force all-mc {active | standby}
        — force lag-id lag-id [sub-group sub-group-id] {active | standby}
        — force peer-mc peer-ip-address {active | standby}
    — log
        — test-event
    — router [router-instance]
        — consistency
        — isis
            — 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 ip-
              addr [ip-addr ...(up to 8 max)]] [use-te-metric] [strict-srlg] [srlg-group
              grp-id...(up o 8 max)]
            — resignal lsp lsp-name path path-name
            — trap-suppress number-of-traps time-interval
        — ospf [ospf-instance]
            — ldp-sync-exit
            — refresh-lsas [lsa-type] [area-id]
            — run-manual-spf externals-only
        — ospf3 [ospf-instance]
            — 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
        — egress-multicast-group group-name
```

```
                        — force-optimize
                    — id service-id
                        — endpoint endpoint-name
                            — force-switchover sdp-id:vc-id
                            — no force-switchover
tools
    — perform
        — subscriber-mgmt
            — edit-lease-state sap sap-id ip ip-address [subscriber sub-ident-string] [sub-profile-string sub-profile-string] [sla-profile-string sla-profile-string]
            — edit-lease-state svc-id service-id ip ip-address [subscriber sub-ident-string] [sub-profile-string sub-profile-string] [sla-profile-string sla-profile-string]
            — eval-lease-state [svc-id service-id] [sap sap-id] [subscriber sub-ident-string] [ip ip-address]
            — forcerenew svc-id service-id {ip ip-address[/mask]>|mac ieee-address}
            — forcerenew {interface interface-name | sap sap-id|sdp sdp-id:vc-id} [ip ip-address[/mask] |mac ieee-address]
            — re-ident-sub old-sub-ident-string to new-sub-ident-string
            — remap-lease-state old-mac ieee-address mac ieee-address
            — remap-lease-state sap sap-id [mac ieee-address]
```

Tools Configuration Commands

Generic Commands

tools

Syntax **tools**

Context root

Description The context to enable useful tools for debugging purposes.

Default none

Parameters **dump —** Enables dump tools for the various protocols.

perform — Enables tools to perform specific tasks.

Dump Commands

dump

Syntax **dump** *router-name*

Context tools

Description The context to display information for debugging purposes.

Default none

Parameters *router-name* — Specify a router name, up to 32 characters in length.

Default Base

lag

Syntax **lag lag-id** *lag-id*

Context tools>dump

Description This tool displays LAG information.

Parameters *lag-id* — Specify an existing LAG id.

Values 1 — 200 (7750 SR-1: 1 — 64)

```
ALA-12>tools>dump# lag lag-id 1
Port state      : Ghost
Selected subgrp : 1
NumActivePorts  : 0
ThresholdRising : 0
ThresholdFalling: 0
IOM bitmask     : 0
Config MTU      : 1514
Oper. MTU       : 1514
Bandwidth       : 100000
ALA-12>tools>dump#
```

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.

Parameters **prefix** *ip-prefix/mask* — Specifies the IP prefix and host bits.

Values

host bits:	must be 0
mask:	0 — 32

persistence

Syntax persistence

Context tools>dump

Description This command enables the context to display persistence information for debugging purposes.

submgt

Syntax **submgt** [**record** *record-key*]

Context tools>dump>persistence

Description This command displays subscriber management persistence info.

summary

Syntax **summary**

Context tools>dump>persistence

Description The context to display persistence summary information for debugging purposes.

Sample Output

```
A:ALA-B# tools dump persistence summary
===============================================================================
Persistence Summary on Slot A
===============================================================================
Client             Location            Entries in use    Status
-------------------------------------------------------------------------------
xxxxxx            cf1:\l2_dhcp.pst    200               ACTIVE
-------------------------------------------------------------------------------

===============================================================================
Persistence Summary on Slot B
===============================================================================
Client             Location            Entries in use    Status
-------------------------------------------------------------------------------
xxxxxx              cf1:\l2_dhcp.pst    200               ACTIVE
-------------------------------------------------------------------------------
A:ALA-B#
```

ppp

Syntax **ppp** *port-id*

Context tools>dump

Description This command displays PPP information for a port.

Default none

Parameters *port-id* — Specify the port ID.

Values

port-id	*slot/mda/port*[.*channel*]	
	bundle-id:	bundle-*type-slot/mda.bundle-num*
		bundle: keyword
		type: ppp
		bundle-num: 1 — 256
	bpgrp-id:	bpgrp-*type-bpgrp-num*
		bpgrp: keyword
		type: ppp
		bpgrp-num: 1 — 1280
	aps-id:	aps-*group-id*[.channel]
		aps: keyword
		group-id: 1 — 64

Sample Output

```
*A:sr7# tools dump ppp aps-1.1.1.1
===============================================================================
Id              : aps-1.1.1.1        ppp unit       : 40
member of       : bpgrp-ppp-1
===============================================================================
looped back     : no                 dbgMask        : 0x0
-------------------------------------------------------------------------------
LCP
-------------------------------------------------------------------------------
phase           : NETWORK            state          : OPENED
passive         : off                silent         : off
restart         : on

mru             : 1500               mtu            : 1502
ack'd peer mru  : 1500
got local mrru  : 1524
local magic     : 0x0                peer magic     : 0x0

keepalive       : on                 echo num       : 2
echo timer      : on                 echos fail     : 3
echo intv       : 10                 echos pend     : 0

options      mru      asyncMap upap     chap     magic    pfc
we negotiate Yes       No       No       No       No      Yes
peer ack'd   Yes       No       No       No       No       No
we allow     Yes       No       No       No       No      Yes
we ack'd     Yes       No       No       No       No       No

options      acfc     lqr      mrru     shortSeq endPoint mlhdrfmt
we negotiate Yes       No      Yes       No      Yes       No
```

```
peer ack'd    No       No      Yes       No      Yes       No
we allow     Yes       No      Yes      Yes      Yes       No
we ack'd      No       No      Yes       No      Yes       No
...
===============================================================================
*A:sr7#
```

system-resources

Syntax **system-resources** *slot-number*

Context tools>dump

Description This command displays system resource information.

Default none

slot-number — Specify a specific slot to view system resources information.

Service Commands

service

Syntax **service**

Context tools>dump

Description Use this command to configure tools to display service dump information.

base-stats

Syntax **base-stats** [**clear**]

Context tools>dump>service

Description Use this command to display internal service statistics.

Default none

Parameters **clear —** Clears stats after reading.

iom-stats

Syntax **iom-stats** [**clear**]

Context tools>dump>service

Description Use this command to display IOM message statistics.

Default none

Parameters **clear —** Clears stats after reading.

l2pt-diags

Syntax **l2pt-diags**
l2pt-diags clear
l2pt-diags detail

Context tools>dump>service

Description Use this command to display L2pt diagnostics.

Default none

Parameters **clear —** Clears the diags after reading.

detail — Displays detailed information.

Sample Output

```
A:ALA-48>tools>dump>service# l2pt-diags
[ l2pt/bpdu error diagnostics ]
 Error Name       | Occurence   | Event log
 -----------------+-------------+-----------------------------
[ l2pt/bpdu forwarding diagnostics ]

 Rx Frames   | Tx Frames   | Frame Type
 ------------+-------------+---------------------------------
A:ALA-48>tools>dump>service#

A:ALA-48>tools>dump>service# l2pt-diags detail
[ l2pt/bpdu error diagnostics ]
 Error Name       | Occurence   | Event log
 -----------------+-------------+-----------------------------
[ l2pt/bpdu forwarding diagnostics ]

 Rx Frames   | Tx Frames   | Frame Type
 ------------+-------------+---------------------------------
[ l2pt/bpdu config diagnostics ]
 WARNING - service 700 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 800 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 9000 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 32806 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
 WARNING - service 90001 has l2pt termination enabled on all access points :
           consider translating further down the chain or turning it off.
A:ALA-48>tools>dump>service#
```

radius-discovery

Syntax **radius-discovery** [**svc-id** *service-id*]

Context tools>dump>service

Description Use thie command to display RADIUS Discovery membership information.

Sample Output

```
A:ALA-48# tools dump service radius-discovery
-------------------------------------------------------------
Service Id 103  Vpn Id 103  UserName 901:103 (Vpn-Id)  PolicyName RAD_Disc for Ser-
vice 103
Waiting for Session Timeout (Polling 60), Seconds in State 17
-------------------------------------------------------------------------------
      SdpId      Vcid  Deliver     Ip Addr        VcType       Mode      Split Horizon
-------------------------------------------------------------------------------
          3       103    LDP    10. 20.  1.  3     Ether      Spoke
          4       103    LDP    10. 20.  1.  2     Ether      Spoke
 -------------------------------------------------------------
A:ALA-48#
```

vpls-fdb-stats

Syntax **vpls-fdb** [**clear**]

Context tools>dump>service

Description Use this command to display VPLS FDB statistics.

Default none

Parameters **clear —** Clears stats after reading.

vpls-mfib-stats

Syntax **vpls-mfib-stats** [**clear**]

Context tools>dump>service

Description Use this command to display VPLS MFIB statistics.

Default none

Parameters **clear —** Clears stats after reading.

Router Commands

router

Syntax **router** *router-instance*

Context tools>dump
tools>perform

Description This command enables tools for the router instance.

Default none

Parameters **router** *router-instance* **—** Specifies the router name or service ID.

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

Default Base

dhcp

Syntax **dhcp**

Context tools>dump>router

Description This command enables the context to configure dump router tools for DHCP.

group-if-mapping

Syntax **group-if-mapping** [**clear**]

Context tools>dump>router>dhcp

Description This command dumps group interface mapping information stored in by the DHCP cache for the Routed CO model of operation.

group-if-stats

Syntax **group-if-stats** [**clear**]

Context tools>dump>router>dhcp

Description This command dumps group interface statistics information about the DHCP cache for the Routed CO model of operation.

lag

Syntax **lag**

Context tools>perform

Description This command configures tools to control LAG.

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.

Parameters **all-mc —** Clears all multi-chassis LAG information.

lag-id *lag-id* — Specify an existing LAG id.

Values 1 — 200 (7750 SR-1: 1 — 64)

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 standy status.

Parameters **all-mc —** Clears all multi-chassis LAG information.

active — If **active** is selected, then all drives on the active CPM are forced.

standby — If **standby** is selected, then all drives on the standby CPM are forced.

all-mc — Clears all multi-chassis LAG information.

lag-id *lag-id* **—** Specify an existing LAG id.

Values 1 — 200 (7750 SR-1: 1 — 64)

log

Syntax **log**

Context tools>perform

Description Tools for event logging.

test-event

Syntax **test-event**

Context tools>perform>log

Description Generates a test event.

ldp

Syntax **ldp**

Context tools>dump>router

Description This command enables dump tools for LDP.

Default none

interface

Syntax **interface** [*ip-int-name* | *ip-address*]

Context tools>dump>router>ldp

Description This command displays information for an LDP interface.

Default none

Parameters *ip-int-name* — Specifies the interface name.

ip-address — Specifies the IP address.

peer

Syntax **peer** *ip-address*

Context tools>dump>router>ldp

Description This command displays information for an LDP peer.

Default none

Parameters *ip-address* — Specifies the IP address.

fec

Syntax **fec prefix** [ip-prefix/mask]
fec vc-type {**ethernet**|**vlan**} **vc-id** *vc-id*

Context tools>dump>router>ldp

Description This command displays information for an LDP FEC.

Default none

Parameters *ip-prefix/mask* — Specifies the IP prefix and host bits.

Values

host bits:	must be 0
mask:	0 — 32

vc-type — Specifies the VC type signaled for the spoke or mesh binding to the far end of an SDP. The VC type is a 15 bit-quantity containing a value which represents the type of VC. The actual signaling of the VC type depends on the signaling parameter defined for the SDP. If signaling is disabled, the **vc-type** command can still be used to define the dot1q value expected by the far-end provider equipment. A change of the binding's VC type causes the binding to signal the new VC type to the far end when signaling is enabled.

VC types are derived according to IETF *draft-martini-l2circuit-trans-mpls*.

- Ethernet — The VC type value for Ethernet is 0x0005.
- VLAN — The VC type value for an Ethernet VLAN is 0x0004.

vc-id — Specifies the virtual circuit identifier.

Values 1 — 4294967295

instance

Syntax **instance**

Context tools>dump>router>ldp

Description This command displays information for an LDP instance.

memory-usage

Syntax **memory-usage**

Context tools>dump>router>ldp

Description This command displays memory usage information for LDP.

Default none

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 none

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 none

timers

Syntax **timers**

Context tools>dump>router>ldp

Description This command displays timer information for LDP.

Default **none**

mpls

Syntax **mpls**

Context tools>dump>router

Description This command enables the context to display MPLS information.

Default none

ftn

Syntax **ftn**

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 none

ilm

Syntax **ilm**

Context tools>dump>router>mpls

Description This command displays incoming label map (ILM) information for MPLS.

Default none

lspinfo

Syntax **lspinfo**

Context tools>dump>router>mpls

Description This command displays label-switched path (LSP) information for MPLS.

Default none

memory-usage

Syntax **memory-usage**

Context tools>dump>router>mpls

Description This command displays memory usage information for MPLS.

Default none

ospf

Syntax **ospf [ospf-instance]**

Context tools>dump>router

Description This command enables the context to display tools information for OSPF.

Parameters **ospf-instance —** OSPF instance.

Values 1 — 4294967295

Default none

ospf3

Syntax **ospf3**

Context tools>dump>router

Description This command enables the context to display tools information for OSPF3.

Default none

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 none

Parameters **detail —** Displays detailed information about the ABR.

asbr

Syntax **asbr** [**detail**]

Context tools>dump>router>ospf
tools>dump>router>ospf3

Description This command displays autonoumous system border router (ASBR) information for OSPF.

Default none

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 none

Parameters *interface-name* — Display 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 —** Display a summary of information about leaked routes for OSPF.

detail — Display 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 none

Parameters **detail —** Displays detailed information about memory usage for OSPF.

request-list

Syntax **request-list** [**neighbor** *ip-address*] [**detail**]
request-list virtual-neighbor *ip-address* **area-id** *area-id* [**detail**]

Context tools>dump>router>ospf
tools>dump>router>ospf3

Description This command displays request list information for OSPF.

Default none

Parameters **neighbor** *ip-address* — Display neighbor information only for neighbor identified by the IP address.

detail — Displays detailed information about the neighbor.

virtual-neighbor *ip-address* — Displays information about the virtual neighbor identified by the IP address.

area-id *area-id* — The OSPF area 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**]

Context tools>dump>router>ospf
tools>dump>router>ospf3

Description This command displays dump retransmission list information for OSPF.

Default none

Parameters **neighbor** *ip-address* — Display neighbor information only for neighbor identified by the IP address.

detail — Displays detailed information about the neighbor.

virtual-neighbor *ip-address* — Displays information about the virtual neighbor identified by the IP address.

area-id *area-id* — The OSPF area ID expressed in dotted decimal notation or as a 32-bit decimal integer.

route-summary

Syntax **route-summary**

Context tools>dump>router>ospf
tools>dump>router>ospf3

Description This command displays dump route summary information for OSPF.

Default none

route-table

Syntax **route-table** [**type**] [**detail**]

Context tools>dump>router>ospf
tools>dump>router>ospf3

Description This command displays dump information about routes learned through OSPF.

Default none

Parameters **type —** Specify the type of route table to display information.

Values intra-area, inter-area, external-1, external-2, nssa-1, nssa-2

detail — Displays detailed information about learned routes.

pim

Syntax **pim**

Context tools>dump>router

Description This command enables the context to display PIM information.

iom-failures

Syntax **iom-failures** [**detail**]

Context tools>dump>router>pim

Description This command displays information about failures in programming IOMs.

Parameters *detail* — Displays detailed information about IOM failures.

rsvp

Syntax rsvp

Context tools>dump>router

Description This command enables the context to display RSVP information.

Default none

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 none

Parameters **endpoint** *endpoint-address* — Specifies the IP address of the last hop.

sender *sender-address* — Specifies the IP address of the sender.

tunnelid *tunnel-id* — Specifies the SDP ID.

Values 0 — 4294967295

lspid *lsp-id* — Specifies the label switched path that is signaled for this entry.

Values 1 — 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 none

Parameters **endpoint** *endpoint-address* — Specifies the IP address of the last hop.

sender *sender-address* — Specifies the IP address of the sender.

tunnelid *tunnel-id* — Specifies the SDP ID.

Values 0 — 4294967295

lspid *lsp-id* — Specifies the label switched path that is signaled for this entry.

Values 1 — 65535

tcsb

Syntax **tcsb** [**endpoint** *endpoint-address*] [**sender** *sender-address*] [**tunnelid** *tunnel-id*] [**lspid** *lsp-id*]

Context tools>dump>router>rsvp

Description This command displays RSVP traffic control state block (TCSB) information.

Default none

Parameters **endpoint** *endpoint-address* — Specifies the IP address of the egress node for the tunnel supporting this session.

sender *sender-address* — Specifies the IP address of the sender node for the tunnel supporting this session. It is derived from the source address of the associated MPLS LSP definition.

tunnelid *tunnel-id* — Specifies the IP address of the ingress node of the tunnel supporting this RSVP session.

Values 0 — 4294967295

lspid *lsp-id* — Specifies the label switched path that is signaled for this entry.

Values 1 — 65535

web-rd

Syntax **web-rd**

Context tools>dump>router

Description This command enables the context to display tools for web redirection.

http-client

Syntax **http-client** [*ip-prefix/mask*]

Context tools>dump>router>web-rd

Description This command displays the HTTP client hash table.

Parameters *ip-prefix/mask* — Specifies the IP prefix and host bits.

Values		
	host bits:	must be 0
	mask:	0 — 32

Performance Tools

perform

Syntax perform

Context tools

Description This command enables the context to enable tools to perform specific tasks.

Default none

cron

Syntax **cron**

Context tools>perform

Description This command enables the context to perform CRON (scheduling) control operations.

Default none

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.

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.

Parameters *action-name* — Specifies the action name.

Values Maximum 32 characters.

owner *action-owner* **—** Specifies the owner name.

Default TiMOS CLI

all — Specifies to stop all CRON scripts.

tod

Syntax **tod**

Context tools>perform>cron

Description This command enables the context for tools for controlling time-of-day actions.

Default none

re-evaluate

Syntax **re-evaluate**

Context tools>perform>cron

Description This command enables the context to re-evaluate the time-of-day state.

Default none

customer

Syntax **customer** *customer-id* [**site** *customer-site-name*]

Context tools>perform>cron>tod>re-eval

Description This command re-evaluates the time-of-day state of a multi-service site.

Parameters *customer-id* — Specify an existing customer ID.

Values 1 — 2147483647

site *customer-site-name* **—** Specify an existing customer site name.

filter

Syntax **filter** *filter-type* [*filter-id*]

Context tools>perform>cron>tod>re-eval

Description This command re-evaluates the time-of-day state of a filter entry.

Parameters *filter-type* — Specify the filter type.

Values ip-filter, ipv6-filter, mac-filter

filter-id — Specify an existing filter ID.

Values 1 — 65535

service

Syntax **service id** *service-id* [**sap** *sap-id*]

Context tools>perform>cron>tod>re-eval

Description This command re-evaluates the time-of-day state of a SAP.

Parameters **id** *service-id* — Specify the an existing service ID.

Values 1 — 2147483647

sap *sap-id* — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for CLI command syntax.

tod-suite

Syntax **tod-suite** *tod-suite-name*

Context tools>perform>cron>tod>re-eval

Description This command re-evaluates the time-of-day state for the objects referring to a tod-suite.

Parameters *tod-suite-name* — Specify an existing TOD name.

aps

Syntax **aps**

Context tools>perform

Description This command enables the context to perform Automated Protection Switching (APS) operations.

clear

Syntax **clear** *aps-id* {**protect** | **working**}

Context tools>perform>aps

Description This command removes all Automated Protection Switching (APS) operational commands.

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command clears a physical port that is acting as the protection circuit for the APS group.

working — This command clears a physical port that is acting as the working circuit for this 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.

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command performs an exercise request on the port that is acting as the protection circuit for the APS group.

working — This command performs an exercise request on the port that is acting as the working circuit for this APS group.

force

Syntax **force** *aps-id* {**protect** | **working**}

Context tools>perform>aps

Description This command forces a switch to either the protect or working circuit

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command clears a physical port that is acting as the protection circuit for the APS group.

working — This command clears a physical port that is acting as the working circuit for this APS group.

lockout

Syntax **lockout** *aps-id*

Context tools>perform>aps

Description This command locks out the protection circuit.

Parameters *aps-id* — Automated Protection Switching ID

Values 1 — 64

request

Syntax **request** *aps-id* {**protect** | **working**}

Context tools>perform>aps

Description This command requests a manual switch to protection or working circuit.

Parameters *aps-id* — This option clears a specific APS on un-bundled SONET/SDH ports.

protect — This command requests a manual switch to a port that is acting as the protection circuit for the APS group.

working — This command requests a manual switch to a port that is acting as the working circuit for this APS group.

consistency

Syntax **consistency**

Context tools>perform>router

Description This command performs route table manager (RTM) consistency checks.

Default none

ldp-sync-exit

Syntax [**no**] **ldp-sync-exit**

Context tools>perform>router>isis
tools>perform>router>ospf

Description This command restores the actual cost of an interface at any time. When this command is executed, IGP immediately advertises the actual value of the link cost for all interfaces which have the IGP-LDP synchronization enabled if the currently advertised cost is different.

isis

Syntax **isis**

Context tools>perform>router

Description This command enables the context to configure tools to perform certain ISIS tasks.

run-manual-spf

Syntax **run-manual-spf**

Context tools>perform>router>isis

Description This command runs the Shortest Path First (SPF) algorithm.

mpls

Syntax **mpls**

Context tools>perform>router

Description This command enables the context to perform specific MPLS tasks.

Default none

cspf

Syntax **cspf to** *ip-addr* [**from** *ip-addr*] [**bandwidth** *bandwidth*] [**include-bitmap** *bitmap*] [**exclude-bitmap** *bitmap*] [**hop-limit** *limit*] [**exclude-address** *ip-addr* [*ip-addr* ...(up to 8 max)]] [**use-te-metric**] [**strict-srlg**] [**srlg-group** *grp-id*...(up o 8 max)]

Context tools>perform>router>mpls

Description This command computes a CSPF path with specified user constraints.

Default none

Parameters **to** *ip-addr* **—** Specify the destination IP address.

from *ip-addr* **—** Specify the originating IP address.

bandwidth *bandwidth* **—** Specifies the amount of bandwidth in mega-bits per second (Mbps) to be reserved.

include-bitmap *bitmap* **—** Specifies to include a bit-map that specifies a list of admin groups that should be included during setup.

exclude-bitmap *bitmap* **—** Specifies to exclude a bit-map that specifies a list of admin groups that should be included during setup.

hop-limit *limit* **—** Specifies the total number of hops a detour LSP can take before merging back onto the main LSP path.

exclude-address *ip-addr* **—** Specifies an IP address to exclude from the operation.

resignal

Syntax **resignal lsp** *lsp-name* **path** *path-name*

Context tools>perform>router>mpls

Description Use this command to resignal a specific LSP path.

Default none

Parameters **lsp** *lsp-name* **—** Specifies the name that identifies the LSP. The LSP name can be up to 32 characters long and must be unique.

path *path-name* **—** Specifies the name for the LSP path up, to 32 characters in length.

trap-suppress

Syntax **trap-suppress** [*number-of-traps*] [*time-interval*]

Context tools>perform>router>mpls

Description This command modifies thresholds for trap suppression.

Default none

Parameters *number-of-traps* — Specify the number of traps in multiples of 100. An error messages is generated if an invalid value is entered.

Values 100 to 1000

time-interval — Specify the timer interval in seconds.

Values 1 — 300

ospf

Syntax ospf

Context tools>perform>router

Description This command enables the context to perform specific OSPF tasks.

Default none

ospf3

Syntax ospf3

Context tools>perform>router

Description This command enables the context to perform specific OSPF3 tasks.

Default none

refresh-lsas

Syntax **refresh-lsas** [*lsa-type*] [*area-id*]

Context tools>perform>router>ospf

Description This command refreshes LSAs for OSPF.

Default none

Parameters *lsa-type* — Specify the LSA type using allow keywords.

Values router, network, summary, asbr, extern, nssa, opaque

area-id — The OSPF area ID expressed in dotted decimal notation or as a 32-bit decimal integer.

Values 0 — 4294967295

run-manual-spf

Syntax **run-manual-spf** *externals-only*

Context tools>perform>router>ospf

Description This command runs the Shortest Path First (SPF) algorithm.

Default none

Parameters **externals-only —** Specify the route preference for OSPF external routes.

security

Syntax **security**

Context tools>perform

Description This command provides tools for testing security.

authentication-server-check

Syntax **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*]

Context tools>perform>security

Description This command checks connection to the RADIUS server.

Parameters **router** *router-instance* **—** Specifies the router name or service ID.

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

Default Base

service

Syntax **services**

Context tools>perform

Description This command enables the context to configure tools for services.

egress-multicast-group

Syntax **egress-multicast-group** *group-name*

Context tools>perform>service

Description This command enables the context to configure tools for egress multicast groups.

Parameters *group-name* — Specify an existing group name.

force-optimize

Syntax **force-optimize**

Context tools>perform>service>egress-multicast-group

Description This command optimizes the chain length.

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* — Specify an existing service ID.

Values 1 — 2147483647

endpoint

Syntax **endpoint** *endpoint-name*

Context tools>perform>service>id

Description This command enables the context to configure tools for a specific VLL service endpoint.

Parameters *endpoint-name* — Specify an existing VLL 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 *sdp-id:vc-id* — Specify an existing spoke SDP for the service.

subscriber-mgmt

Syntax **subscriber-mgmt**

Context tools>perform

Description This command enables tools to control subscriber management.

edit-lease-state

Syntax **edit-lease-state sap** *sap-id* **ip** *ip-address* [**subscriber** *sub-ident-string*] [**sub-profile-string** *sub-profile-string*] [**sla-profile-string** *sla-profile-string*]
edit-lease-state svc-id *service-id* **ip** *ip-address* [**subscriber** *sub-ident-string*] [**sub-profile-string** *sub-profile-string*] [**sla-profile-string** *sla-profile-string*]

Context **tools>perform>subscr-mgmt**

Parameters **sap *sap-id* —** Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for CLI command syntax.

ip *ip-address* — Modifies lease state information for the specified IP address.

subscriber *sub-ident-string* — Modifies lease state information for the specified subscriber ID.

sub-profile-string *sub-profile-string* — Modifies lease state information for the specified subscriber profile.

sla-profile-string *sla-profile-string* — Modifies lease state information for the SLA profile.

svc-id *service-id* — Modifies lease state information for the specified service ID.

Values 1 — 2147483647

eval-lease-state

Syntax **eval-lease-state** [**svc-id** *service-id*] [**sap** *sap-id*] [**subscriber** *sub-ident-string*] [**ip** *ip-address*]

Context tools>perform>subscr-mgmt

Description This command evaluates lease state information.

Parameters **svc-id *service-id* —** Evaluates lease state information for the specified service.

Values 1 — 2147483647

sap *sap-id* — Evaluates lease state information for the specified SAP. See Common CLI Command Descriptions on page 261 for CLI command syntax.

subscriber *sub-ident-string* — Evaluates lease state information for the specified subscriber identification string.

ip *ip-address* — Evaluates lease state information for the specified IP address.

forcerenew

Syntax **forcerenew svc-id** *service-id* {**ip** *ip-address*[/*mask*] | **mac** *ieee-address*}
forcerenew {**interface** *interface-name* | **sap** *sap-id* | **sdp** *sdp-id:vc-id*} [**ip** *ip-address*[/*mask*] |**mac** *ieee-address*]

Context tools>perform>subscr-mgmt

Description This command forces the renewal of lease state.

Parameters **svc-id *service-id* —** Forces renewal of the lease state for the specified service.

Values 1 — 2147483647

sap *sap-id* — Forces renewal of the lease state for the specified SAP. See Common CLI Command Descriptions on page 261 for CLI command syntax.

ip *ip-address* — Forces renewal of the lease state for the specified IP address.

mac *ieee-address* **—** Forces renewal of the lease state for the specified MAC address.

interface *interface-name* **—** Forces renewal of the lease state for the specified interface name.

re-ident-sub

Syntax **re-ident-sub** *old-sub-ident-string* **to** *new-sub-ident-string*

Context tools>perform>subscr-mgmt

Description This command renames a subscriber identification string.

Parameters *old-sub-ident-string* — Specifies the existing subscriber identification string to be renamed.

new-sub-ident-string — Specifies the new subscriber identification string name.

remap-lease-state

Syntax **remap-lease-state old-mac** *ieee-address* **mac** *ieee-address*
remap-lease-state sap *sap-id* [mac *ieee-address*]

Context tools>perform>subscr-mgmt

Description This command allows the remapping of all existing hosts if network card on CMTS/WAC side is changed is required.

When this command is executed, the following restrictions apply

- When **sap** is taken, all leases associated with the SAP are re-written.
  - → For a SAP with a configured MAC in "lease-populate" command, this MAC will be taken.
  - → For a SAP without a configured MAC the MAC from tools command will be taken.
  - → For a SAP without a configured MAC and no MAC in tools command no action will be perform.
- When using the **old-mac** option, providing a new MAC *ieee-address* is mandatory.

This command is applicable only when dealing with DHCP lease states which were instantiated using l2header mode of DHCP operation.

Parameters **old-mac** *ieee-address*

old-mac *ieee-address* **—** specifies the old MAC address to remap.

mac *ieee-address* **—** Specifies that the provisioned MAC address will be used in the anti-spoofing entries for this SAP when l2-header is enabled. The parameter may be changed mid-session. Existing sessions will not be re-programmed unless a **tools perform** command is issued for the lease.

sap *sap-id* — Specifies the physical port identifier portion of the SAP definition. See Common CLI Command Descriptions on page 261 for CLI command syntax.

When configured, the SAP parameter will remap all MAC addresses of DHCP lease states on the specified SAP. When no optional MAC parameter is specified, the **sap** *sap-id* command remaps all MAC addresses of lease states towards the MAC address specified in the l2-header configuration.

Common CLI Command Descriptions

In This Chapter

This chapter provides information about Virtual Private LAN Service (VPLS), process overview, and implementation notes.

Topics in this chapter include:

Common Service Commands

sap

Syntax [**no**] **sap** *sap-id*

Description This command specifies the physical port identifier portion of the SAP definition.

Parameters *sap-id* — The *sap-id* can be configured in one of the following formats:

Type	Syntax	Example
port-id	*slot*/*mda*/*port*[.*channel*]	2/1/11 1/2/3.1
null	[*port-id* | *bundle-id*| *bpgrp-id* | *lag-id* | *aps-id*]	*port-id*: 1/1/3 *bundle-id*: bundle-ppp-1/1.1 *bpgrp-id*: bpgrp-ima-1 *lag-id*: lag-63 *aps-id*: aps-1
dot1q	[*port-id* | *bundle-id*| *bpgrp-id* | *lag-id* | *aps-id*]:qtag1	*port-id*:qtag1: 1/1/3:100 *bundle-id*: bundle-ppp-1/1.1 *bpgrp-id*: bpgrp-ima-1 *lag-id*:qtag1:lag-63:102 *aps-id*:qtag1: aps-1:27
qinq	[*port-id* | *bundle-id*| *bpgrp-id* | *lag-id*]:*qtag1.qtag2*	*port-id*:qtag1.qtag2: 1/1/3:100.10 *bundle-id*: bundle-ppp-1/1.1 *bpgrp-id*: bpgrp-ima-1 *lag-id*:qtag1.qtag2:lag-10:
atm	[*port-id* | *aps-id* | *bundle-id* | *bpgrp-id*][:vpi/vci |vpi |vpi1.vpi2]	port-id: 1/1/1 aps-id: aps-1 *bundle-id*: bundle-ima-1/1.1 bundle-ppp-1/1.1 *bpgrp-id*: bpgrp-ima-1 vpi/vci: 16/26 vpi: 16 vpi1.vpi2: 16.200
frame-relay	[*port-id* | *aps-id*]:*dlci*	*port-id*: 1/1/1:100 *aps-id*: aps-1 *dlci*: 16
cisco-hdlc	*slot/mda/port.channel*	*port-id*: 1/1/3.1

Values: *sap-id*:

null	[*port-id* | *bundle-id* | *bpgrp-id* | *lag-id* | *aps-id*]	
dot1q	[*port-id* | *bundle-id* | *bpgrp-id* | *lag-id* | *aps-id*]:*qtag1*	
qinq	[*port-id* | *bundle-id* | *bpgrp-id* | *lag-id*]:*qtag1.qtag2*	
atm	[*port-id* | *aps-id*][:*vpi/vci*|*vpi*| *vpi1.vpi2*]	
frame	[*port-id* | *aps-id*]:*dlci*	
cisco-hdlc	*slot/mda/port.channel*	
cem	*slot/mda/port.channel*	
ima-grp	[*bundle-id*[:vpi/vci|vpi|*vpi1.vpi2*]	
port-id	*slot/mda/port*[*.channel*]	
bundle-id	bundle-*type-slot/mda.bundle-num*	
	bundle	keyword
	type	ima, ppp
	bundle-num	1 — 256
bpgrp-id	bpgrp-*type-bpgrp-num*	
	bpgrp	keyword
	type	ima, ppp
	bpgrp-num	1 — 1280
aps-id	aps-*group-id*[*.channel*]	
	aps	keyword
	group-id	1 — 64
ccag-id	ccag-*id.path-id*[*cc-type*]:*cc-id*	
	ccag	keyword
	id	1 — 8
	path-id	a, b
	cc-type	.sap-net, .net-sap
	cc-id	0 — 4094
lag-*id*	lag-*id*	
	lag	keyword
	id	1 — 200
qtag1	0 — 4094	
qtag2	*, 0 — 4094	
vpi	NNI: 0 — 4095	
	UNI: 0 — 255	
vci	1, 2, 5 — 65535	
dlci	16 — 1022	

bundle-id — Specifies the multilink bundle to be associated with this IP interface. The **bundle** keyword must be entered at the beginning of the parameter.
The command syntax must be configured as follows:

bundle-id: **bundle**-*type-slot-id*/*mda-slot.bundle-num*
bundle-id value range: 1 — 256

For example:

```
*A:ALA-12>config#  port bundle-ppp-5/1.1
*A:ALA-12>config>port# multilink-bundle
```

bgprp-id — Specifies the bundle protection group ID to be associated with this IP interface. The **bpgrp** keyword must be entered at the beginning of the parameter.

The command syntax must be configured as follows:

bpgrp-id: bpgrp-*type-bpgrp-num*
type: ima
bpgrp-num value range: 1 — 1280

For example:

```
*A:ALA-12>config# port bpgrp-ima-1
*A:ALA-12>config>service>vpls$ sap bpgrp-ima-1
```

qtag1, *qtag2* — Specifies the encapsulation value used to identify the SAP on the port or sub-port. If this parameter is not specificially defined, the default value is 0.

Values qtag1: 0 — 4094
qtag2 : * | 0 — 4094

The values depends on the encapsulation type configured for the interface. The following table describes the allowed values for the port and encapsulation types.

Port Type	Encap-Type	Allowed Values	Comments
Ethernet	Null	0	The SAP is identified by the port.
Ethernet	Dot1q	0 — 4094	The SAP is identified by the 802.1Q tag on the port. Note that a 0 qtag1 value also accepts untagged packets on the dot1q port.
Ethernet	QinQ	qtag1: 0 — 4094 qtag2: 0 — 4094	The SAP is identified by two 802.1Q tags on the port. Note that a 0 qtag1 value also accepts untagged packets on the dot1q port.
SONET/SDH	IPCP	-	The SAP is identified by the channel. No BCP is deployed and all traffic is IP.
SONET/SDH TDM	BCP-Null	0	The SAP is identified with a single service on the channel. Tags are assumed to be part of the customer packet and not a service delimiter.
SONET/SDH TDM	BCP-Dot1q	0 — 4094	The SAP is identified by the 802.1Q tag on the channel.
SONET/SDH TDM	Frame Relay	16 — 991	The SAP is identified by the data link connection identifier (DLCI).
SONET/SDH ATM	ATM	vpi (NNI) 0 — 4095 vpi (UNI) 0 — 255 vci 1, 2, 5 — 65535 -	The SAP is identified by port or by PVPC or PVCC identifier (vpi, vpi/vci, or vpi range)

port

Syntax **port** *port-id*

Description This command specifies a port identifier.

Parameters *port-id* — The *port-id* can be configured in one of the following formats.

Values

port-id	slot/mda/port[.channel]	
bundle-id	bundle-*type-slot/mda.bundle-num*	
	bundle	keyword
	type	ima|ppp
	bundle-num	1 — 256
bpgrp-id	bpgrp-*type-bpgrp-num*	
	bpgrp	keyword
	type	ima, ppp
	bpgrp-num	1 — 256
aps-id	aps-*group-id*[*.channel*]	
	aps	keyword
	group-id	1 — 64
ccag-id	ccag-*id.*<*path-id*>[*cc-type*]	
	ccag	keyword
	id	1 — 8
	path-id	a, b
	cc-type	[.sap-net|.net-sap]
lag-id	lag-*id*	
	lag	keyword
	id	1— 200

Standards and Protocol Support

Standards Compliance

IEEE 802.1d Bridging
IEEE 802.1p/Q VLAN Tagging
IEEE 802.1s Multiple Spanning Tree
IEEE 802.1w Rapid Spanning Tree Protocol
IEEE 802.1x Port Based Network Access Control
IEEE 802.1ad Provider Bridges
IEEE 802.1ah Provider Backbone Bridges
IEEE 802.1ag Service Layer OAM
IEEE 802.3ah Ethernet in the First Mile
IEEE 802.1ak Multiple MAC Registration Protocol
IEEE 802.3 10BaseT
IEEE 802.3ad Link Aggregation
IEEE 802.3ae 10Gbps Ethernet
IEEE 802.3ah Ethernet OAM
IEEE 802.3u 100BaseTX
IEEE 802.3x Flow Control
IEEE 802.3z 1000BaseSX/LX

ANCP/L2CP

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ATM

RFC 1626 Default IP MTU for use over ATM AAL5
RFC 2514 Definitions of Textual Conventions and OBJECT_IDENTITIES for ATM Management
RFC 2515 Definition of Managed Objects for ATM Management RFC 2684 Multiprotocol Encapsulation over ATM Adaptation Layer 5
AF-TM-0121.000 Traffic Management Specification Version 4.1
ITU-T Recommendation I.610 - B-ISDN Operation and Maintenance Principles and Functions version 11/95
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GR-1248-CORE - Generic Requirements for Operations of ATM Network Elements (NEs). Issue 3
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AF-ILMI-0065.000 Integrated Local Management Interface (ILMI) Version 4.0
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BGP

RFC 1397 BGP Default Route Advertisement
RFC 1772 Application of BGP in the Internet
RFC 1965 Confederations for BGP
RFC 1997 BGP Communities Attribute
RFC 2385 Protection of BGP Sessions via MD5
RFC 2439 BGP Route Flap Dampening
RFC 2547bis BGP/MPLS VPNs
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RFC 2918 Route Refresh Capability for BGP-4
RFC 3392 Capabilities Advertisement with BGP4
RFC 4271 BGP-4 (previously RFC 1771)
RFC 4360 BGP Extended Communities Attribute
RFC 4364 BGP/MPLS IP Virtual Private Networks (VPNs)(previously RFC 2547bis BGP/MPLS VPNs)
RFC 4456 BGP Route Reflection: Alternative to Full-mesh IBGP (previously RFC 1966 & 2796)
RFC 4724 Graceful Restart Mechanism for BGP – GR helper
RFC 4760 Multi-protocol Extensions for BGP (previously RFC 2858)
RFC 5065 Confederations for BGP (obsoletes 3065)

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RFC 5086 Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)
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DHCP

RFC 2131 Dynamic HostConfiguration Protocol (REV)
RFC 3046 DHCP Relay Agent Information Option (Option 82)
RFC 1534 Interoperation between DHCP and BOOTP

DIFFERENTIATED SERVICES

RFC 2474 Definition of the DS Field the IPv4 and IPv6 Headers (Rev)
RFC 2597 Assured Forwarding PHB Group (rev3260)
RFC 2598 An Expedited Forwarding PHB
RFC 3140 Per-Hop Behavior Identification Codes

Frame Relay

FRF.1.2 - PVC User-to-Network Interface (UNI) Implementation Agreement
FRF.5 - Frame Relay/ATM PVC Network Interworking Implementation
ANSI T1.617 Annex D, DSS1 ó Signalling Specification For Frame Relay Bearer Service.

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IPSec

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RFC 3706 IKE Dead Peer Detection
RFC 3947 Negotiation of NAT-Traversal in the IKE
RFC 3948 UDP Encapsulation of IPsec ESP Packets

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 (ISIS) 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 3847 Restart Signaling for IS-IS ñ GR helper
RFC 4205 for Shared Risk Link Group (SRLG) TLV
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IPv6

RFC 1981 Path MTU Discovery for IPv6
RFC 2375 IPv6 Multicast Address Assignments
RFC 2460 Internet Protocol, Version 6 (IPv6) Specification
RFC 2461 Neighbor Discovery for IPv6
RFC 2462 IPv6 Stateless Address Auto configuration
RFC 2463 Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 Specification
RFC 2464 Transmission of IPv6 Packets over Ethernet Networks
RFC 2529 Transmission of IPv6 over IPv4 Domains without Explicit Tunnels
RFC 2545 Use of BGP-4 Multiprotocol Extension for IPv6 Inter-Domain Routing
RFC 2710 Multicast Listener Discovery (MLD) for IPv6
RFC 2740 OSPF for IPv6
RFC 3306 Unicast-Prefix-based IPv6 Multicast Addresses
RFC 3315 Dynamic Host Configuration Protocol for IPv6
RFC 3587 IPv6 Global Unicast Address Format
RFC3590 Source Address Selection for the Multicast Listener Discovery (MLD) Protocol
RFC 3810 Multicast Listener Discovery Version 2 (MLDv2) for IPv6
RFC 4007 IPv6 Scoped Address Architecture
RFC 4193 Unique Local IPv6 Unicast Addresses
RFC 4291 IPv6 Addressing Architecture
RFC 4659 BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN
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RFC 3037 LDP Applicability
RFC 3478 Graceful Restart Mechanism for LDP - GR helper
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RFC 3032 MPLS Label Stack Encoding (REV3443))
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RFC 4182 Removing a Restriction on the use of MPLS Explicit NULL
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RFC 1112 Host Extensions for IP Multicasting (Snooping)
RFC 2236 Internet Group Management Protocol, (Snooping)
RFC 3376 Internet Group Management Protocol, Version 3 (Snooping)
RFC 2362 Protocol Independent Multicast-Sparse Mode (PIMSM)
RFC 3618 Multicast Source Discovery Protocol (MSDP)
RFC 3446 Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)
RFC 4601 Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)
RFC 4604 Using IGMPv3 and MLDv2 for Source-Specific Multicast
RFC 4607 Source-Specific Multicast for IP
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RFC 1724 RIPv2-MIB
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RFC 1907 SNMPv2-MIB
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RFC 2012 TCP-MIB

RFC 2013 UDP-MIB
RFC 2096 IP-FORWARD-MIB
RFC 2138 RADIUS
RFC 2206 RSVP-MIB
RFC 2452 IPv6 Management Information Base for the
Transmission Control Protocol
RFC 2454 IPv6 Management Information Base for the User Datagram Protocol
RFC 2465 Management Information Base for IPv6: Textual Conventions and General Group
RFC 2558 SONET-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-BASEDACM-MIB
RFC 2576 SNMP-COMMUNITY-MIB
RFC 2665 EtherLike-MIB
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RFC 2863 IF-MIB
RFC 2864 INVERTED-STACK-MIB
RFC 2987 VRRP-MIB
RFC 3014 NOTIFICATION-LOGMIB
RFC 3019 IP Version 6 Management Information Base for The Multicast Listener Discovery Protocol
RFC 3164 Syslog
RFC 3273 HCRMON-MIB
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RFC 3412 - Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
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RFC 3418 - SNMP MIB

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RFC 2328 OSPF Version 2
RFC 2370 Opaque LSA Support
RFC 2740 OSPF for IPv6 (OSPFv3) draft-ietf-ospf-ospfv3-update-14.txt
RFC 3101 OSPF NSSA Option
RFC 3137 OSPF Stub Router Advertisement
RFC 3623 Graceful OSPF Restart GR helper
RFC 3630 Traffic Engineering (TE) Extensions to OSPF Version 2
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RFC 1332 PPP IPCP
RFC 1377 PPP OSINLCP
RFC 1638/2878PPP BCP
RFC 1661 PPP (rev RFC2151)
RFC 1662 PPP in HDLC-like Framing
RFC 1989 PPP Link Quality Monitoring
RFC 1990 The PPP Multilink Protocol (MP)
RFC 2516 A Method for Transmitting PPP Over Ethernet
RFC 2615 PPP over SONET/SDH
RFC 2686 The Multi-Class Extension to Multi-Link PPP
RFC 1877 PPP Internet Protocol Control Protocol Extensions for Name Server Addresses

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RFC 2082 RIP-2 MD5 Authentication
RFC 2453 RIP Version 2

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RFC 2702 Requirements for Traffic Engineering over MPLS
RFC2747 RSVP Cryptographic Authentication
RFC3097 RSVP Cryptographic Authentication
RFC 3209 Extensions to RSVP for Tunnels
RFC 4090 Fast reroute Extensions to RSVP-TE for LSP Tunnels

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RFC 3985 Pseudo Wire Emulation Edge-to-Edge (PWE3)
RFC 4385 Pseudo Wire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN
RFC 3916 Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3)
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RFC 4816 PWE3 ATM Transparent Cell Transport Service (draft-ietf-pwe3-cell-transport-04.txt)
RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks (draft-ietf-pwe3-ethernet-encap-11.txt)
RFC 4619 Encapsulation Methods for Transport of Frame Relay over MPLS Networks (draft-ietf-pwe3-frame-relay-07.txt)
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RFC 2866 RADIUS Accounting

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draft-ietf-secsh-transport.txt SSH Transport Layer Protocol

draft-ietf-secsh-connection.txt SSH Connection Protocol

draft-ietf-secsh- newmodes.txt SSH Transport Layer Encryption Modes

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RFC 768 UDP

RFC 1350 The TFTP Protocol (Rev.

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RFC 951 BootP (rev)

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RFC 1542 Clarifications and Extensions for the Bootstrap Protocol

RFC 1812 Requirements for IPv4 Routers

RFC 2347 TFTP option Extension

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RFC 3768 Virtual Router Redundancy Protocol

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